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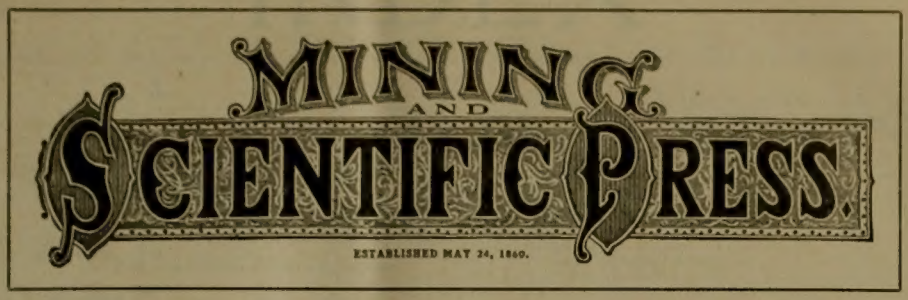

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MINING AND SCIENTIFIC PRESS

ESTABLISHED MAY 24, 1860.

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L. A. GREENE - - - - - Business Manager

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Greeting!

The close of one year and beginning of another is universally a time for casting up accounts. The merchant takes stock, balances his books, and decides what lines to push in the new year. In solemn family council father and mother add up the bills and debate measures necessary to stretch a fixed income to cover an expanding style of living. Everywhere people are sifting and sorting to determine, if possible, what is, and what is not, worth while. I ask your indulgence for a few minutes that we may have a conference of the *Mining and Scientific Press* family, including the publishers, editors, readers, and advertisers, to consider ways and means.

Changes come even in the most united of families. Children grow up and move away, and from time to time new faces appear at the fireside. In 1911 pressure of other business has prevented a number of our friends from keeping up the relation of special contributor, and several have accordingly dropped out, though we hope not for always. Their writings have contributed greatly to the interest of the paper, and their future articles, if unfortunately less frequent, will be no less welcome. When 'business lets up', or any of them reach that haven to which every mining engineer looks forward—when he shall live on a ranch and bother only with cattle and alfalfa—a cordial reception awaits his reëntry into our circle of those who by frequent note and advice help to shape the paper. Other old friends remain in the list and to them the thanks of the editor, swelled, I am sure, by those of the readers, go today. As newcomers we have welcomed Mr. T. Lane Carter, who has written for us frequently

this year of South Africa, Central America, and other countries; Mr. Charles Janin, who is keeping in especially close touch with the development of gold-dredging; and Mr. A. W. Allen, whose knowledge of South America and many other countries will be generously placed at the disposal of our readers. Mr. Courtenay De Kalb has found life in Mexico too exacting for frequent editorial contributions, but continues as a special contributor. Mr. T. A. Rickard, having placed *The Mining Magazine* upon a satisfactory basis as to clientele and business, will find time this year to devote to the *Mining and Scientific Press*. With an eye to rivaling our New York contemporary, *The Outlook*, Mr. Rickard is accordingly listed as Editorial Contributor, and our readers may expect in 1912 a series of those delightful essays and articles for which he is famous.

In the year that has just closed the advertisers have given generous support to the paper; support all the more liberal in that business has undeniably been less good than in 1910, and only the far-seeing business men recognize that it is in bad times that good firms prove their quality and by extra efforts lay the foundation for rapid expansion in the first succeeding period of prosperity. The readers have been kind and discriminating. Many cheering words have come from them to the editorial office, and if there have also been complaints, who shall say that they were not, in part at least, well founded? On behalf of the editors I can say we have given the best we had. If you have missed an expected news item, if you have failed to find a bit of technical information for which you were searching, I can only say that we selected from the store available, to the best of our judgment, what would surest serve your needs. If something has been crowded out, I would remind you that the field is wide and printing forms are not elastic. The Business Manager remarks, too, from his seat in the far corner of the room, that paper and printing bills have steadily climbed while subscription and advertising rates have remained fixed. Extra pages cost extra money, and, pleasant as it is to publish 'the largest paper,' there are limits that must be respected. We have done what we could in 1911 and we shall hope to do better in 1912. The practical problem is, how? And the only reasonable answer is, through the help of our friends. Not that our friends have not already proved more than kind. In the course of the past year members of the editorial staff have visited many States of the Union and a number of foreign countries, and have everywhere been the recipients of much appreciated courtesies. Whether with fellow members of the Institution of Mining and Metallurgy in London glasses clinked over the 'rare roast beef of old England'; or at Colorado Springs, for one brief space of time among the millionaires, as coffee and cigars went round, the story of Cripple Creek was retold; or with fellow travelers at Chitina we ate ham and eggs for breakfast, varying the fare by taking eggs and ham at luncheon, and ham for dinner; or with new-found friends at the Maple Club in Tokyo we gingerly sampled grilled *tai* and *sake*, everywhere it has been the same story of cordial welcome, of quick sympathy, and of ready helpfulness. The year, for myself and associates, is stored full with pleasant memories. Day after day, too, in San Francisco, where a new chair in a new office welcomes old friends to the sanctum, there has been a stream of royal good fellows from all over the world giving of the fullness of their experience and knowledge through the editor to their fellows in the profession.

Service is necessarily the keynote of a technical journal. If it does not serve, and serve well, it withers and dies. And service depends upon knowledge, and knowledge upon willing friends. Give us then of your friendship and your knowledge, that we may give to others. Did it ever occur to you, Mr. Mine Owner, that there would be substantial advantage in allowing us to publish the real figures at which you bought that last property? The promoter, of course, hies himself joyously to the local printshop, gathering in a few ciphers on the way, and the local editor, with the laudible ambition to 'boost' his own community in announcing the sale, perhaps plants a few more where they will do the most good. The next time you try to buy a property you find, as a result, that prices have 'unaccountably' risen. We have known many a good trade to fall through because of honest but none the less absurd notions of the present value of a property acquired by claim-owners through this sort of education. Mr. Sidney Jennings is quoted as saying that for his company he looked into 604 properties and was able to buy only two; yet the United States Smelting, Refining & Mining Company has an enviable reputation for fairness in examining and buying properties. A Dutch mining engineer of knowledge and personal wealth spent some months in the United States and Canada in 1910 and 1911, with a view to acquiring a property or properties. He was prepared to pay a fair price, and he was careful and thorough, but he went back to Holland without buying, and has turned his attention to the Far East. There are whole districts in California and other States where no new capital is going into mining, and the residents wonder why. In part, the reason lies in the crudities of our mining laws, whereby every purchase or find of a good orebody involves a lawsuit, but in part this stagnation is due to the exaggerated notions of claim-owners as to the value of their properties. This is not true in the States alone, for quartz-mining in the Philippines is making but slow progress, and the most important single reason is, that men with money can not buy claims at fair prices. A million dollars in the ground is not worth a check for a million in the bank, and better education in present values is needed.

And you, Mr. Engineer—do you remember the time when, isolated and lonely, far from professional associates and engineering libraries, you awaited the coming of each number of your favorite technical journal, knowing that it alone stood between you and the rustiness that leads to failure? Have you ever, in making estimates, wished you knew exactly what a certain other plant had cost? Have you ever, in puzzling over a process, wished you knew exactly how the other fellow did it? Do you realize that such information can only be obtained by free interchange—that you can not expect to receive unless you also give? Does not such generous publication of detail as in the series of articles on the Goldfield Consolidated mill by Mr. J. W. Hutchinson, published in this journal last year, or the painstaking and exact tables of cost presented in this issue through the courtesy of Mr. G. M. Taylor, call for some return on your part? Such articles require more of labor and effort than any publisher can pay for in money, and the only fitting reward is like generous publication by those who reap the benefit. Engineers must help each other, and it is one of the pleasures of belonging to the profession that the obligation is so widely recognized. It is true, undoubtedly, that there are times and circumstances under which metallurgical secrets must be kept. The experience of Mr. Richard S. Pearce at Argo with the Pearce process, and that of Mr. Willard S. Morse in converting copper matte at Aguascalientes, may be cited as cases in point, to mention only such as have passed into history. Too often, however, the manager who guards jealously 'a method all his own', has merely failed to measure the depth of his own ignorance. So surely does this policy of secrecy defeat its own ends, that many instances might be cited. One in the experience of one of the larger metallurgical companies will do. The manager at

one of the plants of this company went through an expensive and disastrous campaign that might have been avoided had he had the information available at another property belonging to the same company. Everyone has seen mines repeatedly examined at large expense, has seen processes repeatedly tried without result, and has seen time and money wasted where a little frank interchange of information would have been of the greatest benefit. There is reason in all things, but it is hard to be patient with the absurd lengths to which the policy of secrecy leads some engineers and managers. Government bureaus, engineering societies, technical publications, all the recognized means of building up your profession and business, gentlemen, depend on you. They are what you make them. No editor can give out what is not given to him, and if you would have better papers, give them better and more complete data. For the generous support that you, both readers and advertisers, have given the *Mining and Scientific Press* in 1911, I thank you for myself and on behalf of my associates, and for 1912 I bespeak your continued sympathy and support, at the same time that I wish for you all, the fullest measure of prosperity. From the Nizina to Rancagua, from Moji to the Ancobra, from San Francisco to Kalgoorlie, on to London and back again to the "Golden City in the Golden State by the Golden Gate", I send the good wishes of myself and associates to the many mining engineers we have come to look on as personal friends.

H. Foster Bain.

January 1, 1912.

REGULAR departments have been ruthlessly crowded aside to make room this week for review articles, and even much matter pertaining to a first of the year issue has been regretfully held over.

METALLURGICAL development at Cripple Creek is so associated with the name of Argall, that it is pleasant to be able to present a summary of progress for the year prepared by Mr. P. H. Argall, who is now carrying on work initiated by his father, Mr. Philip Argall, so well known to our readers.

TO CYANIDE operators, one of the events to be looked forward to at the beginning of each year is the appearance of the annual review of progress in cyanidation by Mr. Alfred James. 'Good wine needs no bush,' and we need only mention, therefore, that Mr. James' summary appears on another page of this issue.

JAPAN and the Japanese have won many friends among American engineers in the past year, and, since the New Year is a period of which much is made in the Land of the Rising Sun—not one but three celebrations being held there—we are glad to send to our neighbors across the Pacific our especially good wishes at this time.

STATISTICS of production in 1911 are given this week as far as they are available. The excellent preliminary estimates furnished annually by the Director of the Mint, the Director of the United States Geological Survey, and the monthly figures of the Copper Producers' Association and similar organizations, permit a comprehensive summary of business at the close of the year that is extremely helpful. Estimates are not expected to be exact, though those mentioned have enviable reputations in that particular. Readers will notice a few discrepancies. For this reason the source of the figures has been given in each case. In addition, we gratefully acknowledge the assistance of the many friends whose coöperation has made possible the preparation of this review number.

NEVADA'S enviable record in 1911 has attracted wide attention. The excellent general review of mining in that State which we publish this week, was prepared by Mr. L. F. Adamson, State Licensee and Bullion Tax Agent, whose position as collector of the State's share of mining profits, enables him to speak with exceptional knowledge.

CONTROVERSY between German producers and American consumers of potash salts has been finally settled, and an agreement reached which, though causing a loss to the American interests, is apparently satisfactory. One undoubtably good result of the disagreement has been the stimulation of search for sources of supply on the American continent, though so far little definite result has eventuated.

DENVER is fortunate in containing within its purlieus the Colorado Scientific Society, whose meetings have been notable, since they were the gathering place of notable men. The Society continues with unabated vigor and we note that Mr. G. E. Collins will be president for the coming year, with Messrs. E. N. Hawkins and W. P. J. Dinsmore as vice-presidents, J. W. Richards as treasurer, and H. C. Parmelee as secretary. We wish the Society long life and continued success.

MINING LAW revision has attracted much attention recently, both in the United States and Canada. It seems likely that in 1912 active steps will be taken toward a comprehensive rewriting of the statutes relating to mines. We plan to treat the matter in some detail in an early issue, and are glad to present now the discussion by Mr. F. Lynwood Garrison of the problems in Alaska and of Dr. James Douglas of the cost of developing coal on public lands. Such articles strike bottom and such information is a prerequisite to any informed discussion.

WHEREVER mining men go, to the uttermost end of the earth, the name of Collins is known and respected, worthy sons having upheld the traditions of an honorable sire. Mr. H. F. Collins has prepared for us a valuable discussion of the conditions under which mining is carried on in Spain, which will be of interest as well as service to our readers. Americans are becoming a cosmopolitan people, and this is especially true of mining engineers, so that reviews of mining in Turkey, Japan, and other countries which also appear in this issue, will be of value.

COPPER smelting is likely to remain an important factor in the production of the metal, since it is the most expensive one and shares with ore dressing the honor of having made notable advances in recent years. In connection with the review of progress for the year, by one of the editors, it is interesting to note that the oil-fired reverberatory furnaces constructed at El Paso, Texas, under the direction of Mr. Willard S. Morse, were built with 100-foot hearths, but provision was made for the addition of 30 feet more, which, in the light of experience at that and other plants, is likely to be added.

DREDGING has become a most important means of gold production, and the method is being applied to tin in an increasing number of places. In 1910 dredging operations supplied $9,293,100 of the $96,269,100 of gold won in the United States, and the proportion is steadily increasing. We print this week especially interesting articles descriptive of dredging operations, written by Mr. T. M. Gibson, Mr. Hennen Jennings, and Mr. Charles Janin. A continuation of Mr. Janin's review of dredging operations throughout the world will be printed next week. Mr. Jennings' brief description of winter work in Montana will, we are sure, be read with especial interest.

PETROLEUM producers found 1911 an anxious year, but one of substantial progress. The California fields are discussed in detail by Mr. J. H. G. Wolf in this issue, and the general situation on the Pacific Coast was outlined in an earlier issue by Mr. M. L. Requa. Evidently an adequate supply of fuel oil has been developed to warrant steam users changing from coal to oil throughout a wide field. Producers must seek consolation for low prices in this broad market, but one wonders what would happen if the United States Government should insist upon capping wells upon disputed ground until controversies as to title were settled. Evidently the present low prices are by no means certain to prevail, and probably producers may expect better returns in the future. A slight increase in price at the well would benefit them without seriously handicapping consumers, and in view of the risks and capital involved, such an increase is warranted. In the Appalachian fields the price of crude oil was raised late in December, but it is more and more evident that better prices can do but little to increase output east of the Mississippi. According to the *Oil City Derrick*, the new production of the Appalachian fields for the first eleven months of 1911 was 23,649 bbl., as against 49,208 in 1910. The Lima field has practically been abandoned, new production being but 5689 bbl. In Illinois, according to figures compiled by Mr. R. S. Blatchley, of the State Geological Survey, the 1911 output was 31,000,000 bbl.; a marked decline, due to exhaustion of early found pools and lack of development. Prices were raised at intervals through the year and some of the newer fields offer distinct promise, though there is no immediate hope of discoveries rivaling those of 1905 and 1906 in Eastern Illinois. In Oklahoma, Texas, Louisiana, and other Western States, aside from California, the year passed without marked incident. In Mexico production is now estimated at 200,000 bbl. per day.

GENEROSITY has always characterized the miner, but at the end of the year a new and striking instance of this trait was exhibited in the announcement that Mr. F. G. Cottrell and his associates had presented to the Smithsonian Institution the patents covering electrical precipitation of suspended matter. The Cottrell process has already been described in this paper. It is in successful operation in California in acid works, cement manufacturies, and for clearing crude oil of water. Extensive experiments in treatment of smelter fume indicate that it has here a wide field, and further work is now being conducted in Utah. Royalties have, we are glad to say, reimbursed Mr. Cottrell and his friends for the large sum of money spent in developing the process. In the ordinary course of events they might have been expected to result in a considerable fortune. Mr. Cottrell, however, does not care for a business life, and desiring to devote his time to further experimental work under the service of the Bureau of Mines, wished to divorce himself from any private interest in the results of his public work. His associates in San Francisco, with a broadmindedness that is as pleasant as it is unusual, consented to join him in the gift, reserving only the already developed California field. We understand that Mr. Cottrell's example has already been taken to heart by other inventors, so that it is not unlikely that in time the Institution that has done so much for the advancement of scientific research in the world may be fully endowed as a result of that advance. The choice of a depository for the patents is a wise one, since the Smithsonian, while under the protection of the Government, is legally a private corporation and can handle such matters in the same business-like way as could any company. It is thus assured that the patents will neither be buried nor pirated, and much good is certain to result from the gift.

The Year Among the Gold Mines

The close of a year affords convenient opportunity for comparisons between the estimated production for the year just completed and the official figures for the preceding year, since both become available at about the same time. In the case of gold it is useful to compare these with the production of five years earlier, in order that we may obtain a series of 'cross-sections' of the industry which may prove of service in its study. The table below gives the official figures of gold production for the principal gold-producing areas of the world for 1905 and 1910, to which is appended an approximate estimate of the yield during 1911. It should be noted that the data for 1911 for the United States, and the world's production for 1905, 1910, and 1911 are the figures of the Director of the United States Mint, since considerable differences exist between statistics prepared by different authorities. Nevertheless useful conclusions can be deduced. It would appear that the output of gold is no longer increasing at so rapid a rate as formerly, since the increase 1905-1910 was approximately 20 per cent, while the increase in 1911 over 1910 was only 2⅔ per cent. It is also obvious that practically all the increase is due to African production, since the output of the United States, which increased slightly during the five-year period, is now almost stationary, while Australasia has been declining slowly but regularly, the decline being general, though it will be noted that during the past year Western Australia has exhibited a tendency to hold its own. Africa, on the other hand, shows a general advance, with the exception of Rhodesia. But even in the case of the Transvaal the rate of increase appears to be slackening, for it will be noted that the increase for 1905-1910 was nearly 53.5 per cent, while the increase during 1911 was 9.6 per cent. It would seem, therefore, in the absence of unexpected changes in the status of the industry, that a period of declining world's output lies in the not remote future. It is unnecessary to attempt at this time to further analyze the gold production of the world, since we hope, early in the year, when fuller statistics are available, to be able to present a more complete discussion of the topic by Mr. T. A. Rickard.

GOLD PRODUCTION OF THE WORLD

	1905.	1910.	1911.
Africa, Transvaal	$101,225,558	$155,730,260	$170,000,000
Rhodesia	7,203,865	12,607,791	12,000,000
West Coast	3,427,995	3,674,087	5,500,000
Madagascar	1,369,553	2,149,721	.....
United States (total)	88,180,700	96,055,200	96,233,528
Alaska	14,925,600	16,987,990	16,002,976
Australasia (total)	85,970,779	65,329,705	59,000,000
Western Australia	40,490,000	30,393,000	29,800,000
World's production	377,647,700	454,000,000	466,000,000

Turning to the United States production, of which a fuller analysis appears upon another page, we find that California has, during the year just past, taken first place, so long held by Colorado. Nevada remains in the third place, pressing Colorado closely, and Alaska has fourth place, which it assumed in 1910, dropping from second in 1909. It is a curious fact that the four leading producers range from twenty to sixteen millions of dollars each, while the next nearest State, South Dakota, produced only about seven and a half millions. Utah, Montana, Arizona, and Idaho complete the list of the States which produced over one million dollars each.

Comparisons are always of interest, and it may be worth while, therefore, to add that the greatest gold mine in the world, from the standpoint of tonnage, is the Randfontein Central, which hoisted 217,984 tons and milled 212,510 tons

during October 1911. The greatest dividend payer of the year was the Goldfield Consolidated, which declared dividends for the year amounting to over $7,000,000, having milled approximately 338,000 tons of ore of a gross value of over $10,000,000. The largest dividend payer of the year on the Rand was the Crown Mines, which had declared dividends amounting to £517,058 for the ten months ended in October. The largest mine in America from the tonnage standpoint is the Homestake, which milled over 1,500,000 tons in 1911, though this is almost equaled by the Alaska Treadwell mines, which milled 1,500,000 tons. The competition between these two companies is very close, and it is not unlikely that their relative positions may alter at any time. The Treadwell mines have 900 stamps at work, with a stamp duty of over 5 tons per day, and at the Homestake the 1000 stamps have a duty of a little over 4.2 tons per day. The daily output of the Treadwell mines is therefore slightly greater, but working conditions permit the Homestake to operate more continuously, thus overcoming the handicap. The deepest gold mine of the world is the Morro Velho, in Brazil, owned by the St. John del Rey Mining Company, though the deeper mines along the Mother Lode in California are worthy companions, the Kennedy, which is the deepest gold mine in America, having attained a depth of 3550 feet. The United States takes, therefore, no mean place in the gold industry, being second in total production, having the largest dividend payer, and having more dredges at work than all the rest of the world combined.

Mexico Regains Stability

The year 1911 has been one of disturbed conditions in Mexico, and the mining industry has suffered as a result. The Madero revolution, just gathering force a year ago, triumphed within a period of six months, overthrowing a government that had proved strong for more than a quarter of a century. Labor troubles and brigandage have followed in the wake of the political upheaval, and attempts to overthrow the Madero government were for a time feared. Failure late in the year of the counter-revolution attempted by Gen. Bernardo Reyes has set these fears at rest. Francisco I. Madero was legally elected president in October, taking charge of Mexico's affairs on November 6, ending a provisional government of five months' duration. At present the prospects for a peaceful administration are better than at any time in the year. When consideration is given the great political changes wrought by the Madero revolution, it becomes a matter of wonder that the mining industry of the country has not suffered to a much greater extent than it has. In many of the important mining districts of Mexico the political upheaval had practically no effect on operations, and production has been well maintained throughout the year. Naturally, little foreign capital has entered the country during the year, and few important transactions have been recorded; money for projected extensions and betterments has been lacking, and few new enterprises have been launched. An exception, and one that illustrates the faith in the future of the country held by those who know it best, was the continued investment of money throughout the period of disturbance by the men associated with the American Smelting & Refining Company.

The hostilities of the revolution were principally confined to the States of Chihuahua, Sonora, Durango, and Coahuila, and in these mining, milling, and smelting suffered serious interruptions. In northern Mexico railroad lines were cut early in the year, and some of them remained out of commission until after peace was declared. Toward the end of the revolution the affected railroad lines totaled several hundred miles. Early in the revolution the Diaz government prohibited the transportation of dynamite with the object of keeping the explosive out of the hands of the revolutionists, and later the damage to railroads made its transportation impossible. Mining companies that were not well stocked with dynamite were eventually forced to curtail or suspend operations. For some time the Mexican Express Company, operating on the National Railways of Mexico, refused to assume any responsibility for the handling of bullion and money.

The labor troubles that followed the political upheaval in Mexico were mostly of short duration. Strikes have occurred at the Torreon, Mapimi, Chihuahua, Asarco, San Luis Potosi, and Matehuala smelters, and in a number of mining districts, including Velardeña, El Oro, Santa Eulalia, Cananea, and Nacozari. In Chihuahua, when the smelter workmen were ready to return to work they found that the management had no intention of immediately reopening the smelter, and the plant remained closed for several months. During the revolution Mexican workmen generally gained the impression that the triumph of Madero would mean shorter hours and higher pay. Some are now forcing a demand that Madero take steps to bring this about.

Railroad construction in Mexico during 1911 has been limited. The Pearson extension of the Mexico Northwestern railway in Chihuahua was delayed by the revolution and will be completed late this year. Since the close of the revolution the company has built a 22-kilometre branch into the Cusihuiriachic silver-mining district. The revolution also delayed construction of the Durango-Cañitas line of the National Railways, which will provide transportation facilities for the Sombrerete, Nieves, Chalchihuites, Nombre de Dios, and other mining districts. The work out of Cañitas was suspended, and is only now being resumed. The Southern Pacific has just completed its West Coast extension to the Tepic capital, and late in the year engineers of the same company were sent into the field to make surveys for a projected line from Guadalajara to Mexico City. There has been no interruption of work on the Penjamo-Ajuno line of the National Railways, building through the State of Michoacan, and good progress has been made in the building of the Pachuca-Zimapan line, in the State of Hidalgo. An electric line has been built to connect the big Pachuca and Real del Monte districts in Hidalgo. The Mexican Union Company, owning the Torres and Prietas line in Sonora, has been building an extension to Ures.

These advances in railway construction and development are especially worth emphasizing, in that they indicate a substantial recovery from the disturbed conditions naturally incident to a period of revolution. In another column our Mexican correspondent reviews at length the mining situation at the close of the year. The picture he presents is no less cheerful, and it is accurate. The ways of our southern neighbors are not our ways, and a presidential change there is accomplished through methods that differ from our own. It is a debatable question whether their methods result in more real loss to business than follows our own prolonged agitation for a new president and a revised tariff. There are times when the direct methods of the revolutionist at least appeal to one. Mexico has had a troublous year, but has come through it without much damage and with a basis for much permanent gain. It is too much to expect that all troubles are over, but we are not among those who see only clouds in the future, and we are glad to congratulate Mexico and the Mexicans upon the excellent prospects with which they enter 1912.

Review of Metal Production in the United States in 1911

Gold and Silver

The deposits of gold bullion at the mints and assay offices of the United States by domestic producers and domestic refineries during the calendar year 1911 amount approximately to 5,808,982 fine ounces, of the value of $120,082,315. This compares with 5,826,104 fine ounces, of the value of $120,436,258 from the same sources in 1910. These figures include bullion extracted or refined in this country from imported ores, but indicate that the gold production of North America was practically the same in 1911 as in 1910. In the table above are given the gold and silver production of the United States in 1910, revised figures furnished by the U. S. Geological Survey being used, and preliminary estimates for 1911, published by the courtesy of George E. Roberts, Director of the Mint. The 1911 figures do not show complete distribution.

It will be noted that silver production in 1911 is estimated at 57,796,117 oz., as compared with 57,137,900. From Mexico, which is the leading silver producer of the world, the exports in 1911 were substantially the same as 1910, but the production, owing to disturbed political conditions in the northern States, was undoubtedly less than in 1910, when it amounted to 72,574,229 oz. The Canadian output was larger than in 1910, when it was 31,983,328, by some 3,000,000 oz., due nearly to the larger amount of low-grade ore treated at Cobalt.

The price of silver, as shown by the weekly quotations, has ranged from 51.80 to 56.40 in cents per ounce, New York. Starting above 54c., the price dropped to the low point by the middle of February, and then remained fairly steady until the second week in October, when it rose rapidly to the high point of November 21. At the close of the year the price was practically the same as a year ago. The price of silver is intimately related to crop and political conditions in the Far East, modified by the manipulations of a keen lot of speculators at Bombay. Higher prices late in the year seem to have been due to the trouble in China, but more silver is now being shipped from London than a year ago, and with good crop conditions in India higher prices may be expected.

GOLD AND SILVER PRODUCTION IN THE UNITED STATES.

	Gold				Silver			
	1910.		1911.		1910.		1911.	
	Fine Oz.	Value.	Fine Oz.	Value.	Oz.	Com'l Value.*	Oz.	Com'l Value.
Alabama	1,592	$ 32,900	887	$ 18,335	300	$ 200	174	$ 96
Alaska	787,148	16,271,800	774,144	16,002,976	153,900	83,100	275,691	151,630
Arizona	165,114	3,413,200	142,938	2,954,790	2,655,700	1,434,100	1,594,428	876,935
California	988,853	20,441,400	982,544	20,310,987	1,791,600	967,500	2,727,336	1,500,035
Colorado	992,969	20,526,500	926,568	19,153,860	8,523,000	4,602,400	7,530,940	4,142,017
Georgia	1,161	24,000	1,477	30,532	300	200	225	124
Idaho	50,112	1,035,900	56,563	1,169,261	7,027,000	3,794,600	7,507,802	4,129,291
Illinois	.....	.....	280	5,788	2,000	1,100	4,648	2,556
Kentucky	.....	.....	.....	.....	100	100	.....	.....
Michigan	.....	.....	1	20	262,200	141,600	507,234	278,979
Missouri	.....	.....	.....	.....	32,200	17,400	56,228	30,925
Maryland	.....	.....	1	20	.....	.....	87	48
Montana	179,975	3,720,400	153,341	3,169,840	12,282,900	6,632,700	11,116,778	6,114,228
Nevada	913,015	18,873,700	917,605	18,968,578	12,366,000	6,677,600	10,651,571	5,858,364
New Hampshire and Pennsylvania	285	5,900	.....	.....	700	400	.....	.....
New Mexico	23,085	477,200	30,955	639,897	779,000	420,600	1,142,335	628,284
North Carolina	3,120	64,500	3,710	76,693	8,300	4,500	2,227	1,225
Oklahoma	.....	.....	1,485	30,698	.....	.....	168,245	92,535
Oregon	32,963	681,400	28,988	599,235	43,800	23,600	69,116	38,014
Pennsylvania	.....	.....	378	7,814	.....	.....	13,262	7,294
Philippines	7,469	154,400	6,313	130,501	1,800	1,000	3,383	1,861
Porto Rico	48	1,000	106	2,191	.....	.....	51	28
South Carolina	1,829	37,800	650	13,437	.....	.....	14	8
South Dakota	260,267	5,380,200	359,444	7,430,367	120,600	65,100	206,188	113,403
Tennessee	135	2,800	684	14,140	69,800	37,700	126,683	69,676
Texas	19	400	57	1,178	364,400	196,800	442,486	243,367
Utah	208,627	4,312,700	227,834	4,709,747	10,445,900	5,640,800	12,679,633	6,973,798
Virginia	44	900	208	4,300	200	100	45	25
Washington	38,990	806,000	24,407	504,537	204,900	110,600	142,196	78,209
Wyoming	198	4,100	909	18,791	1,300	700	1,009	555
Miscellaneous	.....	.....	12,820	265,013	.....	.....	826,102	454,356
Total	4,657,018	$96,269,100	4,655,297	$96,233,528	57,137,900	$30,854,500	57,796,117	$31,787,866

*Value 54c. per ounce.

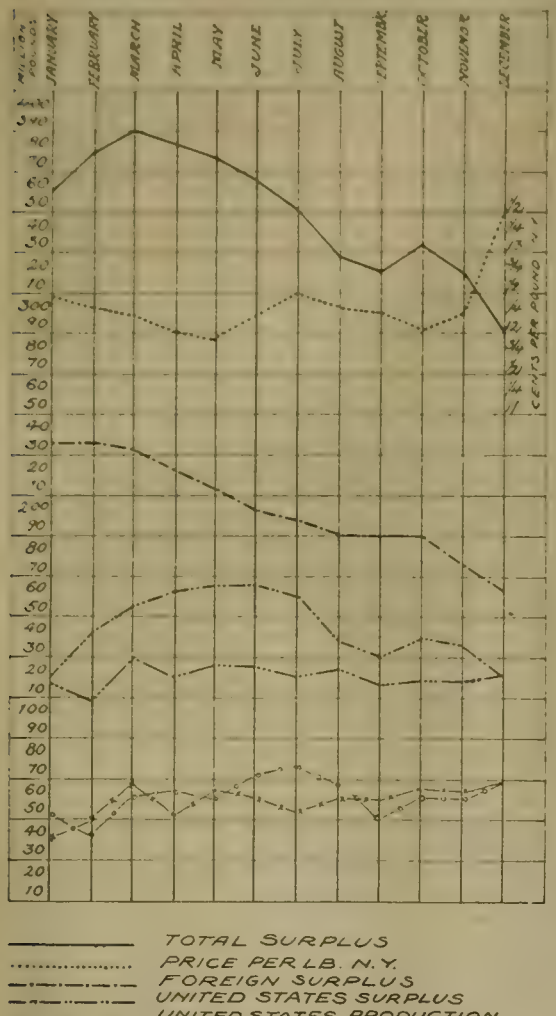
Copper

Statistics and estimates received by the U. S. Geological Survey from all plants known to produce blister copper from domestic ores and from all Lake mines indicate that the copper output from the United States in 1911 exceeded that of 1910 and nearly equaled the record production of 1909. The figures showing smelter production from domestic ore, which have been collected by B. S. Butler, of the Survey, represent the actual production of each company for eleven months and include an estimate of the December output. The November figures for a few companies were not available and these companies furnished estimates for the last two months of the year. According to the statistics and estimates received, the output of blister and Lake copper was 1,091,554,000 lb., against 1,080,159,509 lb. in 1910 and 1,092,951,624 lb. in 1909. Arizona again holds first place, followed in order by Montana, Michigan, Utah, Nevada, California, Alaska, Tennessee, Colorado, Idaho, and New Mexico. Monthly figures of production and consumption, and the course of prices through the year, are described in another column by Mr. Appelbaum.

Copper, Corporations, and Prices

By Misha E. Appelbaum

Fluctuations in production, price, and surplus of copper in 1911 are shown graphically in the accompanying diagram, which is based on the figures of the Copper Producers' Association and the New York quotations published weekly in the *Mining and Scientific Press*. During the first ten months of 1911 the price of copper fluctuated within narrow limits, and the steady tone of the market was principally due to the enormous consumption abroad



COPPER IN 1911.

and to fairly normal consumption in this country. Toward the end of the year, due principally to the small production, a large buying movement developed in Europe. At first American consumers had little faith in this movement and did not enter the market until the price had passed 13c. As a result, however, of liberal purchases on their part, the market quickly advanced, and at the present writing is very firm at 14c. per lb. The statistics for the year show that consumption has more than overtaken production, and as another 25,000,000-lb. decrease in surplus is expected during December, the figures on the first of January should show the visible supply to be less than at any time since the beginning of 1907.

As usual, when the metal experiences a violent advance in price, there are numerous predictions of a copper famine, and, on the other hand, there are people who have no faith in the advance, claiming that the statistics are padded, that the exports are not legitimate, etc. It has been absolutely proved, however, that each copper producer sends to the Producers' Association, on the first of each month, an actual statement of the metal at his refinery. The Producers' figures have checked with those of the Government, and there seems no reason for questioning their accuracy. It is difficult to know upon what basis the charge is made that the copper exported does not go into real consumption. Certainly the visible supply in Europe shows a steady decrease, in spite of the enormous exports. I, for one, do not believe that with the present business conditions, or even allowing the moderate improvement, which is the most that can be expected during a Presidential year, there can be a copper famine. It is quite true that the visible supply is small, and that, should anything happen to one of the leading mines, the metal might advance very quickly. A particularly sudden business revival might also bring about a sharp increase in price, but, assuming that neither of the two will occur during the coming year, I think that the metal will fluctuate between 13½ and 15c., instead of, as during the former few years, between 12 and 13½c. Assuming that the production of copper during the coming year from the old mines remain on the same basis as during 1911, there will be enough copper produced by the few new mines to take care of a moderate increase in consumption, and, furthermore, if the metal should advance to a higher level than 15c., a larger production on the part of existing mines would immediately prevent a runaway market.

There is a good deal of talk to the effect that an agreement should be made among the producers to fix a minimum and maximum price for copper. I fail to see how any business man understanding economic conditions can advocate this. I believe that once a departure is made from the universal rule that prices should be governed by the law of supply and demand, it will create an artificial condition, and, while this might temporarily bring about a better tone to copper, it would eventually result in a much more demoralized condition than can possibly occur if everything is left to the law of supply and demand. The great trouble with business conditions is that, while the need of proper and conservative laws is admitted by everyone, much worse cures are proposed than present methods involve. I fully concur with the opinion of some of the leading business men, that unnecessary competition is ruinous, but I, for one, do not believe that to eliminate competition almost entirely, will be beneficial. The resources of this country having grown to an enormous volume, it is but natural that this growth should bring on many difficult problems, but in solving them, and in passing laws to cope with the enormous combinations, no departure should be made from the universally established principles that competition is the life of trade, and that prices should be governed by the laws of supply and demand. For this reason, I do not see any necessity for creating a large copper combination or having any agreements among the producers as to prices. The best evidence, to my mind, that such agreements are not necessary, is, that the metal during periods of depression has sold around 11c. per lb., and that, without any agreements or laws as to the minimum and maximum price, it at other times advanced to 26½c., because the demand was greater than the supply. Simply because this country has for the past few years been through a period of depression and readjustment, and has registered low metal prices, does not mean that in periods of activity we shall not again see prices very profitable to the producer. If, in the meantime, the wheel of fortune runs in favor of the consumer, this should not be begrudged. Furthermore, this has its advantage that the low copper prices have stimulated consumption and that an enormous surplus is being gradually worked off.

As to the probable course of prices for 1912, it is extremely difficult to predict. The majority of people believe that during a period of tariff readjustment and political

agitation incident to a Presidential election, it is impossible to expect brisk business. Some believe that business will be extremely poor, but I am inclined to hold that the year of 1912 will be at least a little better than 1911, though brisk business cannot be expected until the Presidential election has been settled, and a conservative but wise policy on the part of the Government toward business interests has been established. By that, I do not mean that the Government should shut its eyes to any wrongdoing on the part of corporations; neither do I mean that it should go out of its way to file complaints against those that are known to have lived up to the letter of the law. From my point of view, it is ridiculous for a government to file a dissolution suit against a corporation simply because administrative officers believe that in some particular it has not lived up to the letter of the law. If the rank and file of the people engaged in the same business as competitors admit that the tactics of such corporation have been fair, reasonable, and just, it seems to me that the corporation should be encouraged rather than harassed. The result of the dissolution suit against the United States Steel Corporation will, I think, mark the beginning of a new era in this country, for I believe that the United States Supreme Court will come to the conclusion that the only fault to be found with that corporation is in its tremendous size and the volume of business it is doing, and that the Sherman law was never intended to limit an individual or a corporation provided its work were directed with proper business methods. The corporation question is much in the same state as the tariff question. If it is admitted on all sides that a tariff board composed of the leading business men and statesmen is more able to cope with the question than politicians, I do not see why a corporation board, composed of the leading business men and statesmen should not also be able to handle the question more intelligently. This, with a compulsory Federal incorporation law, would give the board proper supervision over interstate business, and, with a broad viewpoint, it would be able to solve most intricate questions without any disturbance in business.

Zinc Ore and Zinc Smelting

By R. G. Hall

The condition of the zinc business in the year just closing presents a remarkable contrast with that prevailing for some years previously. The latter months of 1910 foreshadowed more prosperous times for the smelter, and as the year 1911 advanced, the smelting margin grew greater. When the conditions which prevailed in the business from the close of 1907 until well into 1910 are considered, no one can deny that the people who have invested money in zinc smelters are entitled to some sunshine between the periods of cloudy weather. Notwithstanding the efforts of the Joplin Ore Producers' Association, the law of supply and demand has not yet been repealed. In the boom days of gas production in Kansas, when a plant could be supplied with fuel by a well in its own yard, gas apparently cost very little. To embark in the smelting business was accordingly an inviting undertaking. The inevitable result was the building to a greater smelting capacity than was justified, either by the supply of ore or the demand for spelter. The shortage of ore was met by importations from Mexico and British Columbia, until the Payne tariff bill put on a prohibitory duty. The resulting decrease in the smelter's margin, together with the rapid decline in the Kansas gas supply, put many gas plants out of existence, while the increasing price of ore stimulated production from the mines. All this tended to work in favor of the smelter. At the beginning of 1911 the reported stocks of metal in producers' hands were about 23,000 tons, which was shown to have diminished to about 17,000 tons by the middle of the year.

European conditions were also such as to bring about high prices, and during the third quarter of the year the prices in the two countries were such as to make it profitable occasionally to export domestic metal. As our own supply was also short, the result was a rapid advance in the domestic price, until in November it, for a time, reached $6.85, St. Louis, with some sales reported at even higher figures. From that high point the price tumbled almost during one day, to around $6.20, at which point it has held pretty steadily. The year closed with stocks in the hands of producers unusually low, and in the hands of consumers down to such a point as they have probably never reached before in recent years. The available statistics of ore production are complete only for the Missouri-Kansas and the Wisconsin districts. They are given below.

Approximate Tonnage, All Ores of Zinc

Missouri-Kansas district, 1911	270,000
Wisconsin district, 1911	76,000
	346,000

Prices in the Missouri-Kansas District

Month.	Base price 60% blende.
January	$41.85
February	40.21
March	39.85
April	38.88
May	38.25
June	40.50
July	40.75
August	42.50
September	42.63
October	42.38
November	45.40

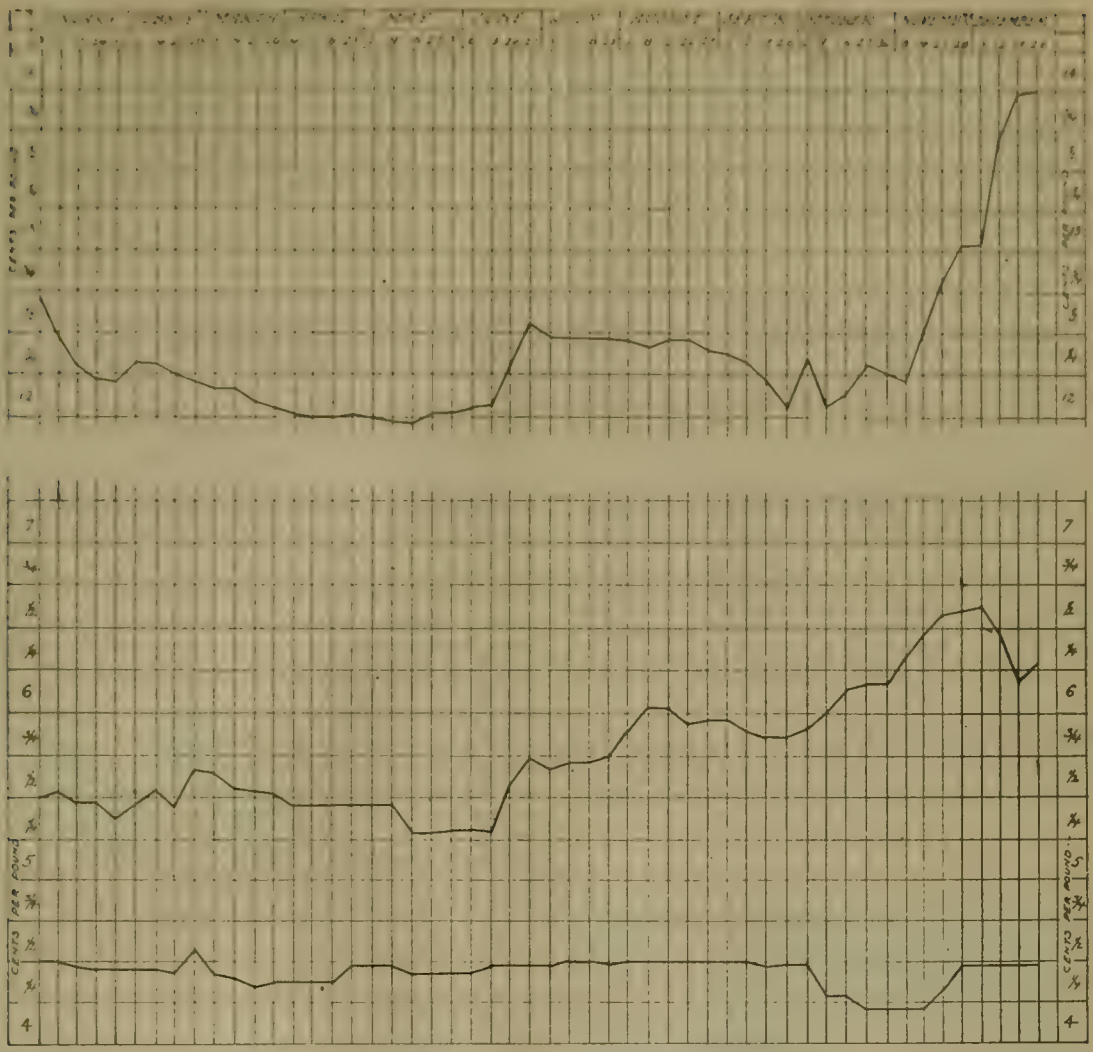
The production in 1910 was 269,000 tons for the Missouri-Kansas district and 56,000 for the Wisconsin district. The prices paid in the two years show, for 1910 an average of $40.42, and 1911 an average of $41.20 for the first eleven months. Apparently the Missouri-Kansas district has made no increase in production, notwithstanding an increase in price, while the Wisconsin output has shown a gratifying advance; perhaps because the mine operators in Wisconsin devoted more time to the mining of ores than they did to attempts to control the market.

In the Western orefields the most interesting development has been the greatly increased production of carbonate at Leadville. The end of the year finds that district with a daily production of close to 350 tons. The tonnage of sulphide ore from Leadville has probably not increased materially, while in the other parts of the State no noteworthy new properties have been opened. Montana's production was large. Fire recently stopped production at the Clark properties, but the Butte & Superior mine continues to operate, and ships a large tonnage. The year 1912 will probably record interesting developments here. The new concentrator of the Butte & Superior company is nearly completed, and W. A. Clark is said to be contemplating building a new mill to replace the one recently destroyed. In Idaho the Success mine has made regular shipments, the Morning mine has begun making some production of zinc, and the Black Horse has been added to the list of producers. In Nevada the Good Spring district continues a good production of carbonates. Other production from the Rocky Mountain States will show a material advance over 1910, and the outlook for ore from these States in 1912 is bright.

The average spelter prices for 1911, at St. Louis, are given below. New York prices, shown in the diagram and quoted from week to week in the *Mining and Scientific Press*, are normally 15c. per hundred higher. At rare intervals there is a wider margin, but when it occurs it is promptly closed.

January	$5.60	July	$5.79
February	5.70	August	6.04
March	5.67	September	6.03
April	5.54	October	6.24
May	5.52	November	6.63
June	5.62	December (Est.)	6.25

Considerable new smelting construction was under way



LEAD, ZINC, AND COPPER PRICES IN 1911.

in 1911. In Oklahoma the Bartlesville Zinc Co., owned by the American Metal Co., is constructing a plant of 5 blocks, or 3200 retorts, and the Tulsa Fuel & Mfg. Co., of the New Jersey Zinc Co., has about completed one of 7 blocks, or 4680 retorts, all at Collinsville. These plants are both partly completed and operating, and will be producing at full capacity in the early months of the new year. In Illinois the R. Lanyon Zinc & Acid Co., owned by William Lanyon, has under construction an acid works and two blocks, or 1600 retorts. This will be completed early in 1912. The American Zinc, Lead & Smelting Co. is constructing an acid works and a 5-block plant of 4000 retorts.

LIST OF PLANTS UNDER CONSTRUCTION

American Z. L. & S. Co.	Hillsboro, Ill.	4000
Bartlesville Z. Co.	Collinsville, Okla.	3200
R. Lanyon Z. & A. Co.	Hillsboro, Ill.	1600
Tulsa F. & M. Co.	Collinsville, Okla.	4680

No new developments are to be recorded in zinc metallurgy for the year in the United States. Some spelter is being produced in Norway by electric furnaces and much experimenting has been done with this method of smelting. In California, especially, important work is being conducted by the Bully Hill Copper M. & S. Co. Undoubtedly some developments along this line may be looked for in the future, but to date nothing of importance has taken place in this country, and for the present attention is being concentrated on better ore dressing and improvements in the conduct of smelting by standard methods.

ZINC SMELTING PLANTS IN OPERATION

Company.	Location.	Retorts.
American Z. L. & S. Co.	Caney, Kan.	3648
American Z. L. & S. Co.	Deering, Kan.	3840
Bartlesville Z. Co.	Bartlesville, Okla.	4608
Chanute Z. Co.	Chanute, Kan.	1280
Collinsville Z. Co.	Collinsville, Ill.	1528
Edgar Zinc Co.	Churryvale, Kan.	4800
Edgar Zinc Co.	Carondelet, Mo.	2016
Granby M. & S. Co.	Neodesha, Kan.	3840
Grasselli Chem. Co.	Clarksburg, W. Va.	5760
Grasselli Chem. Co.	Meadowbrook, W. Va.	2280
Hegeler Bros.	Danville, Ill.	1800
Illinois Zinc Co.	Peru, Ill.	4640
Kansas Zinc Co.	Altoona, Kan.	3840
Kansas Zinc Co.	Gas City, Kan.	2520
Kansas Zinc Co.	La Harpe, Kan.	1856
Lanyon Starr S. Co.	Bartlesville, Okla.	3456
Matthiessen & Hegeler Z. Co.	LaSalle, Ill.	4380
Mineral Point Z. Co.	Depue, Ill.	4520
National Zinc Co.	Bartlesville, Okla.	3040
New Jersey Zinc Co.	Palmerton, Pa.	2868
Prime Western S. Co.	Iola, Kan.	3240
Prime Western S. Co.	Gas City, Kan.	2560
Sandoval Zinc Co.	Sandoval, Ill.	996
U. S. Zinc Co.	Pueblo, Colo.	1680
United Zinc & Chem. Co.	Springfield, Ill.	3680

Lead and Zinc Mining

The U. S. Geological Survey has prepared a preliminary statement of the lead and zinc mining industry in 1911. This statement is compiled by C. E. Siebenthal from the most reliable sources available at this time. It appears probable that the mine production of domestic lead in ore in 1911 made a gain of between 25,000 and 30,000 tons over the 395,313 tons produced in 1910, which, when compared with the estimated increase in the smelter production of domestic lead, 35,987 tons, indicates that domestic lead-ore stocks at the smelters were considerably depleted during the year. This is emphasized by the fact that a large stock of lead ore was accumulated at a Western lead smelter now under construction. Of the great lead-producing districts, that in southeastern Missouri is believed to have fallen behind 1910 by about 4%, while Idaho gained 15% in output. The Joplin district yielded 45,500 tons of lead concentrate, Utah gained about 8%, Colorado remained stationary, and Nevada fell behind about 9%. Montana and Arizona showed large gains.

It is believed that the mine production of recoverable zinc in ore was about 20,000 tons greater than the output of 327,712 tons in 1910. The increase in the output of domestic spelter in 1911 was apparently 21,328 tons. The quantity of zinc recovered as zinc pigments is not known at this time, so that conclusions as to zinc-ore stocks cannot be drawn. The production of the Joplin and Wisconsin districts is discussed elsewhere by Mr. Hall. New Jersey made its usual production, Tennessee attracted much attention and made substantial gains. Leadville is estimated to have shipped 80,000 tons of 30% zinc ore. Montana gained about 40%, as did also Idaho. Nevada increased its output about 60%, while Utah fell behind.

Spelter

Estimates made by C. E. Siebenthal of the U. S. Geological Survey covering production and consumption of spelter in the United States in 1910, show that the year was a record-breaker in many particulars. Both production and exports exceeded those of any previous year.

The production of spelter from domestic ore is estimated at 273,807 short tons, and from foreign ore at 14,237 tons, a total of 288,044 tons, worth, at the average price, $33,837,000, as compared to a total of 269,184 tons in 1910, made up of 252,479 tons of domestic origin and 16,705 tons of foreign origin. The production of spelter from both domestic and foreign ores, apportioned according to the States in which smelted, was approximately as follows: Illinois, 84,626 tons in 1911, as compared to 73,038 tons in 1910; Kansas, 97,790 tons in 1911, as compared to 105,697 tons in 1910; Oklahoma, 46,061 tons in 1911, as compared to 34,760 tons in 1910; all other States, 59,587 tons in 1911, as compared to 55,689 tons in 1910. The total production of spelter is equivalent to the output of 67,555 average retorts operating continuously through the year, or about 80% of the effective smelting capacity of the country when working 60% zinc concentrate.

The apparent domestic consumption of spelter in 1911 may be computed as follows: The stock on hand at smelters at the beginning of the year, 23,232 tons, plus the imports, 285 tons, and the production, 288,044 tons, gives the total available supply of 311,561 tons. From this there are to be subtracted the exports of domestic spelter, 5292 tons, the exports of foreign spelter, 10,678 tons, the exports under draw-back, 2628 tons, and the stock on hand at smelters December 15, 9025 tons, a total of 27,623 tons, leaving a balance of 283,938 tons as the apparent domestic consumption. This calculation takes no account of the stocks of spelter held by dealers or consumers. On comparing the consumption in 1911 with the 245,884 tons consumed in 1910, the 270,730 tons in 1909, the 214,167 tons in 1908, and the 226,969 tons in 1907, it is to be noted that the apparent consumption is abnormally large, indicating that stocks other than those at smelters have appreciated.

Lead

The total production of refined lead, desilverized and soft, from domestic and foreign ores in 1911 was approximately 487,520 short tons, worth at the average New York price $43,876,800, compared to a production of 470,380 tons in 1910 and 448,112 tons in 1909, according to figures compiled by C. E. Siebenthal of the U. S. Geological Survey. These figures do not include an estimated output of 13,195 tons of antimonial lead, against 14,069 tons in 1910 and 12,896 tons in 1909. Of the total production, desilverized lead of domestic origin, exclusive of desilverized soft lead, is estimated at 208,428 tons, against 193,213 tons in 1910; and desilverized lead of foreign origin at 89,706 tons, compared to 108,553 tons in 1910. The production of soft lead from Mississippi Valley ores is estimated at 189,386 tons, compared to 169,244 tons in 1910, which means that Missouri retains first place among the lead-producing States. The final figures for the production of soft lead in 1911 are likely to show an increase of a thousand tons or so over those above given because the argentiferous-lead smelters and refineries undoubtedly treated more or less soft-lead ore from the Mississippi Valley which is not taken into account in their preliminary estimates.

The amount of lead available for consumption during 1911 may be estimated by adding the stock of foreign lead in bonded warehouses at the beginning of the year, 35,972 short tons, the imports, 91,244 tons, and the domestic production, 397,814 tons, making an apparent supply of 525,630 tons. From this is to be subtracted the foreign lead exported from warehouse, 103,656 tons, the exports of foreign lead in manufactures under draw-back, estimated at 10,468 tons, the deduction by liquidation, 16,178 tons, and the stock in bonded warehouses at the close of the year (assumed to be the same as at the close of November), 3728 tons, leaving as available for consumption 391,000 tons, which by comparison with 376,021 tons in 1910 and 370,013 tons in 1909 seems to be a normal increase.

The foreign lead remaining in warehouse at the close of November 1911 was distributed principally as follows: At Chicago, 630 short tons, compared with 10,545 tons at the close of 1910; at Newark, 975 tons, against 3774 tons at the end of 1910; at Perth Amboy, 125 tons in 1911 and 18,056 tons in 1910; and at Paso del Norte, 1852 tons compared with 3469 tons at the close of the preceding year.

Mr. Siebenthal's figures are of especial interest in that they furnish the only information available as to surplus and stocks. Sales of lead in the United States are largely in the hands of the Guggenheim interests, and in that connection the curve of price for lead in 1911 may be compared with interest with that for spelter, in which there is here a free market. The two curves show the effect of 'stabilizing' an industry. The price of desilverized lead was even steadier than indicated by the graph. On October 5 it was reduced from 4.50 to 4.35, that being the first reduction in price since November 18, 1910. October 15 it was dropped again to $4.25. Current quotations take into account the soft lead of the Mississippi Valley which now dominates the situation.

Tungsten

There was a sharp falling off in the production of tungsten ores in 1911, owing to the decrease in the market for tool steels, in which the bulk of the tungsten is used. According to preliminary figures collected by Frank L. Hess, of the United States Geological Survey, about 1125 short tons of concentrate carrying 60% tungsten trioxide was produced and shipped during the year, which is less than two-thirds of the output for 1910, when 1821 tons was marketed. The prices for the year ranged from $4.50 to $8.50 per unit, depending on quantity, quality, and individual bargaining. At the close of the year $5 per unit was offered. The unit is twenty pounds of tungsten trioxide per short ton of ore.

As usual the Boulder County (Colorado) fields gave the

largest returns, 740 tons, and the Atolia (California) deposits the second largest. Smaller amounts were produced in Arizona. Near Nipton, California, work was done by several persons on tungsten-bearing veins, but most of the ore was left at the mines to await higher prices. New mills for treating tungsten ores were operated at Osceola, Nevada, and in the Blue Wing district on Patterson creek, Idaho, and a new mill was being built at the close of the year at Round Mountain, Nevada.

Tin Mines and Market

The year 1911 was characterized by great irregularities in the London tin market, as noted by Mr. Rickard on another page. These sudden gyrations of the market were duly reflected in New York with certain added permutations. Late in the year tin advanced in London to £205, equivalent to 44½c. per lb. At the same time it was announced from the Straits that shipments the first half of December amounted to 3354 tons, and for the month they were estimated at 5500 tons. This brought the total for the year up to 54,870 tons, which is a small increase over last year instead of a decrease as anticipated. According to L. Vogelstein & Co., English and Continental deliveries for eleven months averaged the same as in 1910 and in the United States were slightly less. Figuring on this basis for December, total deliveries for the month should run 600 or 800 tons in excess of supplies, and the visible supply December 31 should have been about 16,000 tons, or 1000 tons less than a year ago. This shows a very even balance between supply and demand. Consumption has really exceeded production, more than these figures indicate. The excess has been drawn from invisible supplies and non-statistical brands, principally Bolivian. Visible supplies frequently and for long periods have been at much lower figures, and present high prices are predicated, not so much on the present situation as on the fear that in the early months of 1912, after the Chinese New Year, Straits shipments will fall off and a serious depletion of stocks occur. Meanwhile supplies will pile up in London.

Average monthly quotations at New York in cents per pound are given below:

	1910.	1911.		1910.	1911.
January	32.70	41.255	July	32.69	42.40
February	32.92	41.614	August	33.97	43.32
March	32.40	40.157	September	34.98	39.75
April	32.98	42.185	October	36.19	41.18
May	33.12	43.115	November	36.55	43.12
June	32.77	44.606	December	38.20	45.00

Of more interest is the commencement of actual shipments of tin from Alaska, as noted by Mr. Gibson, the record of actual shipments from the Black Hills, and the development of our new sources of supply in various parts of the world, as recorded by Mr. Rickard. In the Transvaal tin excited some interest and shows promise, but it cannot be said that its progress has come up to expectation, nor has the long anticipated 'boom' made its appearance. The value of the tin-ore shipments commenced to increase in January, when it was £32,508, and continued to steadily increase until May, when it reached £48,938, but fell to £22,867 in September. There are, however, only two important producing mines in the Waterberg district, which fact will go a long way in explaining the variation in shipments. The Waterberg tinfield has come into increasing prominence during the year, and quite a large number of properties have been taken up by companies, syndicates, and others. The tin ore occurs in both lodes and 'pipes,' the latter being sometimes described as 'chimneys.' They vary considerably in shape, occurrence, and tin content. Quite an extensive area has been proved to be mineralized, and one mine—the Zaaiplaats—has for some time paid dividends at the rate of 200% per annum, the 5s. shares standing in the market in the neighborhood of 90s. As before remarked, a tin boom has been looked for throughout the year, but up to the time of writing it was still out of sight. Near Victoria, in Rhodesia, tin discoveries were announced, and created some stir, but development indicates that the deposits are patchy and irregular.

Quicksilver

The year 1911 was important to American producers of quicksilver mainly because of changes in selling conditions. As is well known, the major part of the American output has been marketed for some years through a single selling agency known as a 'trust' and which worked in close harmony with the Rothschilds in London. In February last, one of the leading producers withdrew his account, and, being followed shortly after by others, the combination was quickly broken. Today buying and selling of quicksilver is on a strictly commission basis and the market is one of the freest in the metal trades. San Francisco is the primary American market for quicksilver, though quotations there, as furnished weekly in the *Mining and Scientific Press*, show a relation to those in New York not greatly different from that obtaining between St. Louis and New York prices for lead. There is also a relation, though not as close as formerly, between New York and London prices. At times this year New York quotations have been as much as $3 above the London parity, though without importations. The average quotation by months in dollars per flask of 70 lb. each, is given below:

	1910.	1911.		1910.	1911.
January	50.87	44.60	August	46.75	50.00
February	50.62	48.40	September	46.00	47.50
March	50.00	52.50	October	46.00	46.12
April	49.55	50.90	November	45.62	45.50
May	48.56	46.50	December	44.90	44.50
June	47.56	46.50	Average	47.80	47.58
July	47.12	48.00			

Production in 1911 was probably a little below that in 1910, but prospects for 1912 are unusually good. California, which remains the main producing State, shipped 17,211 flasks in 1910, a trifle over 18,000 in 1911, and will probably ship 20,000 in 1912. Texas, which ranks second, shipped 3320 flasks in 1910, but only about 2500 in 1911, and probably will not ship more in 1912. It is

ALPINE QUICKSILVER FURNACE.

not that the Texas mines are failing, but that the market in St. Louis, which is the one principally supplied from Texas, does not require more, and the producers do better not to scramble for general business. Nevada and Oregon each produce small amounts. Probably 100 flasks would cover their output in 1911. Nevada, however, will soon become a more important producer, as the Mercury Mining Co. is building a furnace at Ione and should ship early in 1912. In California the New Guadalupe M. Co., New Idria M. Co., Quicksilver M. Co., Oceanic Quicksilver Co., and the Helena mine remain the principal producers. There are in addition a considerable number of small furnaces. The Alpine Quicksilver M. Co. operates a 5-ton Scott furnace, as shown above, near New Indria. The ore is the usual cinnabar in a crushed serpentine, and is said to exist in considerable quantity and up to 7% in grade. Plans are under way for increasing the capacity of the plant. A number of other properties have attracted attention in the past year, and the outlook is distinctly favorable for increased production.

Construction Costs at the New Portland Mill, Cripple Creek, Colorado

By G. M. Taylor

	Labor	Lumber	Galv. Iron	Rods & Bolts	Tank Steel	Structural Steel	Sand	Cement	Belt	Electric Supplies	Nails	Corrugated Iron	Paper	Hardware	Wire	Paint
Railroad switch	$ 6032 30	$ 178 82														
Track and trestle	1377 50	1295 85		$ 212 79												
Coarse crushing plant	8458 30	1219.75		154 04	$804.97	$345.00	$20 05	$931.40	$1074.35	$287.67	$81.23	$560 24	$66.04		$30.81	$71 53
Conveying department	1323 56	711 25		83 20				38 00	1299 50	97 38		262 92				30 00
Sampling	917 40	459 84		11 03					456 71	142,68	17.35					
Fine crushing	1564 32	2046 76		252 97	2396.69				189 35	493 82						31.50
Concentrating	4156 32	2002 00		148 35	490 25		560.10	565.76	355 89	308 27	22.83		5.44		54.84	24 00
Classification	1887 11	723 43	$ 33.35	194 17			13.46	6 85	855,97	132 67	22.80					
Dewatering	959 76	187 99		138 12	5111 87			71.65	55 69	35.82						71.90
Agitating	1764 38	169 41			6703 85		325 84	279.38	130.20	246 36						84 94
Chemical	221 22				90 41				24 46			25.04		$ 1.76		3 00
Laboratory	351 37	77 38								15 53		22.54		5.46		5.20
Filtering	5335.90	2110 79	298.65	128 86	863.89		66 50	92 40	202 75	137.93						13.50
Solution	2734 26	921.15		50.00	4685.63		30 69	59 19	64 00	116.86	24 97	470.62	37.89		8 58	171.31
Precipitating	553 29				770 76		97 70	76.01		110.13						
Tailing	3250 28	682 99					12 00	114 18								
Main mill building	19012.44	3804 69	20.37	107.32		13579 16	98 90	3802 17			99.11	2154 94	372.35	43.57	125.90	573.04
Transformer house	1132 62	283 40		5.30				206 37		4264.42	4.01	149.27	22.70	0.61	62 64	13 32
Machine shop	1665.39	453 99		3 73		1845.87	16 36	202.48	79.32	68.78	12 60	302.08	14 29	2 47	16.07	59 43
Mill lodge	109.81									11 79						10 47
Superintendents house	478 01	104.85								19.36		22.49				13.12
Chemical storehouse	168.80	168.20										65.17	6.93	9.36		16.86
Oil house	94.80	34 66										40.74				
Heating plant	3253.26	433 51		24.78				76.00								
Tube-mill	841 26	63 39		42 78				190.00		88.20						
Engineering																
Undistributed expense	3928 74															
Total construction	71557.60	18134 13	552.37	1557.44	21918.32	15769.03	1241.60	6711.84	4786.19	6577.67	284.90	4076.05	525.64	63.23	298.84	1192.92

Radiators	Metal Lath	Plaster	Launders	Wood Tanks	Ties	Steel Track	Pipe	Pumps	Motors	Powder	Miscellaneous	Mill Machinery	Skylights & Windows	Shafting	Total	
					$ 128.74	$ 969.82				$ 19.24	$ 150.22				$ 9479.14	Railroad switch
					71.18	260.81									3213.13	Track and trestle
	$ 123.61	$ 70.51							$ 1261.39	70.81		$ 12643.21	$ 98.16	$ 902.96	29275.83	Coarse crushing plant
									625.46			378 46	33.86	1132 26	6015.85	Conveying department
									291 16			1196.96			3488 13	Sampling
			$ 53.79						994 80			13416 35		599 44	22039.79	Fine crushing
	12 07		2538 08		71.20	186.00	$ 422.51	$ 178.36	$ 05 04		83.59	11509 84		595 02	24993.96	Concentrating
			281 00				44 40		153.93			4629.78		130.25	9304.17	Classification
			259 43				78 00	51.53	467.71		17.00	68 22		357.96	792765	Dewatering
							774 72	535.08	1901.14		160.44				13075 77	Agitating
				$ 60.30			102 92				4.06			92.86	626 03	Chemical
		26.50									510,92				1014 90	Laboratory
			32 50				845.95	845.08	1088 33		817.74	10052.55		432.21	23365.53	Filtering
	107.67	61.45					2432 16	1797.44	582 31	2.38			48 47		14407.03	Solution
			26 40				85 98	872.60	291.15		157.31	15686 80		36.88	18765.01	Precipitating
					160.80	337.03					52 00	2119.91			6729.19	Tailing
	586.14	339.26									41.00		1156.28		45916.64	Main Mill Building
													27.08		6171.74	Transformer house
	91.86	53.48							233 52			4600.32	101.55	142.16	9965.15	Machine shop
											647.55				779.62	Mill lodge
											197 67				935.50	Superintendents house
													7.04		442.36	Chemical storehouse
											52.00				222.20	Oil house
$ 3563 73							6433.52				2747.00				16531.80	Heating plant
									806.46			2170.31			4107.73	Tube-mill
											11615.53				11615.53	Engineering
											4499.18				8427.92	Undistributed expense
3563.73	1029.35	551.20	3191.20	60.30	1431.92	2753.66	11220.16	4280.09	9294.40	92.43	21753.21	78467.71	1472.44	4422.00	298831.97	Total construction

Operation of Air-Compressors

By E. A. Rix

An air-compressor is rated by the displacement of its piston or pistons in single-stage machines, and by its low-pressure piston in two-stage or multi-stage machines. It is self-evident that this is the proper manner, although it is theoretical. Any attempt to give the actual delivery of an air-compressor would give the consideration of many factors, quite difficult to ascertain. It is right, however, for the public to know about this, for when an air-compressor seems unable to do its work or was not large enough in the first place, an intelligent idea of its deficiencies may be helpful in providing a remedy. While an air-compressor does not differ materially from a steam-engine in matters that affect its volumetric efficiency, a steam-engine which is delivering its horse-power is only criticized for its economy, while a compressor, whether economical or not, if it does not deliver the volume, is not doing its work and may therefore have to be replaced. It may be helpful to inquire into the principal things that affect volumetric efficiency, and perhaps among some of them an explanation may be found for the failure of any particular machine under consideration. Inasmuch as single-stage compressors constitute the majority of all air-compressors operated, these may be considered first, and inasmuch as the majority of air-compressors are built for and operated under 100-lb. air-pressure, investigations will be directed to that pressure. The factors affecting the volumetric efficiency are: (1) Piston and valve-pocket clearance; (2) piston and piston-rod leakage; (3) valve leakage and slip; (4) temperature; (5) piston speed.

Piston and Valve-Pocket Clearance.—When the displacement of a compressor is given in terms of the volume swept by the piston, it supposes that there is no clearance of any kind in the cylinder, and that all the air in the cylinder is forced into the receiver. This, however, cannot be done in practice, for the piston must not reach either cylinder-head by a reasonable distance demanded for safety in operation, and this varies with the character of the compressor. Few builders leave less than $^1/_{16}$ in., and many $^1/_4$; an average may be safely taken as $^1/_8$ inch.

When compressing air to a given receiver pressure, it always takes a higher pressure within the cylinder than is indicated in the air-receiver; this is due to the power required to force the air through the valve passages. At 100-lb. receiver pressure, the pressure remaining in the clearance space is at least 5 lb. greater, or 105 lb., which corresponds to eight atmospheres or eight compressions. The $^1/_8$ in. of clearance, then, is filled with air at 105-lb. pressure. Now, when the piston begins its intake stroke it is evident that, until the compressed air in the clearance space expands to atmospheric pressure, no air can come in from the atmosphere. An eighth of an inch clearance would thus hold compressed air enough at 105 lb. to expand to one inch before any air came into the cylinder. In other words, the stroke has been actually shortened one inch. It is evident, therefore, that the shorter the stroke with the same clearance, the less the volumetric efficiency; a 16-in. stroke losing 6%, an 8-in. stroke losing 12%, and a 4-in. stroke 24%. It might not be supposed that anyone would operate a 4-in. stroke machine with any such clearance as $^1/_8$ in., but I have seen a $^1/_8$-in. gasket put under the heads of a 4-in. stroke compressor that already had $^1/_{16}$-in. clearance, making $^3/_{16}$-in. clearance; and this simply because a gasket of that size was on hand. It was therefore used, the result being that the compressor doctor had to be called in.

Now, in addition to the piston clearance, there are the pockets below the outlet and inlet valves that add to the other clearance. Generally speaking, this is about one-fourth of the piston clearance. Taking both these clearances into consideration and reducing them to percentage of cylinder volume, it may be said that the average single-stage compressor has clearance spaces equal to 2% of its volume. At 100 lb. receiver pressure, therefore, which calls for eight expansions in the clearance, there is a direct loss of volume by clearance of 16% in the average single-stage machine.

Piston and Piston-Rod Leakage.—No piston is ever tight in an air-compressor, even when it is new and fitted with the best of rings; neither can this be expected, for it requires gaskets and many bolts to keep a cylinder-head tight, and heavy pressure from a long wrench to make a pipe-thread tight. It is evident, therefore, that the contact the rings make with the cylinder walls is not sufficient for a joint. This can easily be tried by taking an inlet-valve out of one end of an air-compressor and an outlet-valve from the other end; admit the receiver pressure at 100 lb. into the cylinder, and the air will rush out through the inlet-valve opening in proportion to the condition of the cylinder piston and rings. Inasmuch as sometimes this becomes a great loss in an air-compressor, an operator should, upon installing a compressor, make the above test to familiarize himself with the normal leakage when the compressor is new. Then, when the machine is not delivering its proper quantity, a second test will show the difference. For this purpose I use a plug to screw into the inlet-valve opening. This plug has a round hole bored in it of such a size for any given compressor that the pressure indicated on a gauge also attached to the plug shows somewhere from 2 to 10 lb. By a reference to a 'Discharge from Orifices' table, the approximate volume flowing out may be determined and recorded. If after use this machine requires overhauling, a repetition of this test will show the additional comparative loss, and thus the condition of piston and rings may be determined without removing them. Speaking of rings, it is seldom that snap rings, even with eccentric circumferences, are good enough for compressors having cylinders over 8 inches diameter. Sectional rings provided with springs are better.

The leakage around the piston-rod through the packing gland may be considerable when a compressor is carelessly operated, or it may be practically nothing with good packing, a smooth rod, and proper attention. Taking average cases, it may be assumed that there is a general loss of 3% of the volume of the cylinder due to leakage around the piston and piston-rod. In testing for such leakage the piston is placed in different positions and air under pressure that corresponds to the position of the piston is admitted, and the results are then properly averaged.

Valve Leakage and Slippage.—Poppet valves are seldom perfectly tight, and at ordinary operating speeds do not close exactly at the end of the piston stroke. All resulting leakages are against the volumetric efficiency of the compressor. In the inlet valve comes, first, the slight slippage due to delayed closing when some of the air in the cylinder will be pushed out again; and when the valve is seated, if it is not absolutely tight, a certain quantity is being pushed out as compression progresses. In the outlet-valve the slippage and leak help fill the cylinder as the intake stroke progresses, thus reducing the intake volume. I determine these leakages in the same manner as with the piston leakage, by means of a pressure gauge and small nozzles, using the orifice discharge tables to get the quantity. In ordinary machines these valve leaks and slippages will amount to 4% of the cylinder volume. It will readily be seen that the slippage is a function of the piston speed; the greater the speed the greater the slippage, until a speed of 200 r.p.m. is attained, which is practically the limit for ordinary poppet valves. Indeed it may be less, depending on the weight of the valves. I remember trying a 10 by 10 compressor driven by a water-wheel so that any desired rate of revolution could be maintained. A hole was drilled in the side of a receiver and gauge reading taken at various speeds. At 168 r.p.m. the maximum reading was taken, and this reading was maintained up to 180 r.p.m., when the pressure fell for any increased number of revolutions. If mechanical valves had been used the revolutions could have been materially increased; just what the limit would be, I do not know.

Temperature Considerations.—These are of great impor-

tance and are extremely difficult to determine. It is evident, however, that the lower the intake temperature is, the greater the weight and consequently volume of air the compressor will deliver. It is desirable, therefore, to draw the air from the coolest place adjacent to the machine, and at the same time from a place free from fume or dust. It is also evident that the hotter the inlet-valves, the more heated the intake air becomes in passing through and over their hot surface, and the greater it will expand, thus reducing the weight taken into the cylinder and consequently the resultant volume of compressed air. The same is true of heated cylinder walls and heads. Inasmuch as water-jacketing is the only method in a single-stage compressor for reducing these temperatures, it is important to see that the water-jackets are free from sediment and that a quantity of water is passed through the jackets sufficient to show no noticeable difference of temperature in passing through. The idea is to keep a cylinder cool in order to get as great a weight of air as possible into it.

An experiment can readily be made to show this temperature influence. Drill a hole in the air-receiver and note the gauge pressure when it becomes stationary with the compressor running, then close off the jacket water and note the pressure gradually drop, showing the loss of volume. In average single-stage machines, 7% is not too much to allow for losses due to temperature influences.

Summing the losses, they are: (1) Clearance losses, 16%; (2) piston and rod losses, 3%; (3) valve leakage and slippage, 4%; (4) temperature losses, 7%; making a total of 30%. In other words, the compressor gives 70% of its catalogue free-air rating, when operating at catalogue speed and 100-lb. receiver pressure. This seems quite a loss, but it is practically true, and may be considered inherent in the ordinary poppet-valve single-stage compressor. Now, if this condition exists to start with, and never grows better, but always worse by wear, it is evident that the best care and attention must be given the machine. I have noted many machines of this type that were not giving 50% volumetric efficiency from being in bad repair and unskillfully handled. It becomes evident, therefore, that if an air-compressor is not doing its work, very material gains can be made by investigating the sources of loss as herein indicated, and making necessary repairs. It is also self-evident that these losses will decrease in some ratio as the pressure decreases, and by experiment the result is about as follows:

Volumetric efficiency at 100-lb. pressure, 70%; at 80 lb., 77%; at 60 lb., 82%; at 40 lb., 85%; at 25 lb., 88%. In other words, the same compressor will give 25% more air at 25 lb. than at 100-lb. receiver pressure. Now, inasmuch as 25 lb. is the working pressure of the low-pressure or intake cylinder in a two-stage machine, it needs no comment to show why it is desirable. It is also evident that a purchaser is getting 25% more for his money, independently of other gains, when buying a two-stage compressor.

While compressors are rated by displacement which does not show their true output, most pneumatic tools are very much underrated by their builders, especially pneumatic riveters, chippers, and boring machines; some as much as 50%. An air-compressor need not be condemned for lack of duty, therefore, if it does not operate as many tools as rated in the catalogue.

For first aid for a crippled compressor, it may be suggested that excessive piston clearance may be remedied by putting a thin piece of boiler plate on the piston, or thin paper gaskets under the heads, if possible. Piston and rod losses point to re-boring the cylinder, to new rings, and to need of proper packing. Valve leakage demands re-grinding; valve slippage, the putting in of heavier springs and re-grinding, and, if revolutions of the compressor are excessive, these must be reduced. Temperature losses may be decreased by giving cooler inlet air, cooler jacket water or more of it, or by clearing out the jackets. If a compressor lacks but a small percentage of furnishing air enough for its work, and the preceding suggestions have all been taken advantage of, then a 'booster' consisting of a rotary blower may be attached to the suction of the compressor so as to give an intake pressure of one or two pounds, and this will materially increase the output of the compressor. Care must be taken to supply a blower having at least 15% greater capacity than the compressor.

Tin-Dredging in Alaska

By T. M. Gibson

A dredge was installed this year on Buck creek in the York district of Seward Peninsula for the purpose of mining stream-tin. It is, I believe, the only dredge ever built to mine tin in territory belonging to the United States. The material for this dredge was landed on the ground August 7, and it was completed and ready to run September 6, though, on account of the dam behind the dredge washing out, and some engine troubles, operations were delayed until September 10. This dredge was designed by W. W. Johnson and H. G. Peake and was financed by them and some of their friends in San Francisco. It has a $2^3/_4$-ft. bucket-line and its power is supplied by two 40-hp. Union gas-engines. It uses 160 gal. of distillate per day. The material passes from the buckets into a 4-ft. revolving screen 13.5 ft. long and having 3-in. perforations.

TIN-DREDGE, SHOWING ONE SLUICE BEING CLEANED UP.

The oversize passes to a conveyor-belt running almost horizontally and is dumped just far enough astern to give clearance. The undersize drops into a steel box open at the lower end and set at such an angle that the material flows freely into either of two 42-in. sluices which run to the stern and project 44 ft. beyond, being supported by cables from the rear gantry. A cut-out partition in the steel box enables the operator to send the material down one sluice-line while the other is being cleaned up. The water is supplied by a 10-in. centrifugal pump. A 6-in. pipe leads to the head of the sluices and an 8-in. pipe leads to four 3-in. nozzles in the screen, which spray upgrade against the downward moving material. The sluices contain Hungarian riffles $2^1/_2$ in. deep, set $2^1/_2$ in. apart.

The dredge was closed down October 15, so that the crew could catch the last boat down from York this fall. Between September 10 and October 15, 92 tons of tin concentrate, having an average content of 64% tin, was mined. Of this, 74 tons was shipped to Seattle on the *Corwin*. The rest was shipped out on the *Duxbury*, a small gasoline schooner leaving later. The concentrate at present quotations is worth over $500 per ton. Heretofore, small lots have been shipped from the York district and had to go to Cornwall, to Wales, or to Hamburg, Germany, for treatment, but it is now thought that arrangements may be made to treat it on the Pacific Coast. Mr. Johnson thinks the output will exceed 300 tons of concentrate next season. The phenomenal success of this little dredge seems to open a very alluring field for others, but it must be kept in mind that so far as known, the rich tin-bearing grounds are confined to Buck creek and this company has it all tied up.

The London Market for Mining Shares and Metals

By T. A. Rickard

The past year has been marked by profound political disquiet, which has been so widely distributed as to affect both mining operations and those financial arrangements on which the miner depends for capital. Revolutions in Mexico and China, military aggression in Morocco, Tripoli, and Persia, serious friction among at least three of the Great Powers, has all shaken that pocket nerve which is the most responsive in the human anatomy. The Mexican revolution appears to have run its course to a pacific consummation, and the hope may be entertained that the political stability of the Government in that great mining region will tend to encourage further exploitation. China is still in the throes of an upheaval that seems likely to cause a complete abandonment of hoary anachronisms; but it is improbable that industrial peace will be restored for a long time to come. The mining interest in this revolution is relatively unimportant, except as it affects coal, but the destruction of credit will affect the money markets of Europe. The iron mines of Morocco and the oil- and turquoise deposits of Persia gives a mining touch to the unhappy plight of two decadent nationalities. But these direct relations between mining and politics are insignificant compared to the indirect effect of international imbroglios upon the business of the world. More than one chairman at recent company meetings in London has explained how the financial arrangements made by him and his co-directors during 1911 were modified by the panic which in turn seized Paris, Berlin, and London, with instant echoes at New York, Melbourne, and Bombay. Indeed, the most salient feature of the year under review is its testimony that the London market is keenly sensitive to international political trouble, and that other centres are quick to respond. The telegraphic wire has proved a boon to business by affording swift communication, but it has also added a new terror to the life of a business man in placing his plans at the mercy of events in the far corners of the globe.

THE EASTERN RAND.

Socially the year 1911 was rendered noteworthy by the coronation of King George V, with attendant celebrations and festivities, all of which interfered with the routine of business and the progress of speculation. After the coronation came an exceptionally sunny summer, causing the holidays to be unusually prolonged. To our American friends it may seem that such incidents should not affect business, but they do. It has been said that my fellow-countrymen take their pleasures sadly; they certainly take their holidays religiously. For several months the City was half deserted by its most dynamic personalities. Speculation languished. Then came wars and rumors of wars, a railway strike, a couple of mining fiascos, followed by the usual November fogs and cold rain, enough to dampen the spirit of Sunny Jim himself. On the whole, we are well rid of 1911, and have good reason to expect better things in 1912. A comparison of quotations, given on another page, will exhibit the trend of the market since this review was written a year ago. The general tendency is downward.

Transvaal. The South African or 'Kaffir' market has undergone several shocks, besides a gradual realization of the fact that the Rand has passed its zenith. An enormous quantity of gold remains to be dug out of the ground and many millions of pounds sterling are yet to be distributed among shareholders, but the glory is departed. The best features of mining at Johannesburg have now been discounted, and in future the unexpected will be unpleasant. Much new and original work remains to be done in the technical departments, but the great era of expansion as regards mining operations shows signs of termination. At the beginning of the year the firm of Wernher, Beit & Co. distributed its assets among two holding companies, the Rand Mines and the Central Mining & Investment Corporation. Alfred Beit died four years ago. Sir Julius Wernher is an invalid and has been compelled to withdraw from active business. Thus a big factor in Rand affairs is no longer potent. The financial house next in rank is the Consolidated Gold Fields of South Africa; this also is extending its activities outside of the place of its origin, and has acquired interests in California, Canada, Trinidad, and Mexico. Other South African houses have followed suit. It may be accepted that the well informed recognize a necessity for diverting energies hitherto concentrated on the Main Reef series in the Transvaal.

Turning to the 10 representative quotations, it will be noted that the East Rand Proprietary, after a tardy and discreditable confession of a vain effort to carry out a too ambitious programme, has suffered a drop of 40% in its market valuation. The life of the Robinson is drawing to a close, hence a decline in the appraisal that should have come earlier and more gradually. The Meyer & Charlton affords a pleasant example of stability and good management. The big consolidations of the Crown Mines, Rand Mines, and the Randfontein groups have suffered from the East Rand exposure and from the shortage of native labor. This last has been a constant hindrance to the fulfilment of large-scale plans of operation, and it is only recently that frank acknowledgment has been made of it. The companies that have completed new and large milling plants during the year have tended to check the drooping tone of the market and will be prominent in 1912. I refer especially to the two Modderfontein companies, the City Deep, and the Brakpan. The City Deep has suffered from errors in mill construction and from rumors concerning the title to its mining claims.

Rhodesia has engaged a large share of public attention,

due in part to an uneffectual effort on the part of market operators to stimulate a boom, that is, to drive the public into a state of irrational optimism. The boom spluttered like a damp fire-cracker, and is succeeded by a gloom all the denser for the brief pyrotechnics. The production of gold shows an increase, but it is so slight as to be disappointing. An analysis of the Rhodesian returns indicates that 24 out of the 162 productive mines yield 70% of the gold output. Further, the four biggest producers (the Globe & Phoenix, Giant, Eldorado, and Lonely Reef) contribute 36% of the total output. The Rhodesian market is the most cleverly manipulated of any mining department and the legerdemain of share-dealings is nowhere carried to so dangerous a point. Reports given to shareholders are usually both belated and cryptic. However, as against the slight gain in production and the manifold signs of irresponsible finance, it is pleasant to record the development of several fine properties, quite capable of becoming the basis for profitable mining, if that operation were not tied to over-capitalization and excessive appraisals that leave no chance for sound business. Among the new mines are the Shamva, an agglomerate deposit that continues to open-up splendidly, the Cam & Motor, with several lenticular ore-shoots of excellent grade, and the Lonely

WEST AFRICAN GOLDFIELDS.

Reef, a small but rich and continuous orebody. The last mentioned affords an excellent example of ill-regulated optimism; the vein is rich but narrow, the mill has a capacity of 4000 tons per month, at which rate two levels must be opened up annually, arguing unbounded confidence in the persistence of the ore-shoot. The shares stand at £33s, or over $4,500,000 for a mine having only about $1,500,000 of profit assured. The Globe & Phoenix is the most productive mine and holds its own, despite some minor set-backs. The Giant has lost its orebody by a fault, and now faces an uncertain future. The British South Africa or 'Chartered' company, which is the landlord of Rhodesia, has not declared a dividend as yet, but holds out the promise of doing something for its shareholders soon. The Tanganyika Concessions, the big Anglo-Belgian copper company, with mines in the Congo Free State, has been the sport of bulls and bears, chiefly the latter, throughout the year. This enterprise represents the application of much energy, more money, and less technical experience than is advisable at this stage of the world's history. The coming year should see a show-down, for a smelting campaign was started in June and the publication of results cannot long be deferred.

West Africa has had its set-back in the shape of a fiasco at the Prestea, the company representing the consolidation of the Prestea Block A and the Prestea Mines. When the 110-stamp mill was approaching completion it was stated by the new manager that only enough ore for half its capacity could be supplied. On the other hand, the Ashanti Goldfields is doing well and has opened another ore-shoot of a most promising character. Other mines of which good things were expected have languished. The Gold Coast is affected with a malaise that deadens the energy of every white man and hinders the completion of plans cheerfully devised in London. Lack of labor, or lack of laws regulating the native laborer, has become a familiar complaint. The companies are co-operating and are doing their best to get an unsympathetic colonial Government to aid them in this first step to industrial development. The Government is not quick to respond; it appears to look upon the mine operators as the 'bold bad men' of a nursery ballad and mulcts them of even scant profits by imposing excessive rates for transport of supplies and machinery on the Government railways. The output of gold is increasing, but nothing like as rapidly as was expected. Profits are small because the initial outlay is heavy, time is squandered, and management is rendered costly by climatic obstacles.

As a supplement to gold digging, the West African region boasts the beginning of a petroleum industry and of alluvial tin mining. The latter has brought Nigeria much

THE GOLDFIELDS OF WESTERN AUSTRALIA.

to the front during 1911. At the end of the year the public interest in a dozen tin companies shows signs of increase. Eleven years ago the first samples of tin ore were sent by the then High Commissioner to England. Now a hundred companies and syndicates are at work on the Bauchi plateau and elsewhere in Northern Nigeria. A branch railway is being built to the placer mines. Water conservation during the wet season has helped to prolong productive operations. The landlord of this region is the Nigeria Company. At present shipments are being made ranging from 5 to 40 tons of concentrate per company per month, the total being about 150 tons of stuff containing 50 to 70% tin. Owing to the prevailing high price of the metal a further increase of activity is probable.

Australasia, as a mining region, is largely divisible for market purposes among Western Australian, Broken Hill, and Copper departments. Of these, Broken Hill has been most prominent during 1911, owing mainly to the discovery of a new run of ore in the British Broken Hill Proprietary, a mine whose career has been chequered by over-capitalization and other misfortunes. The mine was shut-down in 1907 and the company sold its tailing heaps to the Zinc Corporation, receiving over $500,000 in cash. With this

no very fresh exploratory work was undertaken. In 1910, a new orebody was cut on the 800 ft. level, and in 1911 this was proved to be a discovery of the greatest importance. Evidence indicates that this ore is not part of a new lode, but belongs to the main ore-channel traversing the series of mines that have made Broken Hill famous for its silver, lead, and zinc production. A high price for the base metals has helped Broken Hill and the successful beneficiation of old dumps, as well as of low-grade refractory ore in the mines, has lifted share quotations. The process companies are still waging a bitter fight, one of the events of the year being the unfavorable decision obtained by the Elmore companies in their suit against the Sulphide Corporation. This particular quarrel, however, represents only a small part of the cross-fire of litigation.

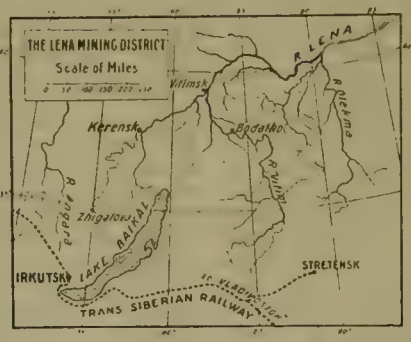
In Western Australia the gradual exhaustion of the Kalgoorlie bonanzas is repeatedly emphasized by acknowledged reduction of ore reserves and decreasing dividends. New mills and new managers are introduced to stem the ebbing tide, but in vain. Among the big mines the Golden Horse-Shoe has suffered from a drastic diagnosis of its condition and the Kalgurli has had to submit to an unpleasant stock-taking. Among the outside mines the Sons of Gwalia holds its own, a new orebody having been traced from surface to the 14th level. The Great Fingall has aroused fresh hopes by the discovery of an orebody in the bottom of the mine, giving some color to a favorable geological surmise. Efforts to regain public interest in new districts have proved futile by reason of the failure to find any new goldfield justifying keen interest. The Bullfinch boom, started in a most reckless manner at the close of 1910 and endorsed by the Premier of the State, came to an inglorious end early in 1911. The shares of the original mine have fallen to 10 shillings from a height of £3 1½, while the 'pups' or extensions have gone to the liquidation morgue.

The crisis at the Waihi mine in New Zealand is one of the notable events of the year. From a quotation of £10 1/4 in 1910, the price of the 500,000 shares dropped to 2 7/8 in 1911. This was due to a belated acknowledgment of the fact that the several lodes in the mine had become poor, necessitating a radical diminution of the gold and silver output. The impoverishment became marked just below the lower limit of oxidation, and is also due in part to a change of country-rock. This was for many years the finest gold mine in the world; hence the fiasco is much regretted.

The American department includes the Mexican group. It is first in alphabetical order, and the first in honor is the Alaska Treadwell. The mine, with its affiliated neighbors, the United and the Mexican, on Douglas island, constitutes one of the very best exponents of the application of technical science and good sense to mining. The management deserves the greatest credit for economy and skill, both of which, fortunately, have been favored by a persistent orebody of big dimensions. The Camp Bird is now a Mexican enterprise, the old mine in Colorado being nearly exhausted, after yielding a magnificent return, part of which has been re-invested in the purchase of the Santa Gertrudis at Pachuca. There the new mill has recently started, the mine is opening up well in depth, and a profit of $1,000,000 this year and $1,500,000 next year is anticipated. At El Oro the year has been marked by the transfer of the management of the Mexico mine from the Exploration Company to S. Pearson & Son. The transfer was not effected without heart-burnings, but it was followed by the reappointment of the former resident manager, and has not been associated with any marked drop in quotations, which remain on the rose-tinted level of French optimism. The Esperanza has had some setbacks, and the El Oro is doing nobly despite its waning vigor. Oroville Dredging has gained interest by the completed purchase of the Pato concession, in Colombia, which it is hoped will restore its shattered fortune. West Mexican is not quoted, being in difficulties with its famous Rosario mine near Guadalupe y Calvo, in Chihuahua. The Tomboy has again prolonged its life by acquiring adjacent property, the approaching exhaustion of the Argentine being compensated by the purchase of the southern part of the Revenue Tunnel property. This company's record exhibits a rare example of management in the interest of shareholders. Other notable events in the American department were the issue of bonds by the Natomas company, controlling dredging and agricultural property in California, and the Granville, a mining company organized by A. N. C. Treadgold, H. C. Hoover, and A. C. Beatty, to exploit a part of the White Channel in the Klondyke district. No public issue was made, all the capital required being readily subscribed.

The quotations for one or two Ontario shares suggest the brief excitement created by the gold discoveries at Porcupine. Bewick, Moreing & Co. brought out the Northern Ontario Exploration Co. and enlisted the co-operation of other financial houses. A block of Hollinger shares was acquired, but was sold on the first big rise. Lack of real information, in the form of assay-plans of the rich mines, has nearly killed public interest in the Ontario goldfields.

Asia. No new discovery of note has been made at the Kolar gold mines in Mysore, India, during the year, but the developments have been satisfactory, especially at the Mysore and Nundydroog mines. The Champion Reef has been in poor ground for four years, but the ore disclosed during the year is better than a year ago, and the profits are consequently greater. The most important factor in the improved situation on the Kolar field has been the reduction in costs consequent on cheaper electric power. Of other gold-mining districts in India, the Dharwar has proved a failure and work has been suspended; on the other hand, the Anantapur goldfield is developing in a promising way.



In Siberia the Lena Goldfields is remarkable as the most productive alluvial gold mine in operation anywhere. The ground is permanently frozen, as in the Yukon, and the gold lies on bedrock 100 ft. below the surface. Drift-mining accompanied by steam-thawing is employed. In the season of 1911 the output of gold was £1,619,406, or $8,047,030, from 881,000 cu. yd., or an average of 10 dwt. per yard. The cost averaged $6.21 per yard. This seems appalling, but it is due largely to difficulties of administration and the expensive character of the methods required to extract the gravel. In the far east of Siberia, the Orsk Goldfields has erected a dredge, from which much is expected. A preliminary run with a stacker-scow has shown a yield of $1 per yard, but it is not likely that this is a correct average of the ground.

Copper. This group is important and interesting. Some of the Australian mines have been unfortunate. At the Great Fitzroy, in Queensland, the oil-flotation process proved a failure in the concentrating mill until the end of the year, and smelting of selected ore gave scanty returns. At Great Cobar, in New South Wales, the acquisition of a neighboring gold-quartz mine has been good policy, as affording a profitable form of silica for mixture with the pyrite ore, but the underground operations in the parent mine had been neglected during the reorganization of the smelting portion of the undertaking. The Poderosa, in Chile, has made many shipments of 22% ore, but the lode is pinching in depth and operations have been hindered by heavy snows followed by flooded workings. The Siberian group has been conspicuously successful. During the

year the Atbasar passed under the control of the group that is operating the Spassky, by the transfer of a block of shares held by an American group, which still holds a large interest in the Kyshtim. These three companies, unlike in many respects, are linked in several ways, and represent the fit survival of a former boom. The Sissert estate, another Russian copper property, in the Ural region, has been the objective of examinations and negotiations on the part of British operators, who, failing to meet the terms of the vendors, have seen the estate pass into the hands of a Russian group, which is likely to develop the mine and then give the Britisher a chance to come in on an upper story.

The Arizona Copper at the end of the current year has completed plans for re-arranging its plant. Several Norwegian copper mines are controlled in London, but labor troubles and other causes less transitory have depressed them. The Caucasus Copper company, which is controlled by J. P. Morgan capital, is still in difficulties. Large sums of money have been spent and the best English and American advice obtained. The concentration plant, as reorganized by James Colquhoun, late of Arizona, and the smelter, under the management of W. R. Van Liew, at one time at Anaconda, are both in excellent condition, and the reserves of low-grade ore are enormous. The climatic conditions are much against success, and the heavy capitalization and debts left by previous mismanagement will always militate against the reputation of this company. The Messina mine in the northern Transvaal, though containing rich ore, has not made any profit so far, because of the inability to smelt on the spot and the lack of communication. The prospects are now more hopeful, because the railroad will be shortly completed, connecting the Rhodesian railway system with Delagoa Bay, and with Pretoria, Johannesburg, and Cape Town. The most important event, however, has been the discovery of a coal seam about thirty miles away; this has been promptly bought by the company. A year or two ago the Ferrobamba copper property, fifty miles south of Cuzco, Peru, attracted much attention in London. Owing, however, to the lack of support obtained here by the promoters, the control has been allowed to pass into the hands of A. C. Burrage, of Boston, and he is now maturing plans for the erection of a concentration plant. The Anaconda and Rio Tinto reflect the improved market for copper; the big mine in Spain is believed to be about to increase its production of pyrite. Copper producers everywhere end the year in a hopeful mood.

Tin. The market for tin has been disorganized by a corner on the London Metal Exchange, where metal produced in the Malay States and Australia has hitherto been the only sort recognized officially in connection with speculations. The other brands produced in Cornwall, Bolivia, and Germany have now been included among the 'good delivery,' so that the erratic course of prices ought to be checked. The high price ruling for tin during the year, culminating in a quotation of £230 per ton in May, has naturally stimulated search for the metal. A group of mines in the Federated Malay States, notably the Tronoh, Gopeng, and Tekka, owned largely by enterprising Cornishmen, has done remarkably well. This has led to one or two flotations of extension claims. I have already referred to the new supplies coming from Nigeria, but I might add here that some of the concentrate unfortunately contains many minerals besides cassiterite. A more important source of tin in the future is South Africa. Already some of the mines in the northern part of the Transvaal are yielding handsomely, the Rooiberg and the Zaaipdaats being specially notable. Deposits have been discovered in various parts of the Rhodesia and German Southwest Africa that appear to be of considerable promise, while the Swaziland gravels continue to be productive. In Bolivia, the lodes containing complex tin ores are being exploited actively, and much modern machinery is being erected. As regards Cornwall, it is worthy of record that the new vertical shaft at Dolcoath is now ready for work and the cost of mining will be reduced considerably in the near future. The dressing cost also ought to be reduced on account of the provision of improved crushing plant. The South Crofty is undoubtedly the best example of modern mining and concentration in Cornwall at the present time. The cost and the yield are two-thirds those of Dolcoath, and the ore is complex, containing much wolframite and arsenopyrite. A notable event has been the appointment of an outsider, E. S. King, formerly of West Australia, to the management of the Carn Brea & Tincroft, with the consequent introduction of more modern ideas of mining and dressing. The results achieved by the Cornwall Tailings Co., on the treatment of the old Carn Brea dumps, provide a practical demonstration of the imperfection of the old ideas regarding the concentration of tin ore. The scheme for dredging the alluvium at Goss Moor has been put into effect and the first results are promising. With these few exceptions, the outlook for Cornish mining is as unfavorable as it has been for the last thirty years.

Zinc has occupied a large share of attention in London during the past year. The zinc problem at Broken Hill continues to be studied closely from various points of view. The Broken Hill Proprietary is now in a position to produce metallic zinc and is considering the advisability of starting an iron-smelting industry for the purpose of manufacturing galvanized sheet and wire, the most profitable outlet for the zinc. The other producers of zinc concentrate are centering their attention on the beneficiation of the accumulated slime, which is high in both lead and zinc and not amenable to table concentration. The plan of the Sulphide Corporation was to add slime concentrate by flotation to the zinc product, so as to conform with the modern requirements of the British and European smelters for a zinc material high enough in lead to save silver in the retort residue. But when the mixture was offered, all sorts of difficulties arose. In consequence, the Broken Hill mines have during the past year been investigating the possibilities of the electric furnace for the production of lead, silver, and zinc direct from the slime. The first system tried was that at Trollhättan, Sweden, but as this did not give good results, attention has been turned to the Imbert-Fitzgerald type of furnace. The cost of electric heat and the incomplete production of molten metallic zinc have so far been against the success of these processes, but there can hardly be any doubt that this method of treatment will provide the eventual solution of the complex sulphide problem.

Oil. The interest in oil has suffered from a reaction following the boom in the spring of 1910. During 1911 one or two Californian enterprises were launched on the London market, but they sailed into troubled waters. Maikop has proved disappointing. The original gushers came from relatively small bodies of petroliferous sand in the shale, and later exploration by boring has failed as yet to confirm the geological supposition that a series of oil-sand formations existed in that part of the Caucasus region. Trinidad has been the motive for several new issues, but the Trinidad Oilfields remains the premier company. The Peruvian companies, notably the Lobitos and London Pacific, are giving excellent results. But speculation in oil is not lively; in the shares as in the wells, too much water is mixed with the petroleum.

The past year has been one of depression, varied by moments of inspissated gloom, but no great destruction of credit has occurred; hence the bad times of the immediate past need bear no sequel of further trouble. British trade returns indicate a continuous expansion of industry. The cheerful spots are occupied by the Broken Hill, Siberian, and tin mining departments. The comparative scarcity of tin is stimulating the search for that metal, and the growing demand for zinc is prompting metallurgical research in the treatment of complex base ores. West Africa and Rhodesia have gained ground slightly. The Rand has retrograded in market estimation. Excessive holidays and disturbed politics have hindered sustained speculation. The market is therefore burdened with undigested securities, but its dyspeptic feelings could be relieved by even a small dose of reasoned optimism. Eras of depression and elevation come in cycles; the London market ought to be lively in 1912.

Pebble Efficiency in Tube-Milling

By A. W. Allen

The question of the efficiency of pebbles of various sizes in tube milling is an open one. In the earliest application of these machines for sliming gold ores at Kalgoorlie it was a common practice periodically to overhaul the contents of the mills and to reject the smaller flints. Some advantage evidently accrued, although the question was not discussed, and there was a want of unanimity of opinion as to the advantages gained by the operation.

The bulk of the sliming action in tube-mills results from the direct impingement of the pebbles, one upon the other. This is also the easier action to consider theoretically. If it be supposed that the contained pebbles in a tube-mill are perfect spheres of 1, 2, 3, and 4 in. diam, their respective masses are in the ratios of 1, 8, 27, and 64; and since the velocity at point of impact would practically be the same in each case, the available energy can be roughly estimated as follows:

(1) At point of impact.

Diam. of pebbles.	Momentum ratio.	Energy ratio.
1 inch	1r.	1
2 "	8r.	8
3 "	27r.	27
4 "	64r.	64

(2) Assuming one point of impingement per pebble, in each cubic foot,

Diam. of pebbles.	Points of impingement.
1 inch	1728
2 "	216
3 "	64
4 "	27

(3) Energy ratio times frequency equals composite efforts per unit volume,

Diam. of pebbles.	Energy ratio.	Frequency.	Unit of effort.
1 inch	1	1728	1728
2 "	8	216	1728
3 "	27	64	1728
4 "	64	27	1728

In place of a statement of simple fact the above details may seem labored, but the idea is to emphasize the utility of the smaller, as well as the larger, pebbles. A composite equality of available energy per unit volume does not, however, necessarily imply identical performance with pebbles of any size, under all conditions. Fracture, and resultant effect, will depend on the friability of the ore as compared with the size of the particles to be broken and the momentum of the mass that is expected to break them. Present-day tube-mill practice indicates that a cylindrical mill operates with a mixture of pebbles of all sizes below 4 or 5 in. diam., with the exception of a proportion of the smallest, which are periodically discharged with the pulp. Attention is seldom paid to the question of feed, but it is evident that efficiency is sacrificed if the material fed contains a proportion that is too coarse even to be fractured by the smaller pebbles; that is, energy is being lost if any individual impact is unproductive of result.

Under these conditions a reduced feed often indicates an improved efficiency, the probable reason being that, with the full feed, coarse sand is found even at the discharge end of the mill, and, in consequence, the smaller flints have no opportunity for doing useful work on particles of ore proportionate to their size. By lowering the feed the coarse sand may be uniformly reduced in the first half of the mill. The smaller pebbles in the second half then have an opportunity of doing useful work in return for power expenditure. From which may be inferred that an efficiency with regard to feed-volume is strictly relative to the grade of ore being introduced.

In considering the action of the larger pebble on a finer grade of material the area of impingement is proportionately increased after fracture of the largest sized particles occurs; and any unspent energy remaining is concerned with the pulverizing of a larger area of smaller particles. The energy expended by the larger pebbles can never be unproductive as long as the unclassified product from the mill contains a proportion of unslimed ore.

Tube-mills are used for sliming a product previously milled, and also for re-grinding a coarse battery product preparatory to classification and leaching treatment of the remaining sand. Where pebbles, and not rough cubes of the ore itself, are used for grinding purposes, it would seem that the tube-mill is better adapted for sliming than for re-grinding; and that where the output from the batteries is through a coarse mesh, another class of pulverizer or grinder should intervene between them and the tube-mills in order to handle and reduce the proportion of coarse sand produced.

The Future of Concentration

By M. P. Boss

Following the introduction of the Frue vanner the public held complacently the thought that that machine would do about all that could be done in concentration. The years that have elapsed since have unveiled additional complexities in proportion as understanding has increased. Sizing and classification have long been in a measure appreciated, but even today are broadening into wider and more universal practice, and are evidently destined to much greater consideration by the general public. It has been and is customary to measure success by profits of treatment, quality of work often being sacrificed for quantity; and often the loss is a final and permanent one. This matter may yet run counter to the conservation tendency, and thus stimulate a desire to get all that mechanical genius can get—to get out by automatic mechanical means what can now be gotten out by a batea through skillful hand manipulation. At the present stage of the art little progress can be expected by haphazard means. A thorough understanding of the principles involved in the obstacles that yet so thwart engineers is essential to cope with today's problems. This is particularly true in slime treatment. New devices bring hopes, to be followed by disappointments, yet the why and how is continually becoming better understood.

In all concentration two active agents are involved, impellant energy and retardation. Retardation may be liquid and non-directing, or it may be rigid and guiding. In a feed composed of true spheres of absolutely equal size, a concentrate could undoubtedly be completely segregated from a gangue of but little less specific gravity, even if the material was so fine as to be classed as slime, by machines now on the market. In true spheres 'impellent energy' (as of gravity) is in ratio as the *cubes of their diameters* multiplied by their specific gravity, while 'liquid retardation' (as in precipitation) is in ratio as the *squares of their diameters*. This unfailing law is the bogey that is the cause of the greatest troubles in intelligently manipulated concentration. Two spheres of equal size but of unequal specific gravity would meet, in liquid precipitation, equal resistance, their displacement being the same, while the 'impellant energy' would be greater in the heavier sphere. Thus a large grain of gangue will sink faster than a small grain of concentrate. This is a clear reason why thorough sizing is desirable. The closer the sizing, the easier and better the dressing. It is easy to size a coarse material, but the difficulty multiplies with fineness, and in slimes one particle may be several times the diameter of another, an associated particle. From this rises the difficulty with slimes, a difficulty which probably never can be wholly overcome, so that there is little hope of slime treatment through 'liquid retardation' (precipitation or longitudinal hurling).

Rigid and guiding retardation, as on a table, or in a batea, introduces other principles, the horizontal plane

estopping precipitation and the finer particles finding their way through the interstices between the larger grains and resting upon the bottom, where they are in a measure protected and are less affected by currents that sweep along the coarser grains. The efficiency of this action decreases with depth of material and is a factor of grain diameter. The bed should be thinnest with slime, as a thick bed brings into play the 'liquid retardation' law, that precipitates the larger grains of gangue faster than the fine grains of concentrate. These are principles to consider in regard to riffles and to table-deck treatment, to avoid as much as possible ill effects from liquid retardation. When a concentrate particle has once reached bottom all effort should be made to keep it there. To this end riffles should be so designed as not to have a turbulent raising effect below them, unless material is very closely sized or of widely differing specific gravity.

The foregoing implies that all unencased concentrate material might be segregated from a gangue, even if only slightly heavier, when properly classified. The term classified, rather than sized, is used here advisedly. Material can be thoroughly sized by screens only. Classified is a broader term and includes hydraulic classification, which is a process based on the law of liquid retardation, wherein the heavier particles are smaller than those that are of lighter specific gravity. As we have seen, the latter is more suited to lateral table-deck treatment and the former to liquid retardation. In looking at the acres of concentrating machines in one of the great modern plants of today and realizing that the same machines are greatly overworked for commercial reasons, one quite naturally drops into computating the percentages of the total area that is actually segregating concentrate from gangue, and it is small.

From the present viewpoint, where is the relief? As has been noted, no space is wasted. Yet it is quite probable that in some future day more work will be done on a less area. About as the flying machine was to human travel a half dozen years ago, so centrifugal concentration is viewed today. Yet an impellant energy many times augmenting that of gravity may be developed by high centrifugal action, some like characteristics existing in both, yet with complications abounding for future solutions. When the capacity of present machines has been greatly increased without increase of cost, then a better quality of work may be expected. While very great progress will likely be made in the near years to come, there will likely be ample field for study for many years.

THE wealth of Sweden lies chiefly in its forests and mines, especially the iron mines. The forests are not only vast, but the wood (chiefly pine) is of a high quality, owing to slow growth. This makes it particularly fit for wood pulp, especially that intended for manufacture of so-called 'kraft' paper, which is tougher and stronger than paper made of lower-grade, softer wood. The result has been that Swedish wood pulp and Swedish kraft paper have been more and more sought after, and the export of these articles shows a steady increase. The extensive iron mines of Sweden, especially those of Lapland (northern Sweden), contain probably the largest high-percentage iron-ore deposits in the world. They were discovered only twenty years ago, and are controlled by the Grangesbergsbolaget. The ore contains 60 to 90% iron, and sometimes even more, and is in great demand on account of its fine quality. The export of this ore to the United States began in 1909 and increased considerably in 1910. It is especially in demand at the seaboard furnaces.

STEEL-MAKING is about to be initiated in the Transvaal, success having at last attended the efforts to secure the necessary capital for the erection of a plant to manufacture drill steel from from scrap. This is regarded as a beginning perhaps of an iron and steel industry in the Transvaal, about which there has been much talk of late, but it is recognized that vast changes will have to take place in Africa before a legitimate self-supporting iron or steel trade can be profitable.

Silver-Lead Smelting

By L. S. AUSTIN

In the intermountain region of the Western States progress in the smelting of silver-lead ores (which at the same time carried more or less gold) was at first one of increasing complexity, but later rather one of elimination, that is, of simplification. In the first period the problem was a simple one. The surface ores, largely oxidized, were subjected to a reduction in smelting, yielding the recoverable lead as base-bullion. If sulphides were present on the charge, the sulphur was largely volatilized, and what little matte might have been made, was thrown away as not worth bothering with. But this condition could not last when it became necessary to treat sulphide ores. They were either put through the furnace, making matte which was heap-roasted, or were crushed, roasted, and then smelted, with the production preferably of no more than 10% of matte as computed on the weight of the total charge. Though no account may have been taken of it, many ores contained some copper which when smelted yielded copper-bearing matte. When this was present the metallurgist began to find out that cleaner slags were produced and, with increasing sulphur, less fuel was needed. Sulphides containing galena, blende, and pyrite, were at first roasted in the long-bedded reverberatory furnace at a cost of $1.75 to $2.50 per ton, but this was an expensive operation, and for some years a determined attempt was made to substitute the mechanical furnace, already successfully used on copper ores. But these furnaces failed because in the presence of lead, the charge, upon an incautious increase of heat, was liable to sinter and adhere to the hearth; then troubles began for the mechanically-operated rakes. Even the Brückner cylindrical roaster might, with lack of care, have its charge 'hung up,' the mass adhering to the entire interior surface of the cylinder, so that it had to be barred off. Still, with careful handling, costs could be cut in half as compared with hand-roasting, and this latter was done only for roasting of that necessary product of the blast-furnace—leady matte. To this day this is still done. The fact is, when crushed matte is roasted, it must have a high finishing heat if there is to be a proper roast, and no furnace has been so satisfactory for this purpose as a hand-operated one, where, before drawing, the charge is subject to the highest temperature of the adjacent fire.

With the introduction of pot-roasting, or blast-roasting, and especially of down-draft sintering or sinter-roasting, as the operation has been variously called, a new set of conditions arose. The plant occupied a comparatively small space, a better sintered product was obtained than with ordinary roasting, and in consequence the blast-furnace drove faster. In down-draft roasting, practically no flue-dust was made, and finally the product, when smelted, lost more sulphur through volatilization than with the old-fashioned roast. According to the patentees of the Carmichael-Bradford process, a final product, $CaPbO_3$, results from the blast-roasting. This reacting upon decomposed sulphides would explain the increased sulphur loss just mentioned.

Smelting under the approved methods would therefore seem to include:

(1) Screening all oxidized ores and sending the oversize of a ⅜-in. screen to the blast-furnace.

(2) Crushing all sulphides intended for roasting.

(3) Combining or bedding the fine oxidized ores with the crushed roasting ore, and by-products of the furnace, that is, with the matte after crushing, and with the flue-dust.

(4) Giving a sinter-roast to mixture (3), and then sending it to the blast-furnace.

(5) Catching all flue-dust and volatilized lead by means of dust-flues and a bag-house.

(6) Remelting all base-bullion, and returning to the blast-furnace, the dry drosses containing not only lead but some copper, arsenic, and antimony.

In the earlier silver-lead smelting plants, even where sul-

phide ores were roasted, materials were handled by wheelbarrow or by tram-car, whereas, in the modern plant, mechanical handling has been substituted to a great extent. But machine handling has increased the cost of plant equipment in such a degree as to overbalance this advantage. Thus, where formerly silver-lead smelting plants were built to cost $2 to $3 per yearly ton, recent methods of construction have raised the expense to as high as $6 per ton per annum. Interest may be computed on this additional amount at 7%, and the history of plants show that in from 7 to 10 years they are in a large degree obsolete, and plant after plant has been discarded largely for this reason. Allowing a depreciation loss of 10%, it follows that 17% of the total additional charge is due to better and more modern construction. Indeed, it may be questioned whether this idea of thorough building and cheap handling has not been overdone. If an alteration is to be made, due to change in methods and improved processes, it is pretty expensive to tear up heavy foundations and retaining walls or to alter iron buildings. With side-hill construction, either expansion of plant or alterations are more expensive than those made at a level site.

If these increased costs of construction be considered to be to obtain cheaper handling only, then the comparative costs per ton of materials may be computed as follows:,

	Old method.	New method.
Unloading and bedding	$0.11	$0.04
Charging to the furnaces	0.14	0.04
Interest and depreciation	0.51	1.02
	$0.86	$1.10

According to the above it would be actually more costly to handle material at a modern plant than in the older and simpler one. But on the other hand, the older wooden construction carried a higher fire risk, needed more current repairs, was more subject to the disadvantages of lower priced labor, and was less certain in operation.

That the fine ore, even when oxidized, should be screened out seems evident when the action of the blast upon it is studied. In the first compartments of the dust-flue will be found particles of 20-mesh material. It is true that this portion of the flue-dust contains particles of coke and limestone, but a general average will be equal to the average of the charge. It seems wise, therefore, to remove fines before smelting rather than to recover them later and to have again to handle them. On the other hand, the blast-furnace is a pretty effective screening machine. The cooled gases, by the time they reach the bag-house, are dropping their load of volatilized lead in flocculent form. As a guard against volatilization, poor working of the blast-furnace, and fine ore, the bag-house is effective. Thus, Sprague has succeeded in so effectively treating the blast-furnace gases that it needs careful observation to note that any visible smoke is escaping, even with a half-dozen furnaces in blast. A recent improvement in the bag-house consists in a new method of shaking the bags. The older way was for a man to enter the chamber, protected with a smoke helmet (such as is used in mine-rescue work), and shake down the adherent dust by hand. Now the method consists in cutting off the pressure in the chamber and so connecting to the stack as to produce a suction in the lower chamber of the bag-house. This loosens the flue-dust as the bag collapses. It is rapid and requires no hand labor.

The older way of preparing ore for use at the blast-furnace has been to layer or bed it and then to smelt each bed as though it were a single ore; but this has its drawbacks. In the first place bedding is more or less imperfectly done; then as the ore is removed the face may suddenly fall so that too much of the upper layers enter the charge. Thus are introduced into furnace-operation various irregularities which reflect themselves in poorer working and in dirty slags. The Messiter system of bedding, as used for copper ores at Cananea, offers an ideal solution to the above-named troubles. Its cost in a warm dry climate is half that as compared with a bin system, though for a northern climate housing-in would add largely to the expense of installation.

Where bins are used materials are drawn off and weighed into the charge-car, making a large unit charge, and this is the best present way of charging. It is now planned to deliver the ingredients of the charge in regulated proportions by conveying belt to the furnace. This plan will cut down charging costs and its development will be watched with much interest. Its difficulties where coarser ore is fed seem serious.

The most important work of the year has been in the working out of the sinter blast-roasting. Besides the now well known Dwight Lloyd down-draft machine, we find the Bellinger up-draft endless-chain machine, where to prevent the escape of flue-dust the ore is covered with a layer of crushed limestone. At the feed end of the grate and outside the roasting hood are two hoppers, one feeds the ore mixture on the bed where it is ignited, the other feeds on top of the ore a thin bed of crushed limestone or coarse ore, which serves as a filter and to hold down the fine ore from being blown away. The sintered ore is discharged outside the roasting chamber at the end opposite the feed. The Dwight-Lloyd machine is now built in 100-ton units and is giving a satisfactorily roasted and sintered product with a minimum of fine unsintered ore. No breaking up of the product is needed as in the case of pot-roasting. For success in sinter-blast roasting a suitably combined mixture is essential, one which will sinter properly and that contains 17 to 23% of sulphur, so that enough is present to give the necessary heat. The ingredients should be for galena about 8-mesh, and for the other ores about 4-mesh size. The other advantage of the continuous sinter-roast machines is that for a given capacity they occupy little space as compared with the hand reverberatory. Thus a 100-ton Dwight-Lloyd machine could be placed in a building needed for a single hand-roaster, or, say, in one-seventh of the space needed by the latter.

Australian practice with the Carmichael-Bradford process has brought out some encouraging features in blast-roasting. Three parts of concentrate, slime, or mixed concentrate and slime, are combined with gypsum which has been heated on iron plates to dehydrate it to about 50% of its contained water. These are mixed in a pug-mill with a small amount of water, and passed through a trommel to form into lumps. The partly hydrated gypsum combines with more water, and sets in hard lumps, and the lumps are further dried on a floor. To start the roasting, a shovelful of embers and a bucketful or so of chips are placed at the bottom of the pot, a gentle blast turned on, and when well lighted the granulated mixture is run in from a hopper and the blast raised to 8 to 12-oz. pressure. The converting is complete in three to four hours. Besides quick roasting but little attention is needed during the process. The plant is less expensive than the Huntington-Heberlein, and where limestone and gypsum are cheap costs less per ton.

Butte Copper Production

The production of the Anaconda and East Butte smelters in 1911 is given by *The Butte Intermountain* as below, figures being in pounds of copper.

	Anaconda.	East Butte.
January	21,600,000	1,137,882
February	20,900,000	770,746
March	21,900,000	1,156,161
April	21,500,000	1,183,636
May	21,700,000	1,235,158
June	21,850,000	1,144,767
July	21,052,000	981,310
August	22,500,000	789,101
September	21,300,000	969,224
October	21,400,000	1,107,714
November	20,850,000	*980,000
December	*21,600,000	*1,120,000
Totals	258,152,000	12,586,699

*Estimated. The East Butte also produced 402,542.81 oz. of silver and 18,177.215 oz. of gold.

Production and Prices in the California Oilfields

By J. H. G. Wolf

Production of petroleum on an extensive scale in California began with the discovery of the Kern River field near Bakersfield in 1900. The yield of all the fields was then some 3,000,000 bbl. annually; the markets were correspondingly limited, and the price per barrel to the producer averaged one dollar. The flood of oil following the opening of the Kern River field sent the production figures for Kern county alone, by 1903, to 18,000,000 bbl. annually, and the price to 20c. and less to the producer. That date and circumstance marked a new epoch. Consolidation of interests, absorption of the smaller by the larger companies in some cases, and the beginning of a coöperative movement among the interests remaining independent was the logical outcome of that situation. The influence of the coöperative movement soon began to be felt; collective instead of individual bargaining with the marketers, together with the effects of the expanding uses of crude oil and the improvement of transportation facilities, sent the price back to about 50c. per barrel by 1907. That year the Independent Oil Producers' Agency (the outcome of the coöperative movement) made a two-year contract with the Associated Oil Co., one of the three marketers, at some 63c. per barrel at the well. The effect was magical; hundreds of drills were set to dropping in every part of the State, and the consequences thereof marked another epoch. When the drill of the Lakeview Oil Co. at Maricopa and near the old Sunset field, dropped through the last 'shell' on March 15, 1910, into the producing sand, it dropped into a veritable Pandora's box, the riches of which no operator, in the moments of his maddest dreams, adequately foresaw. With the opening of the box the riches escaped and spread upon the land, but elusive hope, following the legend, remained bottled up. The dreams of wealth were dissipated almost in a day; the price of crude oil at the wells dropped from 60c. to 30c. within a few months after the Lakeview and the attendant gushers up and down the great Midway valley poured forth the flood of oil.

The table and the graphic exhibits accompanying, present the status of the business in this State in lucid form. The overshadowing factor is the rate at which the stocks have accumulated. The stocks on January 1, 1910, were 21,000,000 bbl.; on November 1, 1911, 39,950,000 bbl., or an accumulated excess of 18,950,000 bbl., equivalent to 900,000 bbl. per month, or 30,000 bbl. per day.

Analyzing the diagrams, Fig. 1 shows that the San Joaquin Valley fields are the dominant factor in the State's production. The Southern and the Coast fields, while

Production and Prices of California Oil

				Returns per Barrel.		†Pumping Wells.		Drilling Wells.	
1910.	Stocks, bbl.	Production, bbl.	Shipments, bbl.	Agency members. (Cents.)	Non-Agency members. (Cents.)	Total number.	Number active.	Total number.	Number active.
February	.....	4,515,560	.....	44.4	50	....	....	....	....
March	.....	5,598,745	.....	43.5	50	....	....	....	....
April	.....	6,618,636	.....	41.5	40	....	3600	....	648
May	.....	7,172,313	.....	42.0	30	....	....	....	....
June	.....	6,696,789	.....	42.9	30	....	....	....	....
July	29,337,808	6,901,965	4,781,065	38.0	30	4320	3965	751	633
August	31,557,635	6,743,159	4,822,468	35.2	30	4444	4071	875	642
September	30,516,319	6,492,462	4,612,185	36.1	30	4658	4112	790	675
October	34,308,509	6,098,388	5,208,322	35 less 5	30	....	....	....	....
November	34,047,388	5,753,625	4,873,803	35 less 5	30	....	....	....	....
December	33,319,724	6,111,807	5,514,860	35 less 5	30	4815	4257	845	678
1911.									
January	34,016,514	5,992,352	5,330,017	35 less 5	30	....	....	....	....
February	34,947,540	5,439,720	4,584,907	35 less 5	30	4937	4322	1003	774
March	37,317,636	6,341,603	4,541,368	35 less 5	30	5007	4386	865	651
April	37,984,865	6,725,259	5,470,318	35 less 5	30	5199	4420	869	606
May	38,294,830	6,630,133	6,032,445	35.0	30	....	....	....	....
June	39,119,527	6,402,304	5,392,716	35.0	30	5134	4536	874	617
July	40,084,099	6,663,325	5,421,515	30.3	30	5168	4557	891	614
August	41,234,623	6,696,896	5,413,430	33.9	30	5273	4639	884	571
September	41,929,003	6,885,135	6,016,848	31.2	30	5229	4567	872	560
October	*39,951,406	6,906,750	6,431,941	32.6	30	5401	4720	845	521
November	41,093,377	6,741,718	6,020,558	...	..	5485	4731	849	505

*Figures readjusted to allow for storage losses, Lakeview well losses, etc.
†All wells of State, except the 402 in Los Angeles City field and the 135 at Summerland, the yield from which combined is only about 1000 bbl. per day, and which can be considered as spent wells.

important in themselves, particularly because of the advantage of being nearer to tidewater, influence the general situation mainly as regulators of the volume of output. The field consumption of the State is some 420,000 bbl. monthly, which constant should be added to the figure for a particular month to obtain the gross output. The amount of fuel consumed in pumping the oil to tidewater is not known, but it must to some extent influence the net output to the market. The drop in output between September 1910 and February 1911 was due principally to the decline and final collapse of the great Lakeview well. The diagram shows a magnified drop in February, due to its having 10% fewer days than an average month. The recovery from March 1911 onward has been uniform and coincident with the bringing in of an increasing number of flowing wells from the deep territory of the Midway, revealed as oil-bearing by the discovery of the Lakeview. The November output (not plotted) was about the same as the two previous months. The one gratifying aspect of the overproduction situation is the manner in which shipments have increased. While shipment figures are not consumption figures, as expounders sometimes think, they are significant indicators of the same. Of the stocks carried in the State, some 20% are carried in the pipe-lines and storage at tidewater. Thus a volume

of 8,000,000 bbl. may be considered as the 'fixed' stocks. With so large a constant, improper deductions as to expansion in consumption can easily be made. The diagram must be interpreted broadly, the shipments for November were some 100,000 bbl. less than October, though it was reliably reputed that the sales in November were greater than in any month since California began producing petroleum; it is also reliably reputed that prices on San Francisco bay have advanced. Fig. 2 exhibits the unvarying rate of increase in stocks from January 1910 onward. The volume of stocks has increased, it would seem, to a figure sufficient to satisfy any ordinary demands of commerce. There is nothing appearing in the outlook to presage a change in this rate of increase. The surplus December 1 over November 1 is reported as 1,141,000 bbl., which is about the monthly surplus for the 12 months past. The returns to the producer have remained fairly constant since the break in the spring of 1910. Fig. 3 presents an important exhibit. It shows that the uniform increase in production has followed the increase in the number of producing wells, and until the rate at which new wells are being drilled and new wells are being put on the beam is decreased sensibly, there will probably be no reduction in stocks or betterment of conditions. The November figures (not plotted) of drilling show no material increase, which is helpful. The production per well per month over the State has dropped but little since July 1910, when the Lakeview had about reached its maximum, indicating unmistakably that the wells brought in since that time are heavy producers. The present yield is about 1450 bbl. per well per month, net.

There are two objects to be served in bettering present conditions. The first is the profits of the producer, which will place the industry on a sound business basis, and which in turn makes for stabler prices for the consumer, and the second, the conservation of the most important, if not the greatest, natural resource of California. Both are worth fighting for and winning. Without the stimulus in 1907 and 1908 of prices which gave the producer a fair profit, it is doubtful whether the extensive wild catting of the great West Side country (the Midway) would have been undertaken. Today the consumer has the knowledge when contracting for fuel oil, that there has been developed in the additional proved fields a supply which competent geologists estimate cannot be exhausted in 50 years. This wonderful showing is a guarantee to him of the certainty of the supply and non-fluctuating prices; it is

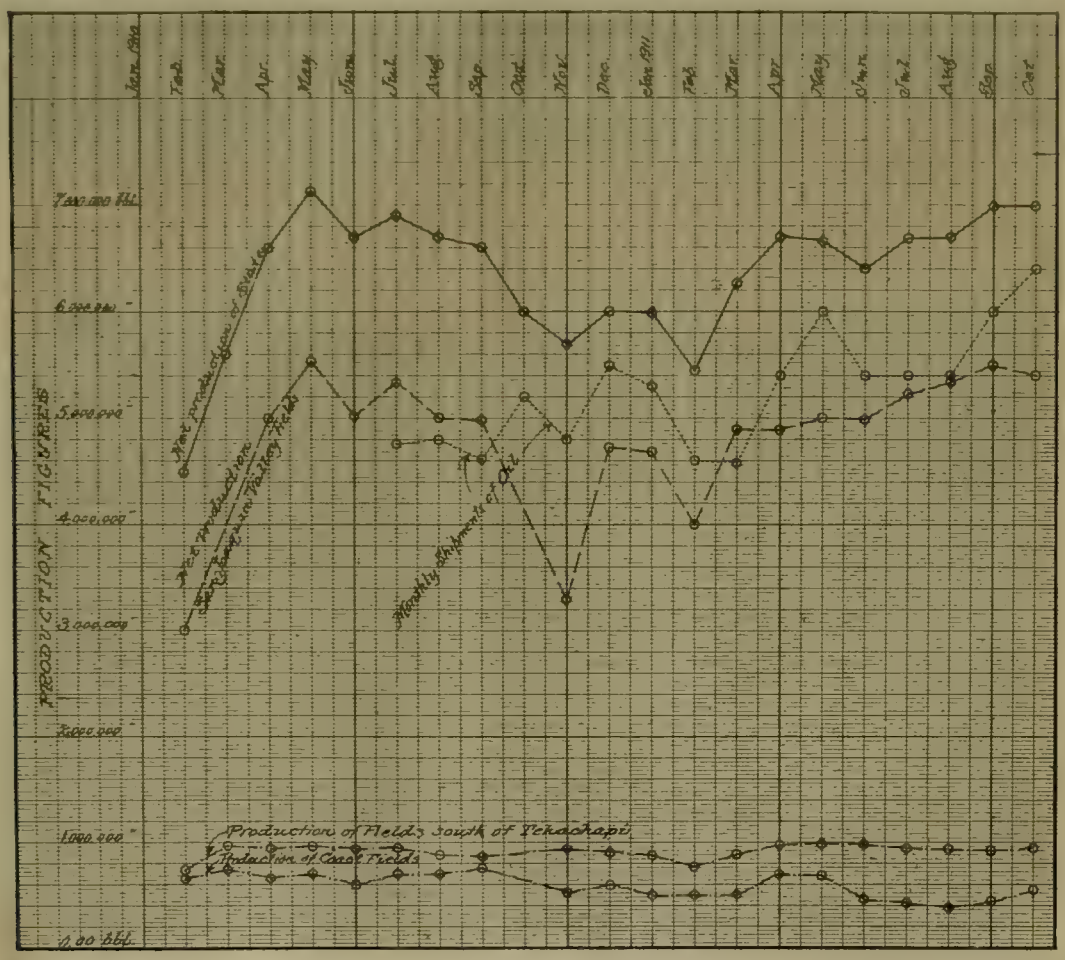


FIG. 1. NET GROSS PRODUCTION AND MONTHLY SHIPMENTS, CALIFORNIA OILFIELDS, JANUARY 1910 TO OCTOBER 1911, INCLUSIVE.

the result largely of the coöperative effort some years ago of a handful of individual producers to improve their own condition, and who succeeded in getting a fair price for their product.

Substantial stocks are a necessary adjunct to every business. The Independent Producers' Agency, through its marketer, the Union Oil Co., has sold 60,000,000 to 70,000,000 bbl. of oil, to be delivered over a period of five years; stocks in the hands of the Agency amount to some 14,000,000 bbl., which is a comfortable surplus, but one that is a burden when prices are depressed. California supplies 36% of the crude petroleum produced in the United States and is carrying stocks aggregating 50% of its annual yield; the remaining States, producing 64% of the total yield, carry stocks of 105,000,000 bbl., or 77%. Viewed in that aspect, the volume of stocks here is not disproportionately large. The menace is the rate of increase of stocks; it

is so much in excess of the rate of expansion of sales (consumption) that there can be no hope for an early resumption of normal conditions. There is no profit in producing crude petroleum at 30c. per barrel in this or any other State, capital and other charges properly considered, excepting from flowing wells, and an industry that cannot be conducted at a profit is not on a sound basis. To improve fundamental conditions, it appears that help might be derived in the following ways or directions: (1) The immediate cessation of active drilling in known or proved oil territory; (2) providing adequate storage facilities for the oil now upon the ground; (3) the release of all leases by the lessors from the requirement to do continuous development work, particularly in proved territory, until normal conditions are restored; (4) expansion of the sales for the product; (5) the stopping of the removal of oil being produced from lands to which the Federal Government claims title, and the lands which were withdrawn from entry and exploitation on September 27, 1909.

Statistics show that on July 31, 1910, or four months after the Lakeview well was brought in, and when drilling activities accelerated by the phenomenal yield of that well, were under full swing, the number of wells being drilled was 751, of which 633 were active. On October 31, 1911, or 14 months thereafter, in the face of an accumulating excess of 1,000,000 bbl. per month, 845 wells were being drilled, of which 521 were active. It is fair to assume, too, that with the limits of the newly discovered highly productive territory better defined, drilling in the fields yielding only ordinary pumping wells has practically ceased. The wells now being brought in are mainly of the flowing type. This is an added menace.

There are today 5401 finished oil wells, of which 4720 are actively producing, against 4320 finished wells and 3965 producing wells 14 months ago. In other words, the actual daily yield of 222,600 bbl. represents but 87% of the potential daily yield at this time. If there were a market, these idle wells would be put back on the beam. All the idle producing wells may not have the capacity of the average producing well now on the beam, but, on the other hand, there are numerous capped and restrained gushers which can pour forth a flood of oil if cut loose and which might maintain the average. The present situation has this added element of danger not generally recognized.

It would seem, then, that so simple a corrective measure as stopping the active drilling in proved territory is demanded by common sense and ordinary business prudence. The big factors in the producing end of the business can get together in a 'gentlemen's agreement', if in no other way, with an understanding as to new drilling. Since the term 'big factors' comes near to meaning the marketers, it is plain the small factors would, in event of any such agreement, likewise cease drilling. Mutual mistrust has to be set aside. If the marketer will stop drilling and stop buying oil for a period, the situation will correct itself

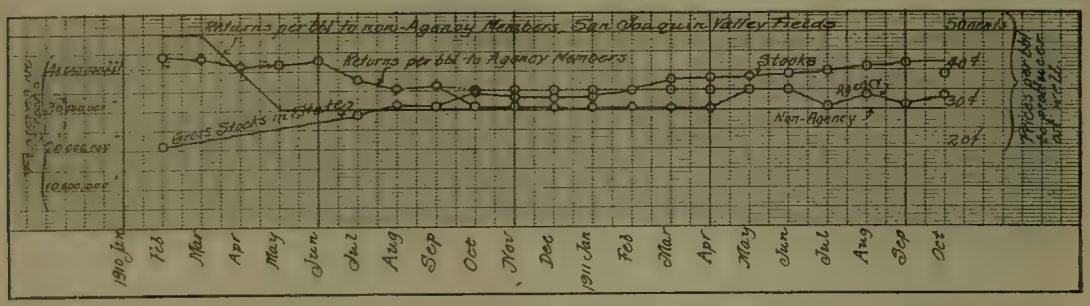


FIG. 2. VOLUME OF STOCKS IN THE STATE AND RETURNS PER BARREL TO PRODUCERS FROM AND AFTER JANUARY 1910.

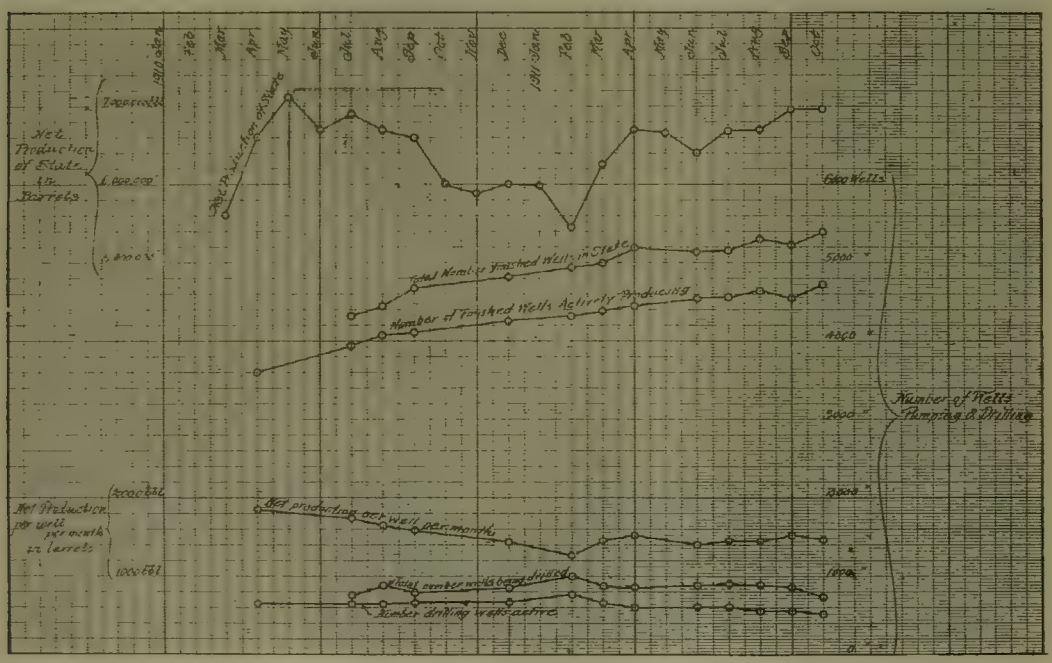


FIG. 3. NET GROSS PRODUCTION OF CALIFORNIA AS INFLUENCED BY THE NUMBER OF WELLS PRODUCING AND WELLS BEING DRILLED.

automatically. Once corrected to that narrow, the measure will be used again, and the status of the business will be raised from its apparent 'extra hazardous' class to its legitimate position. As the industry is the controlling factor in the fuel problem on the Pacific, is it not time to get together?

The building of adequate storage facilities is under way. The Standard has greatly increased its field storage by building permanent reservoirs, the Associated is increasing its field storage rapidly by adding concrete steel reservoirs, and the Independent Producers' Agency has storage measures under way which will, if effectually carried out, make its position secure and will relieve the present distressed situation of many of its individual members. Storage in steel or concrete reservoirs conserves the oil produced; the losses and wastage are enormous under present conditions.

A large percentage of operations are conducted on lands under leasehold. The owners of these lands are concerned principally in collecting royalty—oil produced at no capital outlay or risk of their own. Lessees today can with profit get concessions on their continuous drilling requirements; to do continuous development on proved ground with oil at a price less than its commercial value, is not sound business. A clause in contracts limiting drilling activities when the price at the wells is less than a figure calculated to give fair remuneration is good business for all concerned, though it is not generally used.

The expectation for expansion of sales must be based largely on the adoption of oil as fuel by the trans-Pacific shipping, by the Government, and its more general use in the Northwest. The domestic markets are quite well worked up. Sales have been pushed as far east as Ely, Nevada, in competition with Utah coal, and to Arizona and Cananea, Mexico, on the Southwest, in competition with Texas oil and New Mexico coal. California crude oil is sold as far north as the Copper river in Alaska, in competition with the vast though undeveloped coalfields nearby. The sale of oil as fuel has been pushed as widely as competitive conditions will permit; establishing the present horizon has been a levy upon the producer's livelihood.

Stopping the removal of the oil from lands in dispute would serve the immediate situation well. The courts are about to try the Government's contention that the Southern Pacific railroad has no rights to the oil under the lands patented to that company under the railway-aid acts. The deeds to the lands reserve the right to the mineral contained to the Government. The acts apparently made no such reservation, and an adjudiction of rights is in order. Meanwhile, it would be most helpful if the removal of the oil were held up temporarily. A year ago the railroad was consuming in its service some 32,000 bbl. per day, which quantity was bought largely in the general market. Drilling activities in the past year, through its petroleum department, the Kern Trading & Oil Co., have resulted in a reputed output of 30,000 bbl. per day, which represents about the present daily surplus. The extent of the production from the lands withdrawn from all forms of entry or exploitation by the President on September 27, 1909, is not known. It may be considerable. The gushers or flowing wells of the Midway, the disturbing factor, are wholly upon lands considered prior to 1908 as possible oil-land only. They lie away from the 'cropping' wells, upon the flats and in the hills to the north and east. The withdrawal order came before any sensational wells were found, and includes all lands not then lawfully entered upon or occupied; hence many of the gushers are upon disputed land. The status of the operators upon the withdrawn lands is uncertain, regardless of the rights concerned, and it is not improbable that the Government will endeavor to restrain the removal of the oil pending adjudication. This will retard production until other conditions adjust themselves, which in the end will help the individual producers the more effectively. Whether or not it was lawless to proceed with drilling on the withdrawn lands, did not concern many of those who did so. Whether or not those who respected the law acted kept to their view point, drilling wells should have their prospective character and their returns cut to a modicum of profit was immaterial, so long as more oil could be brought to the surface. The *denouement* of this situation is awaited with interest.

Phosphate Rock in the West

By F. B. Weeks

Of the phosphate rock used in the Western States in 1911, 90% was mined in Idaho, Wyoming, and Utah. The production in these States was about 10,000 tons, which is practically the same as that for 1910. The entire product was obtained from the mines of Bradley Bros., in northeastern Utah near Sage, Wyoming; those of the Union Phosphate Co. at Cokeville, Wyoming, and the mines of the San Francisco Chemical Co. at Montpelier, Idaho. The Utah Chemical & Fertilizer Co. has a large area of phosphate land east of Georgetown, Idaho, but it has not yet begun shipping rock. No production is reported from Montana.

Several placer patents to phosphate lands were issued by the Government during 1911, and the policy heretofore announced by the Interior Department of granting patents, either placer or lode, to original locators who filed on the land prior to the phosphate withdrawals, has been continued. Considerable development work was done during the year preparatory to applications for patents. The question as to how the Government will dispose of the phosphate lands in the withdrawn areas is still unsettled, and there is no prospect of an early decision. There appears to be much difference of opinion among members of Congress and administrative officers in reference to the further disposal of phosphate land. It is quite certain that the phosphate lands now held under patents or mineral locations are advantageously situated with reference to transportation facilities, and the rock can be mined at low cost. These mines will therefore supply the Western market for many years, and there is no necessity for a hurried and possibly inadequate solution to the question. It may well await the result of an extended discussion of our future public land policies and the laws which will make them effective. The legal status of those who acquired mineral rights prior to the withdrawals of phosphate land is still undetermined. During the past year the question as to the rights of lode locators over prior placer locators has been before the U. S. District Courts, but no decisions have been rendered.

Geological field work of the U. S. Geological Survey during 1910 and 1911 has considerably extended the known phosphate area, and its estimate in tons has assumed almost incredible proportions. The productive area of phosphate rock in other parts of the world has been greatly extended within recent years, and there need be no apprehension of the exhaustion of the available supply.

Practically all of the phosphate rock mined in the Western States is shipped to San Francisco and Los Angeles and manufactured into acid phosphate and mixed to make complete fertilizers. About 20,000 tons of fertilizer was sold during 1911, nearly all of which was used in California. With the exception of 1500 tons shipped from Japan, the entire product was manufactured in California. The outlook for a considerable increase in the near future in the use of phosphate rock in the West is not, at present, encouraging. Such increase depends largely on the practical demonstration of immediate improvement in crop returns as the result of the use of fertilizers through Government or commercial agencies. What may be done through foreign shipments to further the sale of phosphate rock is problematical. Existing transportation rates to the Pacific coast are prohibitive so far as foreign markets are concerned. At present, 70% rock is worth about $7 per ton on the seaboard. The freight rate from the phosphate region is $4.20 per ton to San Francisco, and $5 to Los Angeles. This leaves a small margin to cover mining, transportation, and loading charges at the mines.

Metallurgy of Copper During 1911

By Thomas T. Read

Progress in the metallurgy of copper during 1911 has [illegible]

[illegible]

exhaustively discussed by Hofman[1], and but little comment need be added. Blast-roasting, so popular for the treatment of lead ore, has not proved so successful for the treatment of copper ores, and in some cases where it has been tried has later been abandoned. It is in operation now at the Asake plant of the Asake smelter of the Furukawa Mining Co. But, as pointed out by Peters, blast-roasting of copper ores may involve either the removal of as much of the sulphur as possible, or as little as possible, according to circumstances, and the problem of blast-agglomeration is therefore more complex than appears at first sight. It may be said generally that where all the ore must be subjected to a preliminary wet concentration it is hopeless to attempt to so agglomerate the fine concentrate, either by blast-roasting or briquetting, that endless trouble will not arise in blast-furnace smelting, and present practice is to use reverberatory smelting in all such cases. Where, as at Asake, labor is so cheap that a considerable proportion of lump ore can be sorted out to advantage, it may readily be possible to agglomerate enough of the fine concentrate to bring the total fine ore in the blast-furnace within working limits, and thus reap the advantage of lower smelting costs. The various types of sintering machines, such as the Dwight-Lloyd, from which so much was hoped, have not come up to expectations in copper practice, though, curiously enough, they have found an unexpected application in the sintering of fine iron ores. This well exhibits the status of the case; the machines are efficient enough in operation, but the conditions in copper metallurgy are not well suited to them.

L. D. Ricketts, who continues to set an example of generous disclosure of information of value that might well be imitated by fellow metallurgists, has given[2] the cost of operating the McDougall furnaces at Cananea. "I give below costs and other information for the six months from February to July, 1911, inclusive, during which both reverberatory furnaces have been in operation. The smelting expense at the McDougalls includes all costs from the time the railway delivered the material to be roasted to the bins, until the calcine is delivered at the reverberatory furnaces. We have dispensed with the tramway from the concentrate bins to the top of the McDougall furnaces, and have substituted a bedding system, which gives room for two beds of self-flowing charge of 5000 tons each. The ore is removed in belts from the railway bins, sampled on its way to the beds, and is bedded, recovered and conveyed by belt to bunkers over the McDougalls, which we have recently installed and which give storage sufficient to run the furnaces for 18 hours. As a consequence, reclaiming has to be done on but one shift. The costs were as shown in the table below."

Cananea [illegible] Costs, February to July, 1911.

Material roasted	Dry tons	Per cent of total
Concentrate	[illegible]	[illegible]
Fine [illegible] ores	[illegible]	[illegible]
Limestone	732	1.76
Total	[illegible]	100.00
Calcine produced	[illegible]	[illegible]
Shrinkage	[illegible]	[illegible]

[illegible]

[1] Hofman, H. O. Recent Progress in Blast Roasting. Trans. Amer. Inst. Min. Eng. [illegible]
[2] Mining and Scientific Press, October 14, 1911, p. [illegible]
[3] Eng. & Min. Jour., October 7, 1911, p. [illegible]

DISTRIBUTION OF COST

	Per dry ton
Sampling	$0.0051
Bedding	0.0460
Reverbering	0.0710
Operating furnaces	0.1...
Hauling calcine	0.0210
General expense	0.0479
Total direct cost	$0.3791
Flux (cost of)...	0.0254
Total cost	$0.4045

ANALYSIS OF COST

1. Operating:	
Labor	$0.1709
Power	0.0365
Fuel	0.0170
Water	0.0018
Sundries	0.0002
Flux	0.0254
	$0.2527
2. Repairs:	
Labor	$0.0579
Shop expense	0.0083
Supplies	0.0656
Total	$0.3845

At the Steptoe Valley smelter, at McGill, the limestone required for fluxing is not added in the McDougalls, as the sulphur in the concentrate is not high enough to give sufficient excess heat for warming the limestone. At the Tooele plant, on the other hand, screened siliceous ore is added upon the fifth hearth of the McDougalls, this difference in practice being due to a 3% higher sulphur content in the Tooele roaster charge. It should be noted that this addition brings the heat close to the working margin, so that in the case of temporary shut-downs it is necessary to employ a few shovelfuls of coal to bring the roaster back to its normal working temperature. This well illustrates the close margin of economy upon which modern smelting operations are conducted.

Progress in reverberatory smelting during the year chiefly centres about the increasing use of oil-firing, which has been adopted at the Steptoe smelter, following its use at Cananea and elsewhere. It should be noted that the new Tooele plant retains coal-firing, as this illustrates the essential feature of the use of liquid fuel. The Steptoe smelter is at McGill, Nevada, approximately midway between the sources of supply of fuel-oil and coal, while the Tooele plant is near the coalfields and distant from the oilfields. Fuel-oil is worth about 40c. per barrel at the wells, and Wyoming and Utah coal approximately $1.50 per ton at the mine; upon the usual basis of reckoning of 3½ bbl. of oil as equivalent to 1 ton of coal, it is evident that the question of desirability of use comes down to a comparison of freight charges, though this is influenced by other considerations. At the Steptoe, for example, some difficulty was experienced in keeping the furnaces up to the temperature necessary to smelt a rather infusible charge, until oil-firing was employed, when the difficulty disappeared. Oil-firing, therefore, is not a panacea, but a valuable method which will find application where the conditions favor its use.

The general features of reverberatory smelting have been so fully discussed by Peters in the volume already mentioned that only a few supplementary notes need be made. The furnaces at the Steptoe are 120 ft. 10 in. long, due to the removal of the coal grates, and work well. At Cananea 20-in. arch brick are now employed on the furnaces throughout. The waste-heat boilers should be of a type which permits easy cleaning; at Cananea this is expeditiously done by the use of a jet of compressed air to blow the fume off the tubes of the economizers; this is done daily and less than an hour is required to clean four economizers. Oil-burners for reverberatory work apparently continue to offer scope for improvement.

The cost of reverberatory smelting at Cananea has been discussed by Mr. Ricketts[5] and the figures are given below. It should be mentioned, however, that cost data are not to be taken as a general guide unless accompanied by copious commentary regarding methods of computation of tonnage, cost, distribution of cost, and all the other controlling circumstances. For example, if cold screens are included as part of the tonnage smelted a material difference is made in the costs per ton. Liquid converter slag should not be regarded as a part of the charge, for the general opinion now is that its excess iron is of little or no use in slag formation in the reverberatory. In the light of the experiments by G. B. Lee and E. A. Rutherford at the Copper Queen, Mr. Ricketts has suggested that by feeding flue-dust and hot converter slag into a device resembling a concrete mixer the two undesirable products could be converted into a single desirable one. By screening out the lumps and returning the dust to the mixer a useful addition to the charge would be secured, but the question of operating cost is one to which no definite answer can yet be made.

CANANEA REVERBERATORY COSTS, FEBRUARY TO JULY 1911, INCLUSIVE

TONNAGE CHARGED

	Dry tons.	Per cent of total.
Flue-dust	21,019	34.90
Calcine	35,553	59.15
Ores	3,040	5.06
Limestone	479	0.80
Total	60,071	100.00

Furnace days, 312.5.

DISTRIBUTION OF COST

	Per dry ton.
Operating furnaces	$1.8593
Slag and matte expense	0.0851
Boiler house	0.1969
General expense	0.0702
Cost of flux	0.0136
Total	$2.2191
Steam credit	0.8134
Operating cost	$1.4057

ANALYSIS OF COST

1. Operating:	
Labor	$0.2968
Power	0.0099
Fuel-oil	1.4654
Coal	0.0041
Water	0.0015
Transportation	0.0063
Sundries	0.0053
Flux	0.0136
	$1.8029
2. Repairs:	
Labor	$0.1842
Supplies	0.2068
Shop expense	0.0252
Total	$2.2191
Steam credit	0.8134
	$1.4057

The use of the basic-lined converter bids fair to become universal. C. B. Neel has discussed[5] some of the general features of recent progress in this work in a paper of much interest upon which only considerations of space prevent extensive comment. The Pierce & Smith type of converter is coming into wide use for its large capacity and convenient shape, with the modification of the use of a central mouth rather than at the end, as this gives a better distribution of the gases inside and of the flux added. The

[5] *Eng. & Min. Jour.*, April 8, 1911, p. 797.

flux, which was at first preheated, is now commonly added cold. The Day process, of blowing silicious slime into the converter through one of the tuyeres, is now in use at Cananea. I suggested this method to my colleagues in 1904, but was unable to test the method experimentally; doubtless it has also occurred to many others, it remaining to Mr. Day to make successful application of it. The usual basic converter has a capacity of 65 tons of blister copper, about 30 tons being the usual charge finished. The high percentage of working time (88, according to Neel) very materially affects the conduct of operations in the converter house, and the crane, which is kept so busy in an acid-converter plant, stands idle much of the time. This is accentuated by the use of casting machines for handling the blister copper and the pouring of the slag into chilling pans which are drawn to the slag bins, as at Garfield, so that it begins to seem probable that in future plants it may be possible to do away with the heavy and expensive crane and substitute some other device. It is to be hoped that before the end of another year more definite data regarding this subject may be available than at present.

The problem of smelter fume received an accentuated interest during the year by the closing by injunction of the Bully Hill and Balaklala smelters in Shasta county, California, and the procuring of an injunction against the Mason Valley smelter at Wabuska, Nevada, before it had been completed. On the other hand, the United States Circuit Court of Appeals, in the 'smoke suits' against the Washoe and Anaconda plants, upheld the decision of the Master of Chancery and the trial judge that the damage done by these plants did not warrant the issuance of an injunction. The Mammoth plant, in Shasta county, continues to operate, though under surveillance, and the Washoe and Anaconda plants still have the suit of the Federal Government, alleging damage to a National forest, pending against them. In the latter case a committee, consisting of L. D. Ricketts, J. A. Holmes, and J. H. Hammond, has been appointed to arbitrate the matter, the understanding being that if the smelters put in force the recommendations of the committee the Government will not press the suit. The general features of the smelter-fume problem have recently been so admirably discussed by Herbert Lang[6] that only a few points of interest will be made here. The solid particles in smelter fume can be removed effectively upon a practicable working scale by either the Cottrell[7] or bag-house[8] process, but the SO_2 content is more of a problem. The Tennessee Copper Co. is engaged in converting it into H_2SO_4, but this is not of universal applicability for a number of reasons, the chief of which are that markets for the acid thus produced are commonly lacking, and the concentration of the gases in SO_2 is frequently lower than desirable in acid manufacture. Several other methods are commonly employed. The use of tall chimneys to lift the gases so high into the air that they will be diluted before coming into contact with vegetation may be supplemented or replaced by direct dilution by blowing air into the base of the stack. In the former the initial cost is high; in the latter, operating costs are high. In Germany the Wieslenius stack is used to produce vortex currents in the escaping gases, with the idea of aiding dilution by the surrounding air. Young[9] has proposed the reduction of the SO_2 to S, using crude oil, with calcium sulphite as an intermediary, but the process is as yet only in the experimental stage. At the Ashio plant[8] the Asano process in use there, is claimed to neutralize the SO_2 as well as the SO_3, but full details are not available. As long as the principle is held to that a smelter may not commit a nuisance, trouble may be expected. But the decision in the Montana cases that the damage was not sufficient to warrant the issuance of an injunction is a hopeful one, as is the decision of the trial judge in the suit against Rathberger & Gerber of New York City, for committing a nuisance. In this case the court held that the business of the defendants was a necessary one to the community, that it was necessary to carry it on within the city, and that as the odors complained of were not detrimental to health, but only unpleasant, the issuance of an injunction was not warranted.

The great importance which the mining of low-grade deposits has assumed, and the necessarily large losses in wet methods of concentration, has greatly stimulated the investigation of leaching methods. The most important result of such investigations that has been disclosed is the announced intention of the Braden Copper Co. to construct a leaching plant at its mine in Chile. According to Pope Yeatman,[10] the consulting engineer, this plant will consist of 1 Wedge furnace, with acid tower, and accessories, 3 leaching-vats, 3 settling-vats, 9 solution tanks, and a precipitation plant of a capacity of 10 tons of cathode copper per day. It is thought that by this method copper can be produced at a cost of 7 or 6¾c. per pound; the low cost of electric power being a great advantage. Other companies have studied the problem, and by next year I shall doubtless be able to record substantial progress and to cite the results of actual operation. W. L. Austin has published[11] during the year a series of articles, discussing leaching methods in great detail, but the general appreciation of these was somewhat shaken by Mr. Austin's securing, during the year, a patent upon methods of leaching copper ores in place that have been widely known and used for many years.

Below is given an estimate of the total copper production for 1911 by companies in the United States, according to Hayden, Stone & Company.

ESTIMATED PRODUCTION

	Pounds.
Ahmeek	15,000,000
Allouez	4,800,000
Anaconda	225,000,000
British Columbia	10,000,000
Calumet & Arizona	50,000,000
Calumet & Hecla	75,500,000
Chino	*50,000,000
Copper Range	31,000,000
East Butte	12,000,000
Greene-Cananea	45,600,000
Isle Royale	7,200,000
Miami	*38,000,000
Mohawk	11,800,000
Nevada Consolidated	62,300,000
North Butte	25,000,000
Old Dominion	25,000,000
Osceola	18,200,000
Phelps, Dodge & Co.	132,000,000
Quincy	22,500,000
Ray Consolidated	*80,000,000
Shannon	14,500,000
Superior Copper	3,200,000
Tamarack	7,500,000
Tennessee	12,500,000
Utah Consolidated	8,000,000
Utah Copper	95,000,000
Wolverine	9,700,000

*Estimated total capacity.

Considerations of space forbid reference to many details of mechanical equipment. The Messiter electric weigher appears to have successfully solved the problem of keeping an accurate and continuous record of the weight of the mill feed, and is already coming into extensive use. The handling and feeding of ore and concentrate at Cananea, is elsewhere referred to by L. S. Austin, and is of so much interest that it is hoped to make it the basis of a later separate article. The number of plants where extensive new construction was installed or completed during the year was unusually large. The Tooele smelter of the International Smelting & Refining Co., was blown in during 1910, but construction has been in progress this year, though chiefly confined to the two new lead stacks, now in process

[6] Lang, Herbert. 'Metallurgy.' Vol. I. New York, 1911.
[7] *Mining and Scientific Press*, September 2, 1911, p. 286.
[8] *Eng. & Min. Jour.*, March 25, 1911, p. 614.
[9] *Mining and Scientific Press*, September 23, 1911, p. 386.
[10] *Mining and Scientific Press*, December 16, 1911, p. 772.
[11] *Mines and Methods*, January to December, 1911.

of construction. This plant has five 19 by 102 ft. reverberatory furnaces, and has a capacity of 1500 tons per day. The plant of the British Columbia Copper Co., at Greenwood, was built upon the site of a former plant, the time required for reconstruction being five months. This plant has two 48 by 360 in. blast furnaces, and one 48 by 240 in., having a smelting capacity of 2400 tons per day. The Ray Consolidated Copper Co. had a 1600 ton smelting plant under construction at Hayden, Arizona, but arrangements have recently been made by which this plant has been transferred to the American Smelting & Refining Co., and the new scope of work has necessitated some changes in design. This plant should be in operation early in 1912. The Mason Valley Mines Co. smelter, at Wabuska, Nevada, has two 42 by 300-in. blast-furnaces. The ground for this plant was broken late in 1910, and it was expected to blow in late in December 1911. At the Braden mine, in Chile, a 44 by 180 in. blast furnace is under construction, and provision has been made for two more, if they are found necessary. The Copper Creek Mining Co. has under construction at Copper Creek, Graham county, Arizona, a 75-ton matting furnace and a 75-ton reverberatory furnace. The most important new construction now on foot is the new plant of the Arizona Copper Co., at Clifton, Arizona. Full details of the design are not yet available, but the plant will handle approximately 1,000,000 tons of ore per year, in reverberatory-furnaces. L. D. Ricketts is consulting engineer. The following table, revised from one published in 'Mineral Resources of the United States for 1910,' by B. S. Butler, may be of interest. It should be noted that the list includes only plants which treat material derived from the United States.

PRINCIPAL COPPER SMELTING PLANTS TREATING MATERIAL FROM THE UNITED STATES.

Location.	Company.	Final copper product.
UNITED STATES.		
Arizona:		
Clifton	Arizona Copper Co.	Blister
"	Shannon Copper Co.	"
Douglas	Calumet & Arizona Mining Co.	"
"	Copper Queen Consolidated Mining Co.	"
Globe	Old Dominion Copper Mining & Smelting Co.	"
Humboldt	Consolidated Arizona Smelting Co.	"
Jerome	United Verde Copper Co.	"
Morenci	Detroit Copper Mining Co.	Blister
California:		
Campo Seco	Penn Chemical Works.	Matte
Kennett	Mammoth Copper Mining Co.	"
Martinez	Mountain Copper Co.	"
"	General Chemical Company of California.	"
Needles	Needles Smelting & Refining Co.	"
Maryland: Baltimore	Baltimore Copper Smelting & Rolling Co.†	Electrolytic
Michigan:		
Hancock	Lake Superior Smelting Co.	Anodes and lake
"	Quincy Mining Co.	"
Houghton	Michigan Smelting Co.	"
Hubbell	Calumet & Hecla Mining Co.	"
Montana:		
Anaconda	Washoe Copper Co.	Blister
Butte	East Butte Copper Mining Co.	"
Great Falls	Boston & Montana Consolidated Copper & Silver Mining Co.	Blister and electrolytic
Nebraska: Omaha	American Smelting & Refining Co.	Blister
Nevada: McGill	Steptoe Valley Mining & Smelting Co.	"
New Jersey:*		
Chrome	United States Metals Refining Co.	Electrolytic and casting
Maurer	American Smelting & Refining Co.	Electrolytic
Newark	Balbach Smelting & Refining Co.	Electrolytic and casting
Perth Amboy	Raritan Copper Works.	Electrolytic
New York:		
Black Rock	Buffalo Smelting Works.	Lake and electrolytic
Laurel Hill	Nichols Copper Co.	Electrolytic and casting
Tennessee:		
Copperhill	Tennessee Copper Co.	Blister
Isabella	Ducktown Sulphur, Copper & Iron Co. (Ltd.)	Matte
Texas: El Paso	American Smelting & Refining Co.	"
Utah:		
Garfield	Garfield Smelting Co.†	Blister and matte
International	International Smelting & Refining Co.	"
Virginia: West Norfolk	Virginia Smelting Co.	Matte
Washington: Tacoma	Tacoma Smelting Co.†	Blister
CANADA.		
British Columbia:		
Ladysmith	Tyee Copper Co. (Ltd.)	Matte
Grand Forks	Granby Consolidated Mining, Smelting & Power Co.	Blister
Greenwood	British Columbia Co., Ltd.	"
MEXICO.		
Aguascalientes: Aguascalientes	American Smelting & Refining Co.	"
Arizpe, Sonora	Greene-Cananea Copper Co.	"

*This list does not include a smelter in New Jersey and one in Pennsylvania, both of which make blister from material solely of foreign origin.

†Subsidiary of American Smelters Securities Company.

Cost of Developing Public Coal Lands

By James Douglas

*In any revision of the coal-land laws, three questions will have to be considered: (1) The quantity which should be allotted to a single entryman or corporation; (2) the terms under which the Government should part with its coal resources, whether by out and out sale, by lease, or on payment of a royalty; (3) the price which should be paid by a purchaser, a renter, or a worker on royalty. The decision of these questions is more or less interdependent. If a certain amount of coal must be secured in advance to warrant the expenditure of the capital necessary to mine the coal, and to handle it as coal or coke commercially when brought to the surface, and if this outlay is to be repaid, with a reasonable rate of profit to cover interest and risk, the operator must start with the prospect of a certain minimum supply of coal. What that acreage should be depends upon the size of the beds, and the initial outlay to utilize to the best advantage the property. In the following estimate I assume that 50% should be deducted from the estimated coal content of any given area of coal land, in determining its value, and that 10,000 acres, or 40 years' supply at 1,000,000 tons per annum, is the minimum which should be allowed to a corporation willing to erect safe and economical works and equip its mines with every known safety appliance.

The original outlay includes the cost of the surface equipment, which in the West, where the Government coal lands lie, must be costly if it is to be efficient. Based upon experience at Dawson, New Mexico, the following estimates of the value of coal land, based on one acre of land containing 8000 tons of coal, may be made:

10,000 acres land containing	80,000,000 tons coal
Deduct 50% for risk of mining, land will yield	40,000,000 tons coal
Net yield per acre	4,000 tons coal
Royalty per ton	8c.
Royalty per acre	$320
Number of tons mined per year	1,000,000 tons
Years to exhaust	40

	Total.	Per ton coal.
10,000 acres, at $320 per acre	$3,200,000	8.00c.
Cost of plant	1,979,264	4.94c.
Interest on plant investment, at 5% per annum, equals $98,963 per year for 40 years	3,958,520	9.90c.
Total cost	$9,137,784	22.84c.

Payment of 10,000 acres in advance.

One dollar compounded at 6% per annum for 40 years	$10.29
Royalty of $320 ÷ $10.29 equals present worth per acre	31.10

	Total.	Per ton coal.
10,000 acres, at $31.10 per acre	$ 311,000	0.78c.
Cost of plant	1,979,264	4.94c.
Interest on plant investment, at 5% per annum, equals $98,963 per year for 40 years	3,958,520	9.90c.
Total cost	$6,248,784	15.62c.

The value of coal in situ may be assumed to be determined by the royalty demanded in any given district for coal to be extracted. In Colorado, uncomplicated by store licenses, and so forth, this is about 8c. per ton. If, therefore, an acre in the Trinidad district yields on an average 8000 tons of coal, and the royalty is 8c. per ton, the gross value of the coal in the ground is $640 per acre. If the coal were sold out and out, the compound interest calculated on the price and the number of years necessary to work out an area large enough to return the purchaser a fair remuneration for his investment, compensation for his risk, and profits on the enterprise as a business venture, must be deducted.

In determining the cost of coal, the fixed charges (in this case estimated at 15.62c. per ton) should be taken into account as well as the operating charges. Inasmuch as the plant has to be maintained in perfect working order until the exhaustion of the mines, it seems to me that the cost, as well as the interest on the cost, generally represented by interest on a bonded debt, should be included in the fixed charges. This certainly should be done, unless it is extinguished by a sinking fund during the life of the mine. Mining costs are likely to be more rather than less in the future, because the mines must be deeper and greater precautions must be taken to insure safety for the men.

If the Government should lease the coal, reserving the surface rights, and the same requirements as to initial outlay were either imposed or voluntarily acquiesced in, the rental being a mere annual payment and not imposed on the producer in advance, would be calculated on the acreage value of the coal, exclusive of the deductions for discount. But in considering the other alternatives, such as allowing the coal to be mined on royalty or rental, objections may be raised against both systems. If 8c. per ton be a fair valuation of coal in the ground, the Government would seemingly get all it was entitled to by accepting that amount; but under this system the miner has every inducement to mine cheaply and thus wastefully, and to rob the mine of its best and more profitable coal.

Under the rental system, which could be based on the calculation of the coal in a given area, less the deductions made above, the lessee, as he approached the period of exhaustion, would be paying an exorbitant figure on the balance of the value and would be inclined to evade payment.

Would not a fair system be to charge a small rental on the total area and a reduced royalty on the coal extracted? Assuming 10,000 acres to be the required area and 8c. per ton to be a fair royalty, would not a rental of, say $1 per acre on the gross acreage, or say $10,000 per annum, and 4 or 5c. per ton royalty, be equitable? This would secure to the miner his necessary reserves and give to the Government the value of the coal in place.

The above suggestions are thrown out as subjects for discussion; but the conclusion forces itself strongly on my conviction that if a satisfactory revision of our land laws is to be reached, the farmer, the miner, the lumberman, and the banker must be consulted before the politician acts. The coal miner alone knows the conditions and restrictions under which coal can be extracted with safety to the workman, with profit to the operator, and justice to the public; the metal miner and the mining engineer alone appreciate the impossibility of literally living up to the letter of the old mining law, and the lumberman is certainly entitled to be heard before such sweeping judgments are passed upon him as we have heard pronounced of late years. Representatives of all the interests who actually occupy the public lands should sit upon a committee to suggest revision of the laws affecting the sale and the use of the public lands after sale, if such amended laws are to be practicably applicable.

*Portion of an address delivered before the American Mining Congress at Chicago.

Coal Output in 1911

Coal production in the United States in 1911 is estimated by E. W. Parker, of the United States Geological Survey, to have amounted to 490,000,000 tons. This is less by 11,000,000 tons than in 1910. Of the total, 400,000,000 tons was bituminous coal. The year was one of low prices, overproduction, and extremely unsatisfactory business.

Proposed Revision of Alaskan Mining Laws

By F. Lynwood Garrison

In the late summer of 1911 the secretary of the Mining and Metallurgical Society, W. R. Ingalls, received a request from the Committee on Mines and Mining of the House of Representatives at Washington, asking for suggestions relative to revision of the mining laws of Alaska. As it was desirable to have these data in time for the assembling of Congress in December, the secretary referred the matter to the Philadelphia section of the Society, knowing that among its members were some of the ablest coal-mining engineers in the world. The Philadelphia section held several meetings during September and October for the purpose of considering the matter. The outcome of the consequent discussion was a report prepared by a committee consisting of Eli T. Conner, William Griffith, R. H. Sanders, and myself. This report was later approved by the Philadelphia members and, after discussion by a committee of the Council of the Society, submitted for vote of all the members in the following form, in which is embodied a number of minor changes from the original draft:

1. It is essential for the proper development of Alaska that its coal-fields be opened for commercial use without further delay.

2. There are now known to exist but two relatively small fields containing high-grade naval fuel, and inasmuch as the Government now possesses no original source of such supply on the Pacific Coast, it is desirable, in the interests of national defense, that a selected area of these fields be held and operated under the direct control of the Government.

3. All rights which have accrued legally under statutes heretofore existing should be recognized.

4. If it be decided by the Congress that it is to the best interests of public welfare that coal lands in Alaska be leased, we recommend that the following conditions should be embodied in the leases; (A) These leases should be made for all the coal in the ground; (B) The royalty should be low and based on percentage of selling price of the coal at the mines; (C) The minimum annual production upon which royalty is to be paid should be nominal for the first two or three years after the execution of the lease, in order to permit and encourage the installation of efficient and durable equipment, after that period the minimum production upon which the royalty should be paid should increase more rapidly that the area increases (for example; the minimum production upon which royalty should be paid on a tract of 5000 acres should be several times more per acre than for 1000 acres)—such a plan would prevent the tying up of large areas of undeveloped coal territory; (D) A due-diligence and forfeiture clause to effect continuous work should be included in the lease; (E) Leasehold in coal lands should include all necessary timber, mining, and surface rights; (F) Leases should not be given for less than 40 acres, and in shape should be rectangular, their boundaries being east and west and north and south, and after the system of public surveys has been extended to Alaska and the land applied for is in a surveyed township, the unit areas of a lease should be those established by the Government survey as subdivisions of the sections; (G) The tract of land embraced within a single lease should not be more than three times as long as its width.

5. It should be clearly recognized as a basic principle that the value to the Nation of coal-lands in Alaska lies more in their use for industrial, commercial, and naval purposes than in the royalties to be derived therefrom, and it is desirable that the revenue obtained from coal royalties inure to the benefit of the Territory.

The Secretary of the Interior, W. L. Fisher, in his address before the American Mining Congress at Chicago, October 17, 1911, evidently thought well of the conclusions of the Pennsylvania engineers, for he added them verbatim to his address, which was afterward published by the U. S. Bureau of Mines, in Bulletin No. 46. The committee of the Philadelphia section, in carefully considering all the best available information regarding Alaskan conditions, came to the conclusion that the extent and value of the coalfields in that great domain had been unwittingly exaggerated, and that the public had a false notion as to their worth. The beds and seams are not only much crushed and disturbed, but the average quality and grade of the coal is distinctly inferior to that of Pennsylvania and West Virginia. It is true the Bering River and Matanuska fields contain some relatively small areas of high-grade coal, both anthracite and bituminous, but the extent, depth, and uniformity of these beds is absolutely unknown at the present time. Politics has befogged the whole question; mistaken deductions of geologists, unchecked and unrevised by any competent mining engineer, have been rushed into the print by the sensational press

COALFIELDS OF ALASKA. (After U. S. Geological Survey.)

under the banner of 'Conservation', until the very word has become offensive in some quarters, whereas with sensible people it should be a synonym for foresight and common sense. The truth is the mining and mineral laws of the whole United States are antiquated and need revision, and real conservation may be best accomplished in that way. Alaska is a good place to begin, although it is perfectly true, as M. L. Requa has pointed out,[1] that it will probably be many years before the coal of Alaska can be assured of a market outside of local demand; certainly at least not until the superabundant supply of California oil is greatly reduced. One exception in regard to this statement must be noted, that is, in regard to fuel for the Navy. Unless fuel oil comes to be used almost exclusively on the war-vessels in Pacific Coast waters, the Government has no original source of supply of suitable fuel except certain small areas in the Bering River and Matanuska fields.

The suggestion that the Government open and operate these fields for Naval purposes and to supply a limited outside demand, makes evident some differences of opinion.

[1] *Mining and Scientific Press*, November 18, 1911.

That the Government is justified, under the peculiar circumstances indicated, not only in opening collieries, but in building railways to bring the coal to market, was the view of the committees and others concerned in this discussion. Surely no corporation or individual would be justified in making such a large investment as is necessary under the present conditions, even after new and satisfactory mining laws were enacted. To open the coal would be an exceedingly expensive undertaking and should be part of a greater plan for development by building of a through trunk line of railway from the coast to the upper Yukon. In the present undeveloped and unsettled state of Alaska, this can only be done by the Government; the climatic and physical conditions are too uninviting to tempt private enterprise. At best the profits of such an undertaking will be remote, though probably sure in the end: individuals or a corporation could hardly afford to wait perhaps fifty years for an adequate return upon their investment, whereas half a century is not a long span in the life of a nation. This, if you like, is paternalism, but it is sometimes necessary for governments to be paternal and take the initiative when it is desired to make the waste places of the earth blossom and two blades of grass grow where there was before but one. In other words, without Federal aid, the development of Alaska is certain to be painfully slow, and probably would be effected only with great waste of capital and effort.

The leasing system advocated by the Mining and Metallurgical Society may at first sight appear objectionable to some Western miners and mine-owners, they being generally unaccustomed to the idea. It may not always be realized that the plan proposed by the Mining and Metallurgical Society for all the coal in the ground is in reality a sale as far as the coal is concerned, since no time limit is set. An operator, knowing he has a large tonnage of coal to depend upon, may take his own time in mining it, and hence is likely to equip his property with substantial and enduring machinery and buildings, and lay out his underground work in the best manner, feeling sure that in the end it will be most economical and conducive to efficiency and preventive of waste. Another advantage of such a lease is that no large payment of money is necessary at the outset in order to acquire title from the Government. The price of the property, or rather the coal, is represented by the royalty, whose payment is an annual increment of the operating cost, depending upon the quantity of the coal taken out. The royalty rate should be small, and in such a case will hardly be felt by the operator; no amortization charge for his investment other than for equipment will be necessary on the part of the operator, yet the Government will be receiving a fair and just compensation for the public's property, and the feeling that it is giving away for nothing valuable public domain need not be entertained. Similar leasing systems have existed for years in many foreign countries, and have been, on the whole, found to be most satisfactory. It is, in my opinion, the only logical system of acquiring title to public mineral lands of all kinds; provided, of course, the regulations affecting it are based upon sound and liberal business principles. They should obviously be conditioned upon the character of the risk the lessee assumes. Thus, for example, the hazard is much greater in gold mining or drilling for oil than in equipping and operating the colliery upon a well defined coal bed. It is perhaps needless to point out the grave defects in our present archaic mining laws. In some respects they were good for the country fifty years ago, but the statute (Sec. 2322) giving extralateral rights to the locator or owner of the surface has never been and never can be anything but an ignorant and litigious enactment, a reflection upon our national intelligence and practical good sense.

Mr. Fisher's views on the Alaska coal question, which presumably reflect those of the Administration, are apparently set forth in the Chicago address above mentioned.[2] In this document he advocates the building and operating by the Government of railways in Alaska. The physical and climatic conditions of this vast Territory are, on the whole, so adverse, that it is highly improbable private enterprise will venture unaided into such undertakings for many years to come. But it will be argued, has not private enterprise already built 195 miles of railroad over river and glacier from Cordova to Kennicott, on the Chitina river? This is true, and it is likewise true this railway cost its builders about twenty millions of dollars. The question why it was ever built may perhaps be best answered by those responsible for its construction. Supposedly it was intended chiefly as an outlet for the Bonanza copper deposits at Kennicott owned by the same interests, and for whatever incidental business might be obtained by the development of neighboring mineral properties. It has been stated, however, that the Bonanza is but a "third-class property, a sort of copper-plated gold brick, in that an interior core of limestone is surrounded by phenomenally high-grade bornite and copper glance, and that no competent mining man who has visited this property ever has estimated the amount of ore developed and safely inferred as capable of yielding more than 100,000,000 lb. of finished copper; a total production equivalent to only one year's maximum output by any one of the six leading copper mines of the world." "The gross value of all the copper contained in the Bonanza mine, taking the outside estimate of tonnage, is considerably less than the lowest estimate of cost of this railway, and the net profits derivable from the Bonanza mine, cannot, by the most liberal figuring, be estimated at more than $4,000,000 to $5,000,000."[3] Assuming this statement to be correct—but which I personally doubt—it is difficult to understand how hard-headed, experienced business men can be credited with the folly of spending this large sum for a railway that has no assured traffic. It has been suggested this may be a deep-laid scheme to sell the railway to the Government as part of a national trunk-line project to the upper Yukon river. But, as has been pointed out, it would be much better, in such event, that the Government begin this trunk line or continue the existing line from Seward or Resurrection bay, passing through the Matanuska coalfields on to Fairbanks and its destination, wherever that may be. Evidently such a road would be enormously costly, but it would undoubtedly give an immense impulse to the country's development.

Speaking of the extension by the Government of the existing railway from Seward to the interior, Mr. Fisher says:

I believe this road should be continued on to the coalfields and beyond them to the interior, and that if private interests do not care to undertake the task the Government itself should do so. The situation here is not like that in the Copper River country. No large financial interests are back of the railroad; no large investments have been made which it will be necessary for private interests to protect. Such a railroad as I have suggested will pass through a country which appears to have large agricultural possibilities as well as great mineral resources. These possibilities and resources, however, will require time for their development. The adoption of a leasing policy will take away from the promoters of such a road the lure of great gain from the exploitation of the coalfields. This exploitation clearly should be prevented in the public interest. But at the same time the Government must recognize that if it withdraws from private capital this incentive for railroad construction, the Government itself must assume the obligation of making possible that kind of development upon which it insists for the general good. It has been urged that the Government should meet this objection by guaranteeing the payment of bonds or the interest on bonds equal to the cost of the construction of the road. I can see no advantage whatever in this policy. If the Government is to guarantee the cost of construction, I see no reason why the Government should not own the road outright, whether it operates it or leases to an operating company.

Referring, however, to Government ownership of coal mines, he does not take quite the same view as the Mining and Metallurgical Society, for he says:

Unlike the Government ownership of railroads, public coal mining has never been held by the courts to be a function of Government. It would be regarded by many

[2] *Mining and Scientific Press*, November 25, 1911.

[3] Horace J. Stevens, *Mining and Scientific Press*, November 4, 1911, p. 585.

sincere and disinterested citizens as an invasion of the field of private enterprise, and would involve such general and uncompromising opposition that even those who believe in its adoption as a matter of principle should not insist upon tying up the coalfields of Alaska until the great economic and political questions that are involved in its exclusive application to these fields have been fought out to a practical conclusion. The true function of government is not merely the preservation of public order or the regulation of the conduct of individuals, but the carrying on of any enterprise which will promote the welfare of the community as a whole more effectively if carried on by the organized community than if left to the voluntary action of individual members of the community. But to determine whether a particular activity answers this test depends in every instance on a final and complete analysis involving a consideration not only of immediate results, but of the far reaching consequences upon humanity and upon the social order. While, therefore, much can be said in favor of permitting the Government to enter experimentally into those fields upon which industrial development and the welfare of society depend, which perhaps may in the future include the development and distribution of power and the means by which power may be created, I do not believe that the Government alone should preëmpt those fields or exclusively assume their development until it becomes far clearer than it is today that their development by private enterprise cannot be effectively controlled. For this reason I am opposed to the policy of having the Government alone own and mine Alaskan coal.

The views of the Mining and Metallurgical Society on this phase of the subject are fairly set forth in Section 2 of the above recommendations. The contention here is that the Government should control the best coal in the Matanuska and Bering River fields in the interest of national defense. Having drawn this clause myself, I have naturally followed with interest the discussion of it which took place in committee and council meetings. The impression I received as a consequence of the debate was that the majority of the members do not think the Government, under the circumstances, will be assuming too much in opening these coalfields in this way. The inference being, in my own mind, as it appeared to be in that of other members, that the Government could and would be justified in selling such proportion of the high-grade coal produced at its collieries as exceeded the demands of the Navy. In this way the development of these coalfields will be assured and pressing local needs provided; at the same time these collieries would be opened in a proper manner, provided with the best equipment, and become an object-lesson to future operators in the territory.

If the mineral laws in the United States need revision, and it is pretty generally admitted they do, Alaska is a good place in which to begin. The number of existing rights already established there under the present laws is relatively small, but whenever it can be shown they have been honestly and legally acquired they should unquestionably be confirmed. If owners will agree to revision—such, for example as an abolition of the extralateral right—all the better for them and everyone else, except possibly the lawyers. After an effectual scheme for the revision of the mineral laws is worked out and successfully applied to Alaska, I believe the results will be so satisfactory that a general revision for the whole country will be demanded. It is certainly true, as George Otis Smith, the director of the U. S. Geological Survey, pointed out in his address before the San Francisco section of the Mining and Metallurgical Society on October 16, 1911, that "at the present time we are developing oil land with a law that was made, not exactly to help gold mining, but apparently to control and keep gold mining from going ahead too fast. It did not promote gold mining, and it is the worst kind of a law for oil development. Our general mineral-land law antedates the present knowledge of either geology or the technology of the industry and is completely out of date."[4]

When, in the history of the country, was there better opportunity for this revision than now? The U. S. Geological Survey, the Bureau of Mines, the Mining Congress, and the Mining and Metallurgical Society are all interested and willing to advise upon, and even initiate, reforms affecting the welfare of the mining industry.

[4]M. & M. Soc. Amer., Bull. 41, p. 213.

Mining in China, 1911

By Thomas T. Read

Full details in regard to the mineral production and resources of China were given in the *Mining and Scientific Press* for October 7 and November 11, 1911, and it is unnecessary to do more than add a few notes upon matters of more recent occurrence. Of these, easily the most important is the abrogation of the concession of the Syndicat du Yunnan, Ltd., an Anglo-French company which held the mining rights over an area of 40,000 sq. mi. in Yunnan. In addition to its mining rights, the company possessed a concession for railroad building, but in the present temper of the Chinese people the exercise of this right was not within the bounds of possibility, and the company has wisely agreed to surrender its concession for a consideration of 1,500,000 taels (approximately $1,000,000) payable in half-yearly installments of 250,000 taels each. The company was organized in 1899 with a capital of £35,000, and held a 60-year concession (renewable for 25 years more), but has been unable to accomplish much, on account of popular opposition in Yunnan. Most of the foreign mining concessions in China (with the notable exceptions of the Chinese Engineering & Mining Co., the Schantung Bergbau Gesellschaft, and the Peking Syndicate) have now been canceled, and there is little probability that any new ones will be granted.

A recent report from Tai-yuen-fu is to the effect that commercial quantities of petroleum have been found in the neighborhood and that a company of local merchants will be organized to develop it. If the report is true, it greatly extends the area in which petroleum is known to occur in western China. It begins to seem probable that the general area between 30° and 40° N. lat. and 102° and 112° E. long. may eventually develop into a petroleum-producing territory of some importance.

Statistics from China are always a year old, at least. the Han-Yeh-P'ing Iron & Coal Co., which operates iron mines at Ta-yeh, in Hupei, collieries and coking plant at P'ing-hsiang, in Kiangsi, and blast-furnaces, steel plant, and rolling mills at Hanyang, near Hankow, reports that during 1910 it produced 130,000 tons of pig iron, of which 29,000 tons was sold in Japan and 15,000 tons in the United States; presumably nearly all of the remainder was converted into steel at the plant. The colliery produced 160,000 tons of coke and a total of 610,000 tons of coal during the year. In addition, an unreported amount of iron ore, probably about 100,000 tons, was exported to Japan, and a smaller amount to the Pacific Coast of the United States. It is not probable that the works at Hanyang have been much injured during the revolution, and they will probably be able to resume work soon after conditions again become quiet.

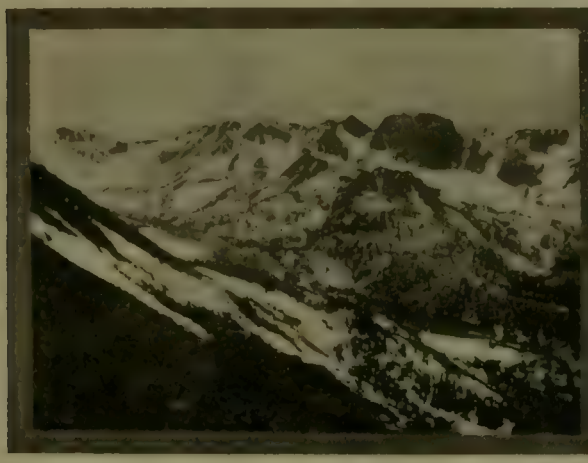
The Schantung Bergbau Gesellschaft reports that during 1910-11 it produced 237,544 tons of coal at Hung-shan, and 194,897 tons at the Fangtse mine. The operating profit was 247,719 marks which, by the payment of interest and amortization charges, is converted into a loss of nearly 600,000 marks. The Chinese Engineering & Mining Co., on the other hand, is a very profitable enterprise, having produced 1,117,312 tons of coal in 1910, at a profit of approximately $1 per ton. The neighboring Lanchow mines, however, which were organized under Government auspices about two years ago, and which have been equipped to produce 4000 to 5000 tons per day, are only producing about 1200 tons per day and seem unable to operate at a profit.

Mining in China will be greatly interrupted by the revolutionary outbreak, and normal production can scarcely be resumed for some time. At the time of writing, the outlook is gloomy, and a speedy restoration of quiet seems quite unlikely. The famine in central China threatens to become more serious during the coming winter than during the past one, and combined with the long interruption of trade in the interior, will tend to produce a year of marked depression in 1912.

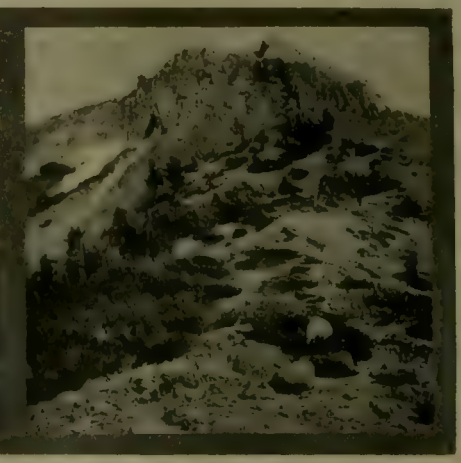
Mines of the Southern Sierras of California and Nevada

By Mark B. Kerr

The eastern escarpment of the Sierra Nevada range, between California and Nevada, marks a tremendous fault culminating particularly in the great drop into the Mono Lake basin. A line drawn in a general northwest course projected through the centre of lakes Tahoe and Mono, would strike through the Sierras and touch most of the gold-quartz mines that have been heretofore prospected along this great mountain mass; but in the northern counties of Placer, Nevada, Sierra, and Plumas, the bold quartz outcrops are situated generally on the western side of the range, while in the southern counties of Alpine, Mono, and Inyo the quartz veins are in the heart of the uplift or near the eastern escarpment. The veins of the Plumas-Eureka district, at Allegheny in Sierra, and in the Washington district in Nevada county have been extensively explored and have been repeatedly described; but the more southerly counties are still comparatively unexplored and inaccessible.



SCENERY IN THE HIGH SIERRAS.



OUTCROP OF THE MAMMOTH LODE.

A State wagon-road from the Yosemite by way of Hetch Hetchy and the Tioga mining district has just been finished after years of delay, but packhorses must still be used over the steep trails by those desirous of prospecting or camping out in this region. In winter the heavy snows accumulate and avalanches frequently rush down the steep eastern escarpment. At Lundy, a little mining village near Mono lake, such an avalanche last year not only destroyed this village, but completely demolished the neighboring power-plant, and all were killed except the wife of the superintendent. The good people of Bodie, after a gallant fight in the storm, came over the mountains some twenty miles on skee, and brought out the only survivor, who was dazed and not informed of her husband's death for months afterward.

Mono lake, a body of water about fifteen miles wide, is situated in a large sink about 6500 ft. above sea-level. Its shores are covered with sand and pumice, but irrigation does wonders, and many green spots, with horses and cattle grazing, stand out as oases in the otherwise general desolation and loneliness. The lake was formerly fresh and of much greater extent, the outlet at one time being through a low gap toward Hawthorne, Nevada, but the waters now contain a strong solution of carbonate and sulphate of soda with chloride of sodium. Two islands have formed near the centre of the lake, and at the southeast corner of the largest one, which extends two miles from north to south, steam issues from a series of crevices which can be seen extending some distance into the lake. This steam cools when exposed to the air and is precipitated on the island in springs of good fresh water.

The valleys of this region range in elevation from 6000 to 8000 ft. above sea-level, and the snowfall begins early and soon blocks the roads. The season is short, and all winter supplies, of any bulk whatever, must be hauled in and the plant made snug and protected to withstand these heavy storms. This renders prospecting and mining expensive and difficult. The ranges east of Mono lake all have the same approximate strike parallel to the crest of the Sierras, and form, in reality, a portion of the structure of the Great Basin plateau. The quartz outcrops are bold, and the veins mark great dynamic disturbance, the ore deposits generally being along fracture planes or fault fissures. While in some places these veins are not in granite, but along contacts of either porphyry or slate with granite, the same general structure exists, and signs of great volcanic activity are much in evidence. Toward the east is the Excelsior mountain mass, ranging from 6000 to 8000 ft. in height. Along the summits toward Mina, veins of silver-lead are found.

Numerous large sinks with steep sides, generally of basaltic cliffs, are found irregularly over this region, such as Adobe meadows, Huntoon and Whiskey valleys. These are now dry and have no outlet. Gold is found at many points, and still farther eastward are desert valleys between isolated mountain ranges. Until the mines of Tonopah and Goldfield were discovered these were as little known as the deserts of Gobi or Takla Makan. The bottoms of these valleys are occupied mostly by borax and salt marshes, sometimes fifteen or twenty miles wide, without a shred of grass and only an occasional bunch of sagebrush, but yet patience and hard work can utilize these salts and make them of commercial value.

The extended view is the great fascination of these deserts, the outlook being only limited by the surrounding high ranges. The outcrops are so well defined that it requires little imagination to project the different veins to some intersection in depth, and greater chances may be taken in suggesting possible orebodies in a country like this where the direction of the veins is so easily traced by the outcrop, than is permissible in a wooded country where little of the surface is exposed. For the pioneers who penetrate these deserts, suffering from heat and thirst in the hot summers and exposed to the winter blizzards, only admiration can be expressed, for in many cases prospecting and hard work reveal that the grade of the ore is too low to pay. The output of such camps as Tonopah and Goldfield, where over a million a month each in gold and silver is regularly produced, however, lures the miner and promoter on to further efforts. The light-colored limestones

and porphyries, the black shales and basalts, combined with the different colored sulphide ores, all more or less eroded, give rise to fantastic shapes, where such names as Aurora, Castellated Buttes, Casa Diablo, Mammoth, Minarets, and Deadmans creek graphically describe the effect of such scenes upon the pioneer.

In the southern high Sierras the gold mines yielded their greatest output between 1871 and 1884, when the Bodie mines alone gave yearly more than $2,000,000. The mines at Benton, prior to the activity at Bodie, yielded a gross output of $4,000,000. The Tioga lodes, at the head of Leevining creek, are large and can be traced for long distances, but since the Great Sierra company, in 1889, built the expensive wagon-road, over 50 miles long, from Crockers by way of lake Tenaya, little has been done. The ore carries considerable silver. The May Lundy mine is credited with a yield of $2,000,000 and is now under bond to the Tonopah Mining Co. The Standard mine of Bodie built the first long line for transmitting electricity.

Cheap power is what is needed in these mines, for until very recently, steam from wood furnished by the Mono Lake Lumber Co. was almost universally used. This lumber company has a good tract of timber land and can furnish timbers for any extensive development in this region, at reasonable prices. The Pacific Power Co., at Jordan, just below Lundy, has recently put in a large electric plant and is supplying electric power to Bodie, Aurora, Fairview, and Wonder.

By far the most picturesque of any of these camps is at Mammoth, in the Lake mining district, and near the border of Mono and Inyo counties. The outcrop of the Mammoth lode is large. The vein lies between quartzite and porphyry and is heavily stained by iron oxides. Specimens of free gold ore were taken out in 1879 and 1880, causing great excitement. The lowest adit taps the Mammoth lode 600 ft. under the outcrop, and in the past two years while the mill was running, the mine is credited with an output of $200,000. Numerous streams and waterfalls fed by the melting snows rush down the mountain slopes, any one of which, on being harnessed, is capable of generating power cheap enough to warrant further development in this and many other properties now abandoned.

This country is now included within the Mono National Forest, and restrictions as to prospecting and securing rights of way and the necessary timbers for mining are bad enough as it is, without further tinkering with the present laws governing mineral location. If the leasing system of mining claims by the Government should be introduced into the United States, then the Government, in my opinion, should also build power-plants and deliver water, power, and timbers at reasonable rates, for it is hardly possible that any private company would care to organize and develop a power scheme under a Government lease, as is now suggested by certain officials of the Interior Department. The lack of steady development on mineral locations is the greatest objection made to present regulations, but if the small prospecting company were encouraged by giving it cheaper power, water, and mining timbers, then in my judgment more claims would be worked steadily. One good paying mine gives steady employment to many miners and quickly builds up a community, and the small prospector, in every case, is entitled to the credit of opening up the ground sufficiently to encourage capital to venture further. Any amendment to present laws should be designed to encourage more vigorous and steady work in these wild and almost unexplored regions, and to the discovery first of the mineral to be conserved.

From the foregoing it will be seen that these southern Sierra mines of Mono and Inyo counties have yielded to date approximately about $30,000,000, and with the advent of cheap and effective power and better transportation facilities, such as are now available with the mines in the northern counties, renewed activity may be expected. To the sportsman, as well as the miner, the hunting and fishing will prove attractive, and I know of no place in California more interesting than this region in which to enjoy a summer holiday.

Literature of Ore Deposits in 1911

By Walter Harvey Weed

The publications on ore deposits issued in 1911 include a number of works of vital interest to the mining engineer, particularly to those engaged in valuing mines or developing prospects. This neither implies any great epoch marking work nor a discovery of new laws of occurrence of ores, for the science is as yet in its infancy. Engineers examining a property still rely upon comparison with other developed deposits as a basis for judgment, but the applications of the searching methods of modern petrography in the study of polished surfaces and thin sections of ores and of wall rocks, of the newer chemistry, and of a recognition of the true meaning of physical factors, are rapidly developing this into a science in which the apparent vagaries of ore deposition are seen to have definite and recognizable causes. The present is yet a transition period in which the literature is still largely descriptive, with a few general papers dealing with principles, or giving generalizations to be tested by the experience of engineers in the field. The bold generalizations of Horace V. Winchell[1] a year ago, have been discussed throughout the year by many engineers. Mr. Winchell contrasts the process of superficial alteration and secondary enrichment in Arctic and temperate regions to the distinct disadvantage of the former, maintaining that in boreal climates there is less migration of material by solution, and secondary ores if formed were planed off by glaciation. His observations upon a veneer of secondary sulphides formed yearly are especially worthy of consideration by examining engineers, and I have personally observed similar crusts in British Columbia. His conclusions are, if sustained by experience, the most important announcement of recent years to the investing public. They may be summarized as follows: (1) boreal regions seldom contain rich and extensive deposits of secondary ore; (2) surface appearances are deceptive, and high-grade ores show a sudden decrease in value at a limited depth; (3) primary ores are likely to extend downward. In temperate zones, (1) deep-seated alteration is an indication of good ore below; (2) ore deposits in general are more abundant in warm and temperate climates; (3) they are not so likely to terminate suddenly or change rapidly in depth. Mr. Winchell's critics have cited exceptions, but do not appear to have contraverted his sweeping generalizations.

The 'Characteristic Features of Replacement Deposits and the Criteria for their Recognition',[2] is perhaps the most important single paper of the year; it certainly is so to the average mining engineer. Replacement deposits have long been recognized as erratic and difficult of estimation of value. Mr. Irving's experience has given him a wide familiarity with the type, and his paper is therefore valuable for its accurate presentation of facts as well as the conclusions drawn. He shows that the shape of a replacement ore mass is due to: (1) relation to channel of ore-bearing solutions; (2) variations in chemical character and structural arrangement of enclosing rock; (3) manner in which mineralizing waters have affected the rock; (4) amount of material supplied in solution. The illustrations in the paper are excellent and tell the story peculiarly well.

The agency of manganese in superficial alteration and secondary enrichment of gold deposits described by W. H. Emmons last year has inspired a paper on the origin of silver bonanzas in the arid regions by C. R. Keyes.[3] Mr. Keyes ascribes these valuable but most astonishingly erratic deposits to solution of the metals by salts in meteoric waters, particularly sodium chloride, with precipitation by the alkaline silicates of clay selvages of faults, shear and joint planes, etc. The latter process is a legitimate deduction

[1]'Prospecting in the North,' *Mining Magazine*, Dec. 1910.
[2]J. D. Irving, *Econ. Geol.*, September 1911; also in 'Types of Ore Deposits,' *Mining and Scientific Press*, 1911.
[3]Bull. Amer. Inst. Min. Eng., July 1911.

from the experiments made by Mr. Sullivan at the suggestion of myself, in the laboratory of the U. S. Geological Survey, and the extensive investigations on clays and soil constituents in the bureaus of the Agricultural Department, especially those of Milton Whitney on soil and those on road materials. This paper should be read by all mining men interested in the ore deposits of arid regions, but it is lacking in direct facts, and the references given to the work of others often prove illusive when consulted, so that the paper is speculative and suggestive rather than the presentation of proved theory. The genesis of mineralized sandstones, whose widespread occurrence in the United States, both east and west, as well as in Russia, Mexico, and South America, has led to many unsuccessful attempts to recover their metallic contents, is discussed by W. Lindgren. According to him, chalcocite, bornite, and chalcopyrite are primary ores and, with accessory galena and vanadium, are typical of the deposits throughout the world. They are described as epigenetic and not of true sedimentary deposition.

In the field of descriptive works there is a wide variety. The State geological surveys of Australia contribute several papers describing the ore deposits of that island continent which suggest comparisons with Arizona and Mexico. The Queensland and Western Australia geological surveys publish bulletins which are not as widely read by mining men as they should be, since they are not readily accessible, and their important deductions are too frequently concealed in a mass of local description. Our own geological survey has contributed several volumes of permanent value, besides carrying out its recent policy of publishing reconnaissance notes on newly discovered mining districts. The monograph on the gold placer gravels of California, by Mr. Lindgren,[4] is the result of twenty years of observation and study of these deposits by himself and other members of the Survey. It is a noteworthy contribution to the subject by our foremost living mining geologist. Cobalt's silver deposits are discussed by R. Hore, who gives a careful and concise description of the rocks of the district,[5] but only brief and rather unsatisfactory notes about its ores or their occurrence. To the engineer the account by W. G. Miller[6] is full of interest, showing by maps and cross-sections the relations of diabase, Huronian, and Keewatin. He considers the magmatic vapors from diabase the source of the ores, but that surface waters working downward played an important part. He finds, however, that secondary enrichment is less important than other geologists believe.

The Huelva copper deposits of Spain have been controversial ground for geologists for many decades. Two new papers have appeared in 1911. Collins[7] has given a pithy description in which he notes a popular error that the great lenses of cupriferous pyrite are uniform in composition. He has also justly called attention to the complex lead-zinc-copper ores of several of the lenses. Attention is also called to the surface, or chalcocite enrichment, and another 'deep' secondary enrichment of pyrite by chalcopyrite as myriads of irregular interlacing strings from $^1/_{500}$ in. up to an inch thick. This he ascribes to crushing and fissuring of the pyritic masses followed by enrichment. The association of chalcopyrite with calcite, dolomite, and quartz is noted, and the genesis ascribed to the intrusion of later basic dikes, the deep enrichment coming from the original copper-forming source whose ascending solutions now highly alkaline, deposited mixed sulphides and but little pyrite. A second paper,[8] by a Spanish geologist and engineer, discusses the specular iron deposits of Huelva and their relations to the copper deposits. His theory assumes one source for the copper and complex sulphides. The sulphurous emanations at or near eruptive centres formed cupriferous pyrite deposits in crushed zones in schist which were enriched by hydroxidation in the middle portion. Sulphides dissolved in acid waters formed replacement enrichment and another portion dissolved by alkalies traveled far from eruptive centres and formed banded complex sulphide deposits.

The geology of the Breckenridge district by F. L. Ransome[9] is a well written account of one of Colorado's lesser but productive and interesting mining districts. The illustrations are pertinent and the facts well presented, though the book is rather large and its subject-matter too varied to hold the average reader who is not personally interested in the district. An excellent example of geological observations of general interest obtained in the course of a mining engineer's professional examination work is given in a paper by F. J. Pope on the ore-shoots of Pachuca, Mexico. The splendid geological report on this district by Ezequiel Ordoñez, published by the *Instituto Geologico Mexico* some years ago, has given an idea of the magnitude of these veins, which contain what are probably the largest bononzas of high-grade silver ores extant today. Mr. Pope's[10] observations show an association of these bonanza ore-shoots with phases of the igneous rocks resulting from magmatic differentiation. Descriptions of geologically unknown mining camps appear in the current periodicals, that of Hostotipaquillo, Mexico, by S. J. Lewis[11] being especially timely in view of the prominence of that district in the past year. The gold deposits of the Philippines are described by H. G. Ferguson[12] in a paper giving his personal experience and observations at the more important mines. He gives a conservative but fairly favorable view of the future of the industry of the Islands. The Transvaal gold deposits are described in two interesting papers. The first, by A. L. Hall,[13] on the Pilgrims Rest district, bears the imprint of 1910, but reached most readers in 1911. This paper deals with a district yielding about two million in gold a year and containing 14 interbedded 'reefs' mostly in dolomite rocks forming the middle of the Transvaal series. The ore is a dirty white honeycombed quartz carrying minute particles of gold yielding $9 to $13 per ton. The reefs are small, the most profitable being but 8 to 24 in. thick. The second paper, by W. E. Bleloch,[14] discusses the correlations and age of the banket deposits of the Rand. It is seldom that a theoretical discussion of this kind has such an immediate application to development work. The gold deposits of the Porcupine district, in Ontario, have been described in numerous papers in the *Canadian Mining Journal* and have been given much space in the technical press generally. The general geology of the district is relatively simple, but the gold occurrence, which is marvelously rich in patches in one or two mines and occurs in sparser quantity over several townships in many veins, appears to be governed by minor geologic features demanding close detailed study. The long-looked-for monograph on the geology and ore deposits of the Lake Superior region, by C. R. Van Hise,[15] has at last appeared, and sustains the reputation of its author, whose views on the mining districts of this region are so well known. The book should be owned by every engineer interested in iron ores.

THE Etheridge Prospecting Syndicate has applied for two 100-acre leases on the Einasleigh river, about 2½ miles west of Hot Springs, Queensland, Australia. As this is about fifteen miles in a northeasterly direction from Georgetown, some idea may be formed of the extent of this great mineral-bearing belt. As a proof that there is rich ore existing in the deep ground on this field, recently a solid mineral specimen was taken from the Durham Consols mine at the 750-ft. level. The mineral weighs a little over 7 lb., and coarse gold can be seen all over it.

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[4]Prof. Paper No. 73, U. S. Geol. Surv., 'The Tertiary Gravels of the Sierra Nevada of California,' by Waldemar Lindgren, Washington, 1911.
[5]Bull. Amer. Inst. Min. Eng., 1911, p. 413.
[6]*Eng. and Min. Jour.*, Sept. 30, 1911.
[7]H. F. Collins, 'The Pyrite Deposits of Huelva,' *Mining Magazine*, August 1911, p. 121.
[8]Juan Herese, *Diaria de Huelva*, April 4, 1911.
[9]Prof. Paper No. 68, U. S. Geol. Survey, 1911.
[10]*Econ. Geol.*, 1911, p. 501.
[11]*Mining and Scientific Press*, Vol. 101, pp. 335-337.
[12]*Econ. Geol.*, March 1911.
[13]Trans. Mine Dept., Geol. Survey, No. 5.
[14]'The Witwatersrand System,' map and pamphlet, London, 1911.
[15]Mon. LII, U. S. Geol. Survey, 1911.

Progress in Cyanidation of Gold and Silver Ores During 1911

By Alfred James

Introduction. America still holds pride of place for advanced practice during the year, although the tendency has rather been to settle down and to assimilate the great advances of the past year or two. One is inclined to regard the Santa Gertrudis mill as absolutely the best example of a silver-gold mill on up-to-date lines. In every way this mill is noteworthy, whether for the trouble taken in the preliminary investigation, the competitive nature of the practical tests, the expert talent assembled from all quarters, or the great success of its working. On the other hand, Africa is coming forward prominently, and there are signs of the more general adoption of methods of great success elsewhere. In this review I last year[1] ventured to suggest that F. L. Bosqui, assisted and not hindered by local talent and experience, would probably give a good account of himself, and the new Brakpan plant, for the success of which W. L. Honnold gives Mr. Bosqui well deserved credit, has signalized itself among recent African plants in being successful from the outset. The Brakpan is notable also as being the first example on the Rand of a mill on modern Mexican lines; thus agitation instead of being by pump transfer is by Pachuca tanks, and the gold in solution is recovered by filtration instead of by decantation, and precipitation is by Merrill zinc-dust process instead of by zinc shaving. The first dividend paid in South Africa from a modern mill—Pachuca tanks, Dorr thickeners, and filtration—seems to be that of the Lonely Reef in Rhodesia, to which credit is due for having at work the first plant of this type in that territory or on the Rand. A feature of Rand practice is the apparent difficulty of estimating the value of the gold in slime, pulp, and cyanide solution. That the difficulty does exist is shown by the discussions on the subject at the meetings of the Chemical, Metallurgical & Mining Society of South Africa, and the official report on the Adair-Usher and Butters results at the Crown Mines. At the same time, it seems almost inconceivable that groups of such great responsibility could be misled. Only a year or so ago the Adair-Usher results (readers will probably remember the criticism of the secretary of the company on the remarks in this review) were reported to show a saving of 5d. per ton over the decantation process. The chief mining group was publicly reported, without denial on its part, to have paid a large sum of money for the right to use the process. It now appears from the Crown Mines official report that the Adair-Usher residue was really 0.423 dwt. instead of 0.225 dwt., the apparent value when samples were taken in the usual way. A fuller account of this interesting report is given under filtration.

In another way Africa has also been prominent. Earlier in the year there were glowing reports on what the Gieseke mill was to do for the industry. Surprise at this was all the greater because it was evident to anyone of experience in ball-mill practice that the mill could not be the success claimed, because it has long been shown that for economical grinding in a tube-mill the elimination of the already slimed material is essential. The Gieseke mill combined a ball-mill with a tube-mill as one unit, the whole of the product of the ball-mill going without separation into the tube-mill portion of the appliance. It was therefore manifestly uneconomical. In addition, it has been common experience from the time of the original Globe, Lamberton, and other ball-mills that the wear and tear of iron or steel balls, when wet-crushing, was enormous, and there was no reason to anticipate any less wear and tear with the Gieseke mill. Indeed, the Krupp mill is the only one which appears to be able to stand the wear and tear of wet-crushing with iron or steel balls, and even in this mill the wear and tear is very much heavier than when dry-crushing. Last year in this review I ventured to predict, although the City Deep type of mill was then at the zenith of its fame, that a high proportion of the new South African mills would be designed for filtration instead of the hitherto impregnable decantation, and already this prediction seems to be completely fulfilled. It must be difficult to gauge the feelings of such pioneers as the Meyer & Charlton and New Goch, which after putting in the filters which enabled them to show recoveries of 94%, relapsed to decantation—it has been stated for the sake of obtaining a mortar-box sample!

India, too, is attacking other methods for the treatment of slime, and the erection of an up-to-date plant is anticipated at the Champion Reef mine; details are not available, but it is understood that the plans provide for Pachuca tanks and vacuum-filtration (Butters type).

West Australia pursues its already evolved practice. Much metallurgical skill has been applied to discover a less unsuccessful system of treatment of the Gwalia Consolidated antimonial ore. On the other hand, H. T. Brett, late of West Australia (of Ivanhoe pan fine-grinding fame), seems to have no doubt as to the correct method of meeting successfully his similar problem at the Globe & Phoenix.

Cornwall, curiously enough, is evolving practice which may later become a potent factor in gold ore treatment. Arthur Richards, who has made no little success of fine grinding of local tin residues with a consequent production of tin only surpassed by the largest mine or mines in the county, has set himself to increase the fine-grinding standard from –200 mesh to –400 mesh, and is endeavoring to find some more suitable appliance than the tube-mill for this particular purpose. Again, Dolcoath has now an equipment of smooth running—giving almost the impression of velvet cushioned—pneumatic stamps which in American or African hands would probably easily beat the record for tonnage per head per diem. It is a matter for surprise that someone has not taken a battery of these and determined their output on, say, 3-mesh screening with quick drop and most suitable quantity of water, leaving the finer crushing to be accomplished in some secondary appliance such as the tube-mill.

Before proceeding further it is fitting to refer to the satisfactory (from the metallurgical point of view) termination of the East Rand fiasco. It started with a reported huge loss of gold in the cyanide plant altogether incredible to those knowing E. H. Johnson, the able chief metallurgist. As Mr. Johnson was referred to in this review last year as regaining the laurels for the Rand in the matter of crushing, the accusation or charge was all the more inconceivable to me, and it has given much relief and satisfaction to find that the official report of the committee not only entirely exonerates Mr. Johnson and states there has been no (such) loss of gold in the cyanide plant, but shows how the supposed loss has really been brought about as a result of overcalculation of ore content and tonnage by the mine officials. Mr. Johnson had my sympathy; I now add my congratulations.

New Mills.—Probably the most notable mills of the year are the Santa Gertrudis, Dome, Randfontein Central, City Deep, Brakpan, and Lonely Reef, the last a quite small mill but at the time of its starting probably the most up-to-date in Africa. The Lonely Reef company has already within three months after its starting the mill, declared a dividend. If the City Deep (decantation) be excepted as being really a last year's mill, possibly still somewhat in an unfinished stage, and the Randfontein Central as being of the standard but now obsolescent decantation practice with a vast number of stamps (600) instead of a greater proportion of tube-mills, it will be seen that all these new Mexican, Canadian, Rand, and Rhodesian mills have points in common. They all include stamps of 1250 lb.

[1] *Mining and Scientific Press*, January 7, 1911, pp. 52-56.

or heavier, Dorr type thickeners (Brakpan excepted), air-lift agitation (Pachuca tanks), filtration of slime, and, with the exception of Lonely Reef, Merrill zinc-dust precipitation. They appear to have gone to work smoothly from the start (except the Dome, not yet started) and to be giving results which are records for their particular territories. The Stratton's Independence mill, treating dump, and the Alaska Treadwell mill, treating concentrate, are also noteworthy, as will be seen later. The Tonopah Belmont, Modder B, and Palmarejo mills are not included, as details of the starting of these mills are not yet at hand.

Of the Santa Gertrudis mill, it is proper to state that the extraction from the outset has exceeded the estimates, and that it amounts to over 90% of the silver. Exact figures will be given in a paper shortly to be published by Hugh Rose. The mill is of 600 tons capacity and is being brought up to 800 tons by a small additional expenditure. It includes 4 gyratory crushers; sixty 1550-lb. stamps; 14 Dorr classifiers; 6 primary 5 by 16-ft., and 4 secondary 5 by 20-ft. tube-mills; 5 primary 35-ft. and 3 secondary Dorr thickeners; and 18 Pachuca tanks. A feature of the mill scheme is primary and secondary treatment almost all the way through. Even the agitating in continuous agitators is not in one operation. The pulp, when a little more dilute than 1:1, is agitated in a battery of 8 Pachucas, is then elevated by air-lift to a launder, whence after dilution with 4:1 of barren solution, it flows through a second set of Dorr thickeners for a second treatment in 10 Pachucas. Filtration takes place in 4 Merrill presses, the water used for sluicing being recovered by two 35-ft. Dorr thickeners. After classification in 2 sand filters, the solutions are precipitated by 6 Merrill precipitation-presses in two circuits, one involving complete precipitation, the other and larger reducing the amount of bullion in solution in course of flow. The Merrill slime-press is officially reported to be doing everything expected and to be showing greater capacity than originally claimed and to recover a high percentage (98%) of gold and silver in solution at a cost of 2½ to 3d. per ton. This takes no credit for the additional extraction obtained in the press, but actually debits the press with total dissolved metal—under 2 grams of silver—in the residues, although the two grams and more is undoubtedly extra extraction obtained in the press itself during the treatment with barren wash. The above cost does not include royalty or the loss, perhaps 1½d., in dissolved silver and gold. The zinc-dust consumption is stated to equal the weight of bullion recovered (1:1).

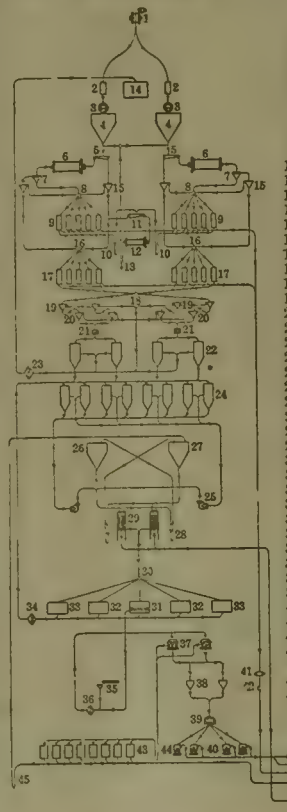
The La Blanca mill, which started at the close of last year, is reported to be obtaining an extraction of 92.8% silver and 95% gold, and to be milling 300 tons per diem at a cost of $4.40. The Moore filter is used in this mill and is stated to show dissolved silver to the value of 3 to 4 grams only on the residues from 750-gm. original heads.

Some mystery appears to hang on the Benoni mill. Last year the technical press gave full details of the proposed equipment, the chief new feature of which appeared to be the Way-Arbuckle slime-plant. It is reported that after many delays the mill was started in October to comply with certain Government regulations, but that the slime equipment is not yet in working order; doubtless full information will be available later, and it is to be hoped that Mr. Way has made as great a success of the Benoni mill as he previously made of his New Kleinfontein plant; but the latter was based on the treatment methods prevalent at the time, whereas the Benoni slime-plant would appear to be based on practice as yet unproved and untried; except in so far as the unsuccessful experiments at the East Rand may be held to apply to it.

The New Dome mill has had a setback owing to the disastrous forest fire which has necessitated reconstruction. From the published description it would appear to be a mill of standard modern type; forty 1250-lb. stamps, Dorr classifiers and thickeners, 4 tube-mills, continuous Pachuca agitation, Merrill slime-filtration, and zinc-dust precipitation.

The cyanide plant at Treadwell is notable as an example of a recent concentrate plant as well as for the extreme attention to detail characterizing the design. W. P. Lass gives a full description of it in the *Mining and Scientific Press* of October 21, 1911. Filtration takes place in Kelly presses and there is Merrill zinc-dust precipitation.

The Stratton's plant is left until last, as it is undoubtedly one of the most noteworthy achievements of the year. Readers will remember that the treatment cost of the West Australian telluride ores was brought down from a very high figure in the early days to as low as 11s. 6d. per ton.[2] It was a brave if not audacious proposal, therefore,



FLOW-SHEET, ALASKA TREADWELL MILL.

to spend a large sum on the erection of a mill to treat telluride dump rock of a grade of 3 dwt. and under! How Philip Argall has succeeded may be seen in the November number of *The Mining Magazine* and also in the account of the November general meeting of the company. He has justified and beaten his estimates, and congratulations are none the less sincere because he has accomplished what few would have dared venture. Briefly, Mr. Argall beneficiates the dump at a cost of $1.40 per ton by crushing, concentration, and cyanidation of sand and slime, using gyratory crushers, rolls, Chilean mills, classifiers, concentrators, tube-mills and reconcentration, vacuum-filtration, and zinc-shaving precipitation. It should be noted that the concentrate (3%, containing 44% of total gold in ore) is not treated, but is sold to the smelters on advantageous terms, but the figures include bromo-cyaniding, whenever necessary, of the slime. During the fiscal year 109,800 tons containing 17,288.96 oz. of gold was treated, with a recovery of 7546.8 oz. in the concentrate and 4814.8 oz. from the sand and slime; a total recovery of 12,361.6 oz. or 17.5% for a profit of $65,000.

New Processes.—It is the experience of many that old processes continually reappear under new names with some ingenious change ringing on old chemical or electrolytic methods. It is not, therefore, my practice in this review to refer to newly-proposed methods until the ordeal of

[2]Great Boulder Proprietary—see this review for 1906.

practical trial has strengthened rather than effaced them. Usually money and time and trouble may be saved by a knowledge of the result of scientific speculations in the past, and a compilation of these schemes is needed, even though it prove a record mainly of obituary notices. The memory of the old Cassel electro-chlorination process still lingers, and with it the knowledge of the troubles then met in finding anodes that would stand the disintegrating action of passage of current, electrolysis of solution, and wear and tear of agitation of ore pulp at the same time. It was obvious that the cyanamide process as described by J. C. Clancy must encounter just the difficulties that worried workers with the older process, and from all accounts this trouble has in fact caused delay in bringing the process to a working stage. In the same way the difficulty of the electrolysis of dilute solutions with complete precipitation of metals yet exists, and the troubles that befell Peletan-Clerici and Rieckeu still await the enthusiastic inventors who chronically rediscover these processes. Long before the advent of the Adair-Usher process it was found that displacement by upward solution was so imperfect as to be unreliable, and that the attempt to recover deposited thickened slime by a screw-conveyor working under water had caused the failure of many a filter or slime-treatment device, and it was, therefore, not a little surprising to learn of the huge sum (£30,000) stated to have been expended on the Arbuckle experiment at the East Rand. Similarly, the continuous reshuffling of the chemical reaction, solution, or oxidation processes led me to write for the last International Chemical Congress a brief sketch of the results of the employment of various oxides, alkalies, lead salts, lead coating, halogen salts, hypochlorites, accelerators, mercuric cyanide, and alkaline persulphates, with a note of their original introducers into the field of cyanidation. A glance back at history is often sufficient to indicate the part probably to be played by a 'new' method, and that, too, even when the method involves some ingenious application of nice chemical reactions. And as this was my excuse to the reviewer who criticized the omission from 'Cyanide Practice' of any reference to a certain process then advertised but never since heard of, so it may last year and today be taken as my reason for not including in this review of progress in *practice*, comments on ingenious scientific speculations.

Agitation.—The attempts to turn an air-lift agitator into a continuous decanting device have so far had as little success as the old attempt (this year repeated) to filter slime from the bottom of the agitation plant through a filter-bed immediately under the agitator. The feature of the year has undoubtedly been the almost universal adoption of the continuous system of agitation in Pachucas pioneered by A. Grothe, whose able and ingenious article on the principles of agitation in air-lift tanks has given us all food for much reflection. Who before was brave enough to discount what many thought the supreme advantage of the air-lift accelerated agitation, and to argue from the downward travel of the particles only? That article[3] should be read by all. But none the less, the continuous agitation method has brought to light many snags and pitfalls hitherto unsuspected, and from plants on all sides valuable experience is at hand as to means of overcoming the difficulties that crop up. Probably the best course for the intending user is to get into touch with Mr. Grothe at once and to obtain from him the latest results; otherwise he may repeat the experience of a company whose mill is stated in the technical press to have suffered delays of some months on account of the non-working of a locally-devised adaptation of the Pachuca tank. It cannot be too strongly urged that anyone modifying a standard agitator should first experiment with a glass model; he would then find that much of the so-called agitation is merely the escape of bubbles which, cleaving through the volume of liquid, make a great show at the surface, but fail to even slightly modify the descent of all but the finest particles of the slime-pulp.

[3]*Mining and Scientific Press*, July 15, 1911.

The originally proposed method of connecting the tanks by inclined pipes is expensive, the more so as by-pass pipes are necessary and the stoppers are awkward to get at, and valves get choked by sand. M. H. Kurvla arbitrates the pulp across any particular tank it is wished to cut out, and Mr. Grothe has central feed and discharge tanks with the Pachucas grouped around so that any of the tanks can be made No. 1, and thus any particular tank can be cut out without difficulty. All tanks have discharge valves, and thus any tank can readily be made the last of the series. A simple system of continuous agitation has also been described by Huntington Adams.[4] This method can readily be adapted to existing tanks, and has the advantage of having all connections at the surface of the charge, but to one who has not seen the apparatus in operation the by-passes would appear liable to choke and the system of a variable-cut sampling box at each tank would seem to call for attention and adjustment—otherwise why the adjustments?—whereas it has been shown that the Grothe method does automatically give a pulp of equal screen analysis throughout. The provision, however, in the last tank for agitating a partly filled tank when this is used as a reservoir for filling filters is surely a step in the right direction.

The form of dropping spider shown in the description of the Treadwell plant[5] is worthy of note. A spider which will start up within 15 minutes a densely-packed 30-ton mass of high specific gravity concentrate is an appliance of considerable value in the agitation of concentrate. The Trent tank has come into prominence during the year, mainly by reason of the description of it by J. W. Hutchinson.[6] He describes it as the most serious competitor of the flat-bottom agitator and as a good means of bringing flat-bottomed tanks up to an efficiency comparable to that obtained by Pachucas. The agitator resembles a garden sprinkler, submerged in the pulp, which it agitates by reason of the motion imparted to the radial arms by an issuing stream of circulating pulp. In a personal letter Mr. Hutchinson states the Trent agitator takes 6½ hp. to operate in a charge of 200 dry tons at a dilution of 1½:1.

Amalgamation.—In parallel with the practice of concentration ascribed to F. L. Bosqui in this review of last year, whereby the tables immediately after the battery were omitted and concentration limited to vanners or slimers after the tube-mills, several mills in South Africa do away with plates after the mortar-boxes and rely on after tube-mill amalgamation only. It has been foreseen that plates after the mortar-boxes would have to go, because the coarse-crushing now taking place in the mortar-boxes yields fragmentary pulp quite unsuitable for amalgamation on plates, but this removal of the battery plates in no way obviates the difficulty of the effect of cyanide solutions on amalgamated plates, and W. C. Caldecott avoids this by his scheme of dewatering and adding cyanide solution after the tube-mill tables. C. W. Merrill, similarly, at the Dome, is unable, by reason of his employment of amalgamating plates, to avail himself of any advantage arising from crushing in cyanide solution, and either dewaters his slimed pulp prior to agitation or does not introduce cyanide solution until the pulp is in his press. The Caldecott system yields a beautifully separated and dry (10% moisture?) product adapted to his special requirement—the adding of cyanide solution with as little dilution as possible—but it is questionable whether a valveless table is the most satisfactory or economical method of accomplishing this object. A waste of vacuum at the scraper and a wear and tear of cloths seems inevitable, and possibly a continuous filter of the Askin Nicholas-Oliver type would be more satisfactory in the long run.

A recent advertisement shows that J. V. N. Dorr has fitted a vacuum-filter to the bottom of his well known classifier, presumably to give a dryer product. Mr. Argall,

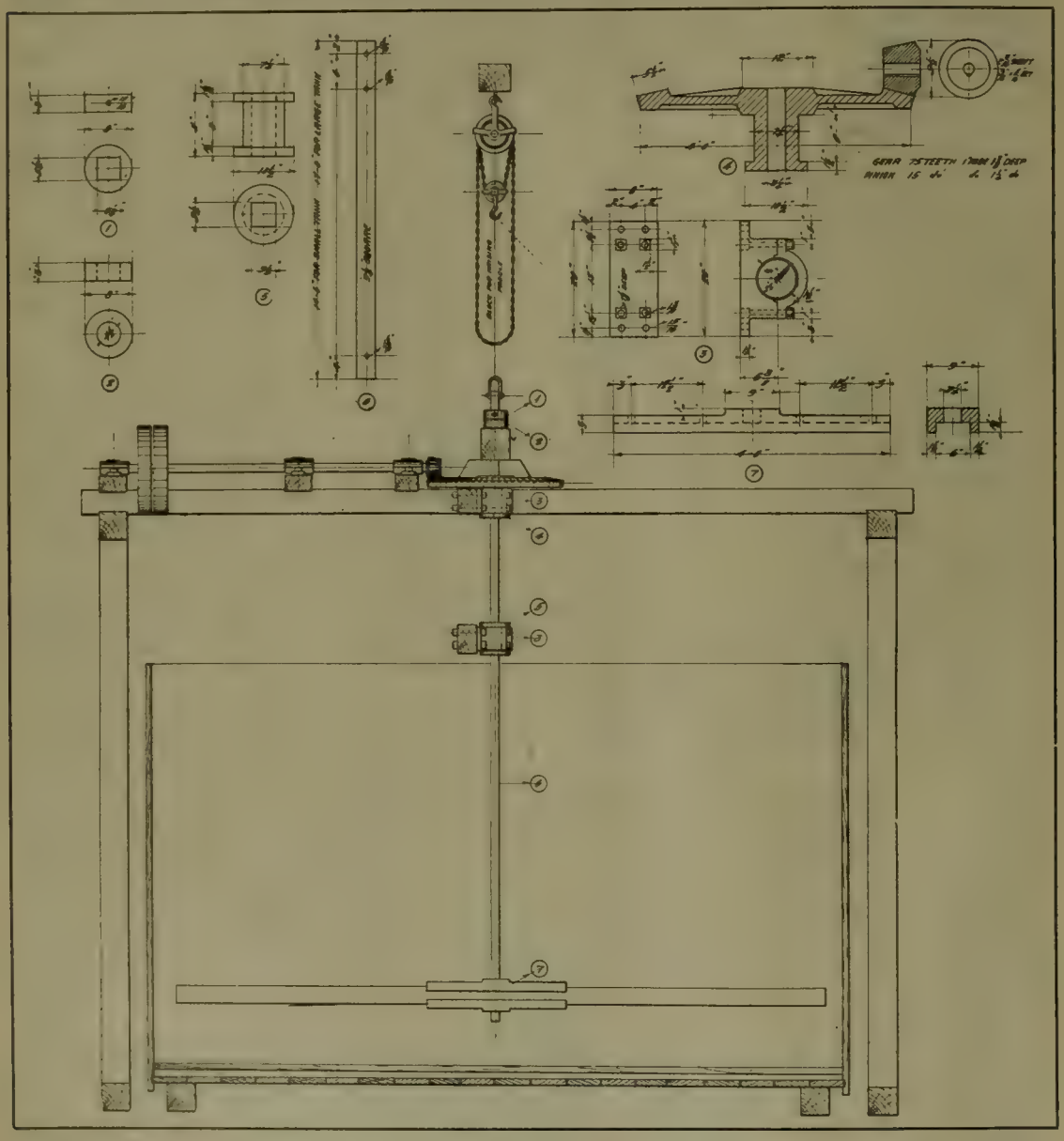
[4]Bull. Amer. Inst. Min. Eng., August 1911.

[5]*Mining and Scientific Press*, October 21, 1911.

[6]For description of Goldfield Consolidated Mill, see *Mining and Scientific Press*, May 6, 13, 20, and 27, June 10, 1911; also, *Eng. & Min. Jour.*, June 17, 1911.

at Stratton's Independence, classifies and dewaters his pulp down to 15 to 20% moisture, treating 200 tons per day with $\frac{1}{2}$ hp. By means of two screen-conveyors he presses the sand and withdraws it with considerable control of fineness of particles and dryness.

For thickening slime-pulp the Dorr type thickener, and its last variant, the El Tigre, holds the field by reason of its simplicity, its low operation and maintenance cost, and of a series of parallel corrugated sheets placed at an angle of, say, 45° to the surface and continuing for some distance (18 in.) below. The corrugations are stated to regulate the flow of descending slime and ascending clarified water without interfering with the settlement of the rest of the pulp. At the Sons of Gwalia an experimental plant is stated to have improved the thickness of the pulp from 26 to 41 per cent.



ADJUSTABLE AGITATOR IN GOLDFIELD CONSOLIDATED MILL.

its efficiency. For dewatering slime-pulp the Oliver type filter is probably as convenient as any other apparatus. The method of filtering (dewatering) slime by squeezing it in a folded belt between rollers, described in this review for 1909, is still being experimented with in Australia, and the latest development has been recently described in the *Journal* of the Western Australian Chamber of Mines. A considerable amount of work has recently taken place in South Africa and Australia on systems of dewatering slime by assisted settlement such as that included in the Way-Arbuckle Benoni plant, or that described so fully by Gardner in the May *Journal* of the Western Australian Chamber of Mines. This system depends on the acceleration produced in settlement resulting from the employment

Clarifying Solutions.—E. J. Sweetland, the Treadwell staff, and C. W. Merrill have all invented presses for clarifying solutions with flowing or sluicing off of the sediment. It is perhaps too early to predicate as to the success of these presses; this must to a considerable extent depend on the nature of the suspended matter in the solutions to be clarified. At the Santa Gertrudis recourse is had to sand filters; the well-known Dehne (hand-cleaned) clarifier was specified for the Palmarejo mine, but at the last moment sand filters have been substituted here also.

Crushing.—The race of the Rand to heavier stamps has received a serious check, and the City Deep mill does not appear to be entirely satisfactory. Indeed, the Nissen stamp is reported to have shown up remarkably well against

this 'last word' in Rand mills. It may be assumed that for the present Rand practice will for the future assimilate itself more closely to the Mexican and New Zealand practice of increased ratio of tube-mill to stamp. Unfortunately, no figures of performance are available. It was known that the overloaded and over-revolved Rand tube-mills almost immediately after their original installation, passed the margin whereby crushing capacity at the then standard of fineness could be more economically increased by addition of tube-mills rather than of stamps, but on the other hand, the increased fineness resulting from tube-mill grinding has brought about increased extraction and sent up the Rand standard of fineness from 60 mesh to 90 mesh. Indeed, the greatest opponent of tube-mills on the Rand is apparently at last convinced and has not only laid down a record ratio of tube-mills to stamps for the Rand at the Benoni, but it looks as if the New Kleinfontein plant itself was following suit on the same lines. We may thus take it that, in spite of the greater horse-power used in grinding through tube-mills, the practice is one that pays.

In this review reference has been previously made to

HEAVY STAMPS AT CITY DEEP.

the low ratio, 2 to 4% of tube-mills to stamps prevailing on the Rand as against 16.6 and even 20% elsewhere. An instructive table is given in the *South African Mining Journal* for September 2. It shows that the mills with a tube-mill to stamp ratio of about 1:18.5 crush from 11 to 20 tons per head per diem; when the ratio is 1:20 the output is from 10 to 13 tons per diem, with a ratio of 1:25 the output descends to from 9 to 10½ tons per diem, and those with only 1 tube-mill to 30 or more stamps show only 8 to 9½ tons per diem; but the value of the table is diminished by absence of any note of the weight of the stamps or of the total horse-power employed.

The trial of the Nissen stamp at the City Deep has provided some extraordinary results; it would scarcely be too much to ascribe a superiority of over 30% in crushing capacity, weight for weight, for less horse-power and repairs, and that, too, taking a considerably coarser feed.[7] It is evident from the above results that a limit will be put to the development of heavy stamps in batteries of 5 heads per mortar-box, as the heavier the head the greater should be the area of shoe and die. A noteworthy point is made by J. W. Hutchinson,[8] who states that instead of increasing the Goldfield Consolidated mill by 40 stamps and 3 tube-mills as originally proposed, they obtained the desired output by the addition of 6 Chilean mills only between the existing stamps and tubes. Battery-screens of 4 mesh were substituted for the existing 12-mesh with a resulting duty of 8½ tons per head. This scheme saved a month's time, $100,000 in money, and yet increased the capacity of the plant by 40 per cent.

Fine Grinding.—E. J. Ball, in a paper before the Institution of Mining and Metallurgy, shows that present African practice is to grind 1.30 tons of product passing 90 mesh screen for 75 to 90 hp. with a pebble load of 8 to 14 tons, depending on the wear of the liner. This gives a factor for comparison with the data of El Oro, Waihi, and other fields previously given in these reviews. A standard mill in South Africa consumes 7 hp. per ton of pebbles and produces 10 tons of ground sand per ton of pebble charge per diem, or, roughly, 1½ tons per horse-power through 90 mesh. El Oro produces 1.2 tons per horse-power through 200 mesh. Waihi figures are greater than these, but include the slimed ore from the mill. The best feed appears to be 30 tons per ton of pebble load at a moisture of 38.8% (Walter Neal). The pebble load is shown by Mr. Ball to be the best when the mill is filled to just below the centre of rotation, while the speed of rotation should be 10% greater than that given by Davidsen's formula. Now Ball's tests were so successful that he brought the efficiency of a makeshift tube-mill—an old chlorination barrel—from 3.87 (S.S) to 8.82 (V) and gave results comparable with those from present-day specially-designed mills. It is to be hoped ere long similar tests may be made on the economical limits of coarseness of feed and of irregularity of mine rock (substituted for pebbles).

There is but little fresh to chronicle in tube-mill practice. As previously suggested, Walter Neal's reverse screw outlet is becoming more and more widely used, and bar liners are displacing all other forms. The ideal liner would seem to be an El Oro liner with replaceable ribs or bars, so that the backing need not be wasted when relining is necessary. Richards (Cornwall) points out the necessity of having small pebbles as well as large in the charge of tube-mills newly started. After continued running, the necessary proportion of small pebbles is mechanically produced, but at the outset he finds output poor unless the charge is made up as stated above. Allen's point of rounding off mine rock prior to its introduction into the mill appears well taken, and is supported by the work of Davidsen and the experience of Neal. The original ten machines at the Great Boulder have treated a million tons of slime to date—a pretty good record. The latest type of machine, however, has adjustable periods of revolution enabling the cycle to be altered at will or even with the age (and lessening filtering capacity) of the cloths. It works automatically, the adjustment being by water-balance, with feed varied at desire, and is showing a good capacity even with the difficult St. George kaolin. On Great Boulder pulp this latest Ridgway type handles daily over 250 tons per unit.

Filtration.—The fact that all the new great mills of the world referred to under 'New Mills' treat their slime by filtration, evidences how absolutely this method has displaced decantation. From West Scotland Street to Karangahake, from Karangahake to Kalgoorlie, from Kalgoorlie to the uttermost parts of the earth, filtration has progressed on its triumphant march; except for the Rand, where the New Consolidated Langlaagte mill is reported to be designed for decantation, it may be regarded as universal. It is noteworthy that all the typical new mill plants noted, except the Brakpan, have pressure-filters in spite of the great advances made in vacuum-filters, mainly on the lines indicated by Crush in 1909, namely, the adoption of gravity-filled huge pipe-line plants emptying or filling in three minutes and thus avoiding or lessening cracks, in place of the centrifugal-pump-throttled slow-filling systems described in the technical press of that date.

Pressure-Filters.—The Dehne still easily ranks first for number of installations, and is the press adopted by such new mills of the year as the Lonely Reef and the Matabele Queen. The Merrill has given a remarkably good account of itself at the Santa Gertrudis, and the Kelly has been adopted for the treatment of concentrate at the Goldfield Consolidated and the Alaska Treadwell new mills.

Vacuum-Filters.—A spell of holy calm has supervened after the enthusiasm of past years. The Moore is reported to have been adopted for a further plant at Pachuca by an old friend there. The submerged filter has undoubtedly advanced since the adoption of the principle of rapid

[7] *South African Min. Jour.*, Nov. 4, 1911.
[8] *Mining and Scientific Press, loc. cit.*

emptying and filling. Charles Butters has been energetically moving in new territory, Africa and India, and the official report of the Crown Reef plant may be regarded as a veritable triumph. Years ago the Denny brothers pointed out the loss in dissolved gold in the decantation residues and their accompanying solution. It was reported that the total maximum further possible saving was only 8d. It seemed impossible to break down this stand and to save gold for people who thus plainly expressed their belief it was not there to save. Even the Ridgway demonstration which reduced decantation residues from 0.5 and 0.6 dwt. to 0.12 dwt. failed to shake this attitude, and when the same demonstration showed indubitably that gold was still being dissolved after the pulp had been agitated and treated by decantation, even then the possibility of this was locally denied. The official report on the working of the Butters plant at the Crown Reef should put an end to all this. The true average of Adair-Usher residue is shown to be 0.423 dwt. instead of the 0.225 dwt. stated. The Butters plant recovers the dissolved gold, and also by the use of barren solution wash further gold, to the extent of 0.332 dwt., 1s. 5d. per ton, and may under normal conditions be reasonably expected to show a gross saving over decantation of 0.20 dwt. (10d.), or a net saving of 0.12 (6d.) per ton of slime filtered with a treatment cost of 9d. per ton filtered. It may be reasonably anticipated that under normal conditions the Butters cost will not amount to anything like this figure. Under demonstration conditions extra cost will have naturally been incurred to bring the figure above normal. It will be remembered that the fixed submerged costs were given as from 6d. to 10d. per ton in this review for 1909, and with the huge-main gravity-filling system now being adopted at all plants, it may be expected that costs will be still further reduced.

The following cycle is given for comparison with the old ones published in 'Recent Cyanide Practice'. It well shows the advantage of the gravity-filling huge pipe-line plant to which an old pump-filling plant was converted, and is only possible, of course, by the use of the hydraulically operated valves first included in the rapid-filling Crush installations. By the use of 20-in. pipe-lines the cycle is completed in one hour, as follows, the time being stated in minutes: Fill, 3; form cake, 19; discharge pulp, 3; fill, wash, discharge with barren solution, 21; water-wash and cake discharge, 11; total, 57. This may be compared with a cycle of 2 hr. 5 min. by the old pump-throttling system. By the new method, not only a better washed product is obtained by avoiding the formation of cracks by long exposure of the uncovered cake, but also the unparallel output of 7 dry metric tons per leaf per 24 hr. is achieved. The industry is indebted to C. W. Van Law, of Real del Monte, not only for the record established for the above work, but for much serious original investigation into the question of the continuous solubility of gold and silver in pulp after agitation, and even after filtration. Mr. Van Law establishes the necessity for dilution with barren solution after agitation, and for slight re-agitation to obtain best results. An extract from a letter dealing with one of the largest and most recent submerged-filter plants of the day gives point to the remarks above regarding the evils of throttling and the advantage of the Van Law cycle. "The bad feature of it is that the excessive time of change from slime to wash is worse than wasted, for it allows the cakes to crack. When giving a water-wash the time lost in manipulation, exclusive of discharging the cakes, is 36 minutes on each cycle. Allowing an hour and a half per cycle, that shows a 20% loss of capacity as compared with changing in 6 minutes."

J. W. Hutchinson's articles on the mill at Goldfield[9] have already been the cause of the saving of many thousands of dollars by submerged-filter operators. He most carefully prevents unavoidable loss of the water-wash into which his cakes are discharged, pumps off all possible water to a storage tank, and uses it for diluting his Pachuca charges. Any enrichment of the solution is thus retained in the mill-flow for ultimate precipitation. His slime residue flows to the dam as a very thick pulp, carrying little more than 33% moisture. Whether this method is an improvement on that of A. H. Smith, also at Goldfield, described in this review of 1909, is perhaps a moot point. Mr. Smith runs his residues into a pond with wash solution, settles, and decants, and to this extent may recover a larger proportion of value contained in the cake than Mr. Hutchinson, who decants from his tank; on the other hand, Mr. Hutchinson's method should be less costly and less liable to loss. But it would look as though he could make a higher recovery by following the example of Mr. Smith and decanting after the cake has been agitated with wash instead of after a dropping only.

The Ridgway has not been entirely resting on its laurels. From New South Wales comes the account of its having ousted a grouped-frame filter of well known type, and a plant has also gone into British Columbia. But in Africa its sponsors, having demonstrated its efficiency, have preferred to wait for a coming to terms by the mining groups rather than to undertake further expense for a problematical minute remuneration. The Thompson-Davis-Crush plants have this year introduced a further refinement by a contrivance which avoids the use of air (with its inconvenience of frothing) for agitation. Drage has brought out a filter in Australia which somewhat resembles a Ridgway set vertically. The Way-Arbuckle combination appears to have been long endeavoring to patent a somewhat similar appliance with double screen-area, judging from U. S. Patent Specifications issued June 6, 1911.

Heating Solution.—Year by year I refer to this in the hope that it may lead to a general communication of views as to the benefits or disadvantages of this course. The difficulty of precipitating gold from solution on the Rand in the winter months emphasizes the necessity for some such exchange of experience. The method suggested by Swen of reheating the air employed in air-lift agitators seems a simple and feasible plan of warming solutions and at the same time making less air necessary for a given duty. C. T. Rice[10] refers to an increased recovery of 2% at the Desert mill resulting from heating the solution.

Precipitation.—The Merrill zinc-dust method has been gaining ground as a result of the careful technical supervision of the inventor and his associates. This method has been still further improved by the adoption of a two-circuit plan, the main circuit for reducing solution content during flow, and the secondary circuit for the complete precipitation of solution to be used as wash, etc. By the adoption of this system the consumption of zinc-dust has been reduced to 1:1 of bullion; indeed, even a lower consumption is claimed at some plants. The system has also shown to advantage in the precipitation of cupriferous solutions. The continuous feed of zinc-dust acting at once, instead of becoming more sluggish after a while, as with copper-coated zinc shaving, has given remarkably good results in dealing with such solutions, as witness the Goldfield Consolidated plant when the precipitate contains 43% copper. Undoubtedly, a drawback to the system is the large amount of oxide and impurities, perhaps 15%, added to the precipitate, all of which has to be fluxed off unless resort is made to acid treatment. Another drawback is undoubtedly the clogging up of the pipe system between the feed and the press with bullion precipitate—this latter difficulty should be easily overcome, and I am expecting Mr. Merrill to make his hold on the process greater than ever by supplying a specially prepared pure zinc-dust.

General.—Silver mills seem to have bulked more largely this year in the matter of advanced practice than gold mills; silver sulphide is not so easily attacked by cyanide solution as metallic gold, and this fact probably accounts for the advanced position in practice held by Mexico and for the extraordinarily high efficiency in gold recovery of the mills there. The keen enthusiastic emulation of the Santa Gertrudis, Real del Monte, San Raphael, La Blanca, El Oro, Esperanza, and Dos Estrellas mills reminds one of the similar position in Kalgoorlie some years back, and cannot but make for great technical progress.

[9] *Mining and Scientific Press*, loc. cit.

[10] *Eng. & Min. Jour.*, June 17, 1911.

Iron Ore Movement on the Great Lakes in 1911

By George H. Cushing.

Approached from the standpoint of either ore of the raw materials—iron ore or coke—the steel business in the North and East for the past year has been quiet. Ore shipments considered above and showing a falling off of 10,000,000 tons, would very clearly measure the dullness in the steel trade, were it not for the fact that a great quantity of iron ore was held over in furnace stock piles and Lake docks from the season of 1910. To get a complete survey of the status of the steel trade, it is necessary to study the coke trade, and especially that of the Connellsville district, which still exercises a predominant influence over the blast-furnace business. The figures of coke production show an output of approximately 60% that of the preceding years, such as 1907. Lake iron-ore shipments, on the contrary, amounted to a little more than 75% of those of 1910, which were more than a million tons in excess of those of the big steel year of 1907. It being considered that coke consumption measures the extent of pig-iron manufacture and coke production, and this, for the last two years, not being in excess of 60% of the normal, it must be concluded that the furnace and dock companies have on hand both at the plants and at the Lake ports an enormous quantity of ore, or enough to keep them in operation, even though business should revive speedily, well along into next summer.

The Lake ore shipments, up to the close of navigation on November 30, 1911, totaled 32,130,411 tons. This compares with the record shipments by the Lakes of 42,620,201 tons in 1910, and shows a decrease from the maximum of 10,489,790. This was incidentally a decrease of 8,158,344 tons from the record made in the season of navigation of 1907. It marks, in fact, the smallest shipment, save one, of iron ore since 1904, which was the climax year of the 'rich man's panic,' started in 1903. In 1904, the Lake shipments amounted to 21,849,401 tons. The following year there was a gain of 12,000,000 tons, which took account of the revival of business following the 'rich man's panic.' There are some who believe that from the present outlook there is likely to be another such an increase in shipments in 1912 as a natural growth of business and reaction from the period of depression just now drawing to a close. A similar increase to that made in 1905 over 1904 is expected for 1912 over 1911. This would bring 1912 shipments up to the record total of 44,000,000 to 45,000,000 tons, and this has been and is being freely predicted. Mitigating against any such result, however, are both the accumulation on the Lake docks and furnace stock-piles as previously referred to.

The Lake shipments of iron ore, in fact, for the past four years have been lively, and this can only be accounted for on the basis that the iron trade has constantly been expecting a return of business prosperity which would warrant such enormous tonnages. That disappointment has followed consistently for the last three years is evident to every student of iron trade conditions, and the heavy movement of 1909 and 1910, taken with the shipments of this year, must leave a large accumulation in the hands of dock companies and users. Since no statistics are compiled showing ore on furnace stock-piles, this point can be made by conjecture only.

The shipments, as compiled by the *Iron Trade Review* for the past eight years, have been as follows:

Year.	Tons.
1904	21,849,401
1905	33,476,904
1906	37,513,595
1907	41,288,755
1908	25,427,094
1909	41,683,873
1910	42,620,201
1911	32,130,411

The statement of shipments by the various ports does not give as clear an idea of the quality of ore used and the purpose to which it has been put as was the case last year. The principal shipping ports and the amount moved from each for the past two years are as follows, figures being, as usual, in long tons:

Port.	1910.	1911.
Escanaba	4,959,869	4,278,445
Marquette	3,248,929	2,209,380
Ashland	4,093,822	2,429,290
Superior	8,437,261	9,920,490
Duluth	13,609,155	6,934,260
Two Harbors	8,271,165	6,367,537
	42,620,201	32,130,411

While it is known that the metallic content of the ore shipments has been steadily decreasing for the past few years, an analytical review of the trade has not been made or published. At this time it is only possible to make the rough calculation which is naturally suggested by the amounts moved through the various ports. The 'bessemer old range' ores are commonly supposed to be shipped mainly from Escanaba and Marquette, while the lower grade ores, such as those from the Mesabi range, come from the other ports mentioned. According to these statements, Escanaba lost but little of its tonnage, its shipments being less than three quarters of a million tons below those of 1910, while Marquette showed a decrease of about a million tons. On the other hand, the business of Ashland was almost cut in two, Superior made a gain of a million and one-half, while Duluth, her sister port, lost almost 7,000,000 tons. Two Harbors, which is well up toward the head of the Lakes, and which ships about the same grade of ore as Duluth and Superior, lost approximately 2,000,000 tons. Making a rough estimate, it would seem that the low-grade ores bore more than 80% of the total loss in business, this making its own suggestion as to the relative manufacture of bessemer and of open-hearth steel.

In connection with the Lake shipments a point is brought out clearly by trade peculiarities this year. It is no longer possible to judge with any accuracy the iron-ore situation by the activities of Lake boats. The time was, and not very long ago, when the carrying capacity was about equal to the Lake movement. In fact, at times the carrying capacity of Lake ships, and especially the dock facilities, determined what the Lake movement of ore might be. That time is definitely past until the end of a long reconstruction period. There has been, through accident and otherwise, a loss in the actual number of boats navigating the Lakes, but this is far more offset by the increase in the size of the carriers. The larger boats which are now navigating the Lakes are able, on the draught permitted by the interlake channels, to carry easily 15,000 tons of any bulk commodity. Almost all of the new ships which have been built in the last four years have had a carrying capacity in excess of 10,000 tons. This constant increase in the size of ships, taken with an increase in speed of dock equipment, has given the Lake carrying fleet such an enormous capacity that it is almost out of the question for any reasonable movement of iron ore and other Lake commodities to keep the total equipment constantly employed. Thus if anyone had attempted to judge what the iron-ore shipments were for the last season by computing the running time of the Lake fleet, he would have come to the conclusion that the movement had been more nearly 250,000,000 than 32,000,000 tons. The fact was, that the boats got a late start because there was no demand for iron ore. Then they ran in haphazard fashion for a good part of the summer and stopped the movement of ore for some companies as early as the latter part of October. At no time was there any rush of equipment, and at no time was

the business even fairly active. In fact, the middle of the summer brought the remarkable situation that these great carriers were coming down the Lake in ballast instead of with ore cargoes, for the purpose of carrying coal back to the head of the Lakes; a thing which, in my thirteen years' association with Lake commerce, I have never known to have happened before.

The carrying capacity of the great fleet now available for Lake commerce is best illustrated by the fact that with a halting movement, with speed at no time attempted, with the boats of the Steel Corporation, in a large measure, in ordinary for a fair share of the time, the equipment moved easily the 32,000,000 tons of iron ore, 25,000,000 tons of coal, and proportionate tonnages of grain, lumber, and package freight. It is needless to say that this evidence of overproduction of Lake equipment has had a decided influence upon the shipbuilding industry, and has practically brought an end to the construction of new ships except those of smaller size which must trade at small and imperfectly improved ports. This has had a certain influence upon the steel business, since each one of the big ships contains upward of 5000 tons of finished steel. Practically no orders have been taken for the delivery of new boats next spring, and the state of affairs can be understood when I say that I remember one year when 42 new steel ships were constructed. This, for one small industry, means a considerable loss in steel consumption, and accounts for some of the reaction in the steel trade.

Last spring it began to look as though the steel business was in for a slight upturn in demand. Beginning at the bottom, efforts were made to readjust prices in such a way as to bring the buyers back into the market. The factors which controlled the iron-ore movement from the head of the Lakes decided to bring about a horizontal reduction of 50c. per ton in the price of ore to the furnaces. In pig-iron circles the influence of merchant furnaces had already been exerted to bring the price of No. 2 foundry iron to an average of below $14 per ton in 'The Valleys.' Of course, this was not the minimum price, because the trade reports were teeming with suggestions that pig iron of this grade, to meet Southern competition, had gone as low as $12, or even below that. At the same time, there had been a radical reduction in the price of coke. In a good many instances, the manufactured product was not bringing much more than the price of coal; not enough, surely, to cover the actual cost of conversion into coke. It was believed that, with this readjustment in the prices of raw material it would be possible to scale down in the prices of finished steel so as to invite timid buyers back into the market and possibly start a renewal of activity that would be beneficial to the country.

It is always easy, in attempting to explain why a thing did not materialize according to plans, to lay the blame principally upon the most conspicuous factor and to disregard other important factors which may be basic in their nature and therefore governing, while the others are superficial and of a sentimental effect only. Thus it is the easy thing to say that, just when all plans were being made for a revival in business, the Standard Oil and the American Tobacco Co. decisions were handed down by the U. S. Supreme Court, upsetting confidence and working through sentimental channels to the destruction of the promised prosperity in trade. It is easy to follow from this to the assault upon the United States Steel Corporation by the Government's legal department, and to say that this completely destroyed the confidence which business men and financiers were beginning to feel in the situation. Coming on the heels of that, were the assaults upon the lumber companies and associations, and similar actions against other large industries which were accused of violating the Sherman anti-trust act. I would not contend that these were not important factors, because they were. It may be nothing more than a coincidence, and again it may be highly significant, that the plans for larger trade were either annulled or suspended instantly following the announcements of these actions. From a broader economic standpoint, it is necessary to take into consideration other factors, and to make this point was one reason for dwelling upon the size of Lake ships and for dwelling upon other phases of the Lake carrying trade. Through the force of competitive effort, the Nation has, for a matter of almost a decade, been struggling to obtain economy, and, in order to reach that goal, has been constantly increasing the size of the producing and transporting units of industry. Emphasis has already been placed upon the increased size of Lake ships and their influence. The railroads have moved in the same direction by increasing the size of both cars and engines to move the larger units of freight to market. The steel mills have increased the size and productive capacity of single trains of rolls in order to get out more steel with the same plant and men as were employed formerly. Particularly, the coal mines of the East have done exactly the same thing. The size of mines has grown from 1000 to 3000 tons of daily output through a single shaft. With big producing units and with big transportation units, and the high speed of loading and unloading equipment, and no other market than that supplied by home consumers, it has been absolutely impossible for the country to absorb all that has been produced. It can easily be realized by the business interests that it is practically impossible to continue the old scale of prices and costs, and certainly it is impossible to expect to market the output if producing units are further increased in size, except through unhoped expansion of foreign trade.

All this gives particular point to the discussion which has been going on for the past year, and principally for the past six months, of the effect of certain National statutes and the need for radical revision. The fact of the matter seems to be that the country has reached a period where reconstruction is necessary, and this is toning down the activities of the country, regardless of any action on the part of Mr. Taft's administration in enforcing laws which inveigh against trade crimes. At the time this is written there is quite a general feeling all through the East that an expansion in trade may be expected on the first of January. It is impossible to say what is the hope at root in this matter, but it is a known fact that the hope is there. A few indications may tell precisely what is anticipated. In the first place, despite the enormous accumulation of iron ore from the Lake Superior region, assurances are given that the output will be increased next year. There is a slight tightening up in the pig-iron situation, and prices are firmer on future delivery than they have been for the entire year, with the exception of a short time in June and July. Also, for the past two or three weeks, reports have been coming in that consumers of coke are ready to abandon the open-market policy which has prevailed heretofore and are now willing to place contracts at existing prices for deliveries of considerable quantities over the first quarter, and even through the first half, of 1912. One representative of a company which is a large factor in the steel business, made the statement recently that his orders and inquiries for January and February delivery are heavier for either month than have been the sales for October, November, and December combined. A report from the East says that some of the steel mills at Philadelphia and Baltimore are expecting to resume activity by the first or fifteenth of January. Statements from the South or from the Birmingham district indicate the same condition. Knowing the need for readjustment along the fundamental lines previously outlined, my own disposition is to take these optimistic statements with a certain degree of allowance. I do not want to contend that the economic conditions, such as were outlined, are always and surely ruling factors in ordinary merchandising, but I do contend that, whether recognized or not, their influence, within certain limits, is powerful. It may be that certain constructive legislation at Washington this year will permit a gradual toning down of the great stress of competitive action and thus eliminate the need for a radical readjustment such as has been indicated. It is almost sure that some constructive legislation would have a large sentimental influence, at least upon the business situation, which now definitely needs some encouragement.

Gold-Dredging Industry on Seward Peninsula

By T. M. Gibson

Such figures as I shall quote in this article are obtained in part directly from the management of the companies discussed, and in part from other sources, but I believe them to be close approximations to the truth. Solomon river is the oldest, and at present the most important, dredging district on Seward peninsula. Seven dredges have operated in this area this season and all have made satisfactory showings, while some have had quite phenomenal success.

The Three Friends dredge, now in its seventh season, was the first modern dredge installed on Seward peninsula. It has a 5-ft. close connected bucket-line, and when running in gravel of a suitable depth has been able to maintain an average of 3300 cu. yd. per day for many consecutive days.

MINING LOCALITIES ON SEWARD PENINSULA.

It is a steam-driven machine and burns coal. Its power costs are perhaps the highest of all the dredges on the peninsula. It is equipped with simple slide-valve engines, exhausting into the open air, and its fuel consumption has been from 12 to 15 tons of coal per day. For many years coal cost about $21 per ton at the dredge. I am informed that the price this year is $19 per ton. It was the intention of the management to install a hydro-electric plant at the foot of Salmon lake, fifty miles distant, the year following the installation of the dredge, and thereafter run the dredge with electric power, but litigation over water rights, and other causes, prevented this plan from being carried out.

Last winter the Three Friends company sold this dredge, and a large tract of ground on lower Solomon river, to John A. Webb, who later transferred it to the Seward Dredging Co., an organization promoted by Mr. Webb and Otto Halla, both of Nome. This company was financed in the East, chiefly at Boston, and is a merger of the Nome Mining Trust and the Three Friends Mining Co. into one concern. It appears from the deed filed for record here, transferring the Three Friends Mining Co. holdings from Mr. Webb to the Seward Dredging Co., that the consideration paid for the property was $200,000, and the last payment must be made on or before January 1, 1912.

Mr. Halla informs me that the dredge has handled 200,000 cu. yd. so far this season, and that the cost, including amortization and winter care, is 18c. per cubic yard. He also said the gold content in his section of Solomon river is between 40 and 50c. per cubic yard. Mr. Halla will remain here this winter and will continue to operate the dredge as long as the weather conditions will permit. He says the company will probably build an electric plant near the mouth of Solomon river, early next season. This plant will cost about $85,000 and will generate 1000 hp. It will burn crude oil, and it is hoped thus to reduce the cost of handling gravel to 13c. per cubic yard. The depth of the gravel worked this season is about 7 ft. and the profitable area 600 to 800 ft. in width.

The Nome-Montana-New Mexico Co., operating a 5-ft. open-connected Risdon dredge on Solomon river, near the mouth of Shovel creek, has had a very successful season. This dredge is now in its fourth season and has been a money maker from the start. But heavy investments in a ditch scheme, with other complications, involved the company in considerable financial difficulty at the beginning of this season. J. P. Pearson was succeeded in the management by Dr. Ramsey, and a heavy indebtedness was wiped out by the end of the first month's run. The dredge now has about $100,000 to its credit for this season. This boat is steam-driven, but, unlike the Three Friends, it has compound condensing engines and water-tube boilers, and consumes about one-half as much coal. Its actual operating costs do not exceed 12c. per cubic yard, but as there was only five years of work ahead of the dredge when it started the amortization charges are necessarily high.

Charles Kimball installed a 2½-ft. open-connected dredge, known as the sluice-box type, on Shovel creek this season. Shovel creek is a tributary of Solomon river, flowing in from the west side. It is well suited to a dredge of this type. The gravel is loose and free from clay, and is moderately coarse, though containing but few boulders of large size. The gold is coarse and easily saved. The gravel averages about 85c. per cubic yard. Mr. Kimball's dredge has neither screen, tailing-stacker, nor tables. The buckets dump on a grizzly, which cuts out the largest boulders and dumps them over the side, while the undersize drops into an ordinary sluice, which runs the length of the boat and projects about 20 ft. beyond the stern. It is driven by gas-engines and the sluice water is supplied by a 10-in. centrifugal pump.

The total cost of the dredge, when ready to run, was about $18,000. It was landed on the ground early in July; was built and ready to operate by the middle of August, and has handled an average of 800 yd. per day for about 70 days. It has paid its expenses, its initial cost, and has a snug profit besides. Mr. Kimball has enough ground to keep it working six or seven years. In an article published in the *Mining and Scientific Press* last fall I emphasized the profitable nature of this class of investment on Seward peninsula, and while this area may be classed as among the very best, there are other good ones awaiting the enterprising dredge man of small means.

The Sivertsen & Johnson 2½-ft. Risdon dredge, built last year on Solomon river, made a rather poor beginning this season, but in the latter half of the season has been doing well. It worked through a shallow area having low gold content, but later reached good ground and will make a very creditable showing.

The Flodin Dredging Co., operating a Risdon dredge near the mouth of Big Hurrah creek, has had a very successful season. Mr. Flodin, the president and manager, has informed me that they have handled 130,000 cu. yd. this season, at actual digging cost of 11c. per yard. His repair bills have been pretty heavy this season, and these, with winter care and amortization, make his total charges considerably higher, though he was not prepared to say exactly what they are. He stated, however, that more than 50% of his gross output is net profit. His dredge has a 2½-ft. bucket-line and is steam-driven. The fuel used is coal, which costs $20.50 per ton at the dredge. He has had a 130-day run this season, and closed October 28.

The Solomon Dredging Co., operating a 3½-ft. Bucyrus dredge near East Fork, on Solomon river, has had a splendid season. It handled approximately 160,000 cu. yd., and cleaned up about 70c. per yard from rim to rim of the river bed, which is about 300 ft. wide in this area. This company was promoted by Frank Reed, of Nome, in the winter of 1909-10. Some of the stock was taken by local people, but the majority is held in California. Henry Malloch, a California mining man, is the president and controlling stockholder. The dredge cost $75,000, and the eight claims secured by Mr. Reed upon which to place the dredge cost $16,000. The company has issued $100,000 of its capital stock. The operating expense for this season is about $30,000, and they have taken out about $102,000 with a $100,000 investment. This dredge was built last summer, and owing to delays in the delivery of machinery it was not completed until the freeze-up set in. Mr. Reed, who was then manager, started in and ran long enough to try it out, and then laid it up for the winter. At the annual meeting of the stockholders, Mr. Reed was retired from the management, and a brother of Mr. Malloch was elected in his stead, and the dredge has been run by him this season. The dredge was equipped to burn crude oil, but for some reason coal has been used. Coal costs $16.50 per ton landed at the coast, and $6 per ton for a 12-mile haul on the Solomon River railroad, thus making it cost $22.50 per ton at the dredge. Oil costs $2 per barrel at the coast and $10 per ton railway freight. Since 3½ bbl of oil is equivalent in fuel value to 1 ton of coal, there would be a saving of $5.50 per ton in the use of oil. The dredge was stopped for the season on October 19. The company has acreage enough ahead of the dredge to keep it digging four more seasons, and then it will reach a block of ground, consisting of 21 claims and covering about five miles of the river bed, which was lately purchased by the Pioneer Mining Co. for $79,000, of which $15,800 was cash and the remainder to be paid October 15, 1912.

The Wild Goose dredge, on upper Ophir creek in the Council district, leads all the dredges on Seward peninsula both in yardage and in value of output for this season. This is a 3½-ft. dredge of California type and was built by the Yuba Construction Co. It was installed last season, and was run about 10 days to try it out just before the freeze-up. Its power is supplied by a Standard gas-engine of 125 hp., which drives all machinery except the light plant, which has a separate engine of 6 hp. The dredge has now been running four months and will continue to run as long as the weather will permit. F. M. Ayre, general manager for the Wild Goose Mining & Trading Co., estimates the operating costs at 12c. per cubic yard for this season, but thinks it will be reduced to 10c. next season. Gilbert Russel has been in charge this season. This dredge used an average of 300 gal. of distillate per day, which cost 6c. per gal. in San Francisco; the combined ocean and river freight and wagon haul up Ophir creek to the dredge adds 17c. per gallon, making 23c. per gallon, corresponding to a total of $73.60 per day for fuel. The dredge has handled an average of 2000 cu. yd. per day, and has had some phenomenally rich ground. As much as $25,000 has been cleaned up for an eight-day run. It is not all as good as this, however, but the average has been above $1000 per day for 120 days, so far this season. The first cost of the dredge was about $80,000, a large part being freight.

The Blue Goose company's dredge on lower Ophir has had a much better season this year than last. It has worked through a portion of claim No. 3½, all of the Humbug Fraction, and a portion of No. 4 which the company holds under lease from the Wild Goose company. This is the oldest dredge on Seward peninsula now in operation. It was built by I. B. Hammond of Portland, Oregon, for Hernando De Soto, and installed on the Niukluk river just below Council City, in 1904. Hernando De Soto was unable to make it pay, and it passed into the hands of a receiver appointed by the court and by him sold to a company organized by local people, and called the Blue Goose Dredging Co. This company floated it up the river to a point opposite the foot of the valley of Ophir creek and worked across the intervening flats to Ophir creek, where it has worked successfully for the past five years. It has a 5-ft. open-connected bucket-line, shaking-screen, and belt-stacker. Almost every part of the machinery has been renewed, some of it several times, so that today, although it is old-fashioned in many respects, it is a staunch and strong dredge. It handles about 1000 cu. yd. per day, has about $80,000 gross output to its credit this season, and is still running at this writing. It is a steam dredge and burns wood. This is laid down at the dredge for $10 per cord. I have been unable to get figures as to the cost per yard for this season's run.

The Alaska Dredging Co., having one dredge on Gold Bottom creek and one on Warm creek, is reported by Jerry Wilson, the promoter and one of the heaviest stockholders of this company, to have had an excellent season. These are both 2½-ft. gas-driven dredges, and Mr. Wilson says they have averaged 1000 cu. yd. per day and the digging costs were 10c. per yard. It is said they are digging in ground that runs from 30 to 50c. per cubic yard, so it is evident they have made a profit.

The Kimball & Saupie sluice-box dredge, on Melsing creek, is reported to have kept up the high standard of work set last year, and the results of the season's work are highly satisfactory. This is a low-cost gas-driven dredge and is the type after which Charles Kimball's dredge on Shovel creek was made. On shallow creek bottoms having loose gravel and coarse heavy gold they are to be strongly commended, though they do not look as 'classy' as some of the other types.

Charles Lubby has installed a 2½ ft. dredge on Mystery creek, in Council district, this season. It was built by the Union Iron Works of San Francisco, and is said to have been built from the same patterns as the dredges of the Sioux Alaska and Arctic Gold Dredging Co., which were designed by W. W. Johnson and installed in the Nome district last year. I have not visited this dredge, but if it is like the two mentioned, its bucket line, trommel, and stacker are driven by a 50-hp. Standard gas engine and its pump is driven by a 35-hp. Western gas engine. It uses 150 gal. of distillate per day, has a crew of nine men, and its actual operating costs are about 10c. per cubic yard. This dredge was completed in August and has been running about 70 days. I am told it has handled about 1000 cu. yd. per day and that its owners are well pleased with the showing.

The Beardsley dredge, on Willow creek in Casa river district, has not been very successful this season, I am told, as compared with most other dredges on the peninsula, although Mr. Beardsley says his disappointment lies not so much in the returns upon the investment, which have been fairly remunerative, but in his failure to realize the immense profits that he anticipated when he went into the enterprise. He stopped work early in October, as Willow creek does not furnish water for flotation after the first frosty weather sets in.

In the Nome district the dredges have had a busy season and have met with a fair degree of success in most cases. The Plien Mining & Dredging Co., having a 3½-ft. Risdon dredge on Otter creek, has had a satisfactory season. For several reasons the yardage was much less than the theoretical capacity of the dredge, but Mr. Plien tells me that the ground is good enough to make up for the low capacity. The dredge has only averaged about 1000 cu. yd. per day, and it is rated at 2000 yd. The low efficiency is due in part to a high percentage of heavy sand in the material, making it difficult to wash, and in part to an insufficient amount of sluice water. This is, perhaps, the weakest point in every dredge on the peninsula. Nearly every one of them can dig more material that it can wash, and the chief reason why they cannot wash more gravel is because their pumps do not give them sufficient water. Larger pumps should be installed with a given sized bucket than has been the practice. Possibly if the perforations in the spray-pipe were made larger, thus reducing the back pressure on the pumps, the difficulty might be overcome. There is no cemented gravel to be disintegrated by the action of the screen and spray, and I notice that wherever a dredge strikes a bed of clay, it passes through the screen and out over the stacker in balls a foot or more in diameter, just as if no spray were played upon it, so it seems probable that enlarging the perforations and reducing the pressure would increase the flow of water from a given sized pump and thereby increase the efficiency of the sluicing tables.

There are some spots of permanently frozen ground in the area being dredged by Mr. Plien, and he has found it necessary to cut through some of them. He has had a unique experience in thawing some of this ground with steam points, and at a lower cost than has generally been thought possible. His gravel deposit is from 10 to 12 ft. thick and overlain by 1 to 2 ft. of muck and sod—an ideal deposit to thaw. If it were much deeper, the points would have to be too long and cumbersome to handle, and it is not likely that they could be kept vertical in penetrating the gravel, and if much shallower the yardage would probably be too small to pay to work unless it were especially rich. Mr. Plien mounted a 35-hp. boiler on heavy skids and covered it with light housing. This boiler supplied steam to a battery of 18 points. Crude oil was used for fuel, and the consumption was 300 gal. per day. The points were 12 ft. long and were set 6 ft. apart in a line covering about 100 ft. The next line was 6 ft. back, and the points were set so that each was midway between the points in the line in front. Steaming was continued for 20 hours. It was found that this overthawed the space between points, so it was widened to 7 ft. and the lines of holes made 7 ft. apart. Repeated tests show that this is the correct distance for most economical work. To set the points requires two men and consumes about two hours time. The roustabout from the dredge aids the point man in this work, and then goes back to his regular duties. There is one point man on the day shift and one on the night shift, and each works 12 hours. Crude oil costs $2.85 per barrel, delivered. The plant is moved ahead from time to time by means of a long cable passing through a sheave anchored ahead. By this system Mr. Plien thawed 20,000 cu. yd. at a total cost of $2000, or 10c. per cubic yard. These figures allow for wear on points, hose, and other equipment, and for use of the boiler, but do not cover the whole cost of this equipment. This work has demonstrated the feasibility of working shallow frozen deposits, which are conveniently situated, at a total working cost of 22½c. per cubic yard. Mr. Plien tells me his operating costs are $125 per day, or 12½c. per yard on 1000 cu. yd. daily average.

ON THE BEACH OF NOME IN WINTER.

It must not be understood that these figures apply to all depths of frozen ground, nor to all localities where gold may be found in permanently frozen ground. With greater depth of ground it becomes increasingly difficult to penetrate it with points. It is impossible to control the direc-

tion of a long slender point in ground containing coarse material, and a limit is soon reached below which it is economically impossible to thaw by any known method. Nor would Mr. Plien's figures apply to interior points, where the cost of fuel is prohibitive. Mr. Plien tells me that this season's run has enabled him to pay off obligations of the company amounting to $20,000, and, in addition to this, a substantial dividend to the stockholders. This is certainly a satisfactory result.

The Saunders Dredging Co., which was organized here last year to take over the machinery for a dredge which had been shipped here for the Gold Beach Dredging Co., and which was held for freight and certain charges which the company were unable to meet has, at last, after overcoming many obstacles, completed the construction of its boat and launched it on what is hoped will prove a long and successful life. It was thought by A. Anderson, the manager for the Saunders Dredging Co. when this plant was taken over, that he was getting a high-class Bucyrus dredge, and he was much chagrined to find, after the dredge was delivered at the ground upon which it was to operate, that the only parts the Bucyrus company had built were the bucket-line, tumblers, and driving gear, and the balance of the machinery had been bought from various houses and selected by a man who had but little knowledge of the requirements, and therefore, as might have been expected, the machinery, other than the Bucyrus equipment, was little else than an aggregation of misfits and unbalanced parts. Many thousands of dollars had to be spent in the purchase of new machinery and in making changes in the first lot. The machinery was landed on the ground about the middle of last summer, and it was not until the middle of this summer that it began to run, although every effort was made to hurry the work along. The dredge has now closed for the season, after 45 days of running, and Mr. Anderson is going outside to purchase additional material. He says after the contemplated changes are made he will have as good a dredge of its size as any in the country. None of his winch friction clutches worked satisfactorily, and his main-drive winch friction would not work at all. If he wanted to stop his bucket-line it was necessary to stop the engine driving it. Fortunately he is digging to a false bottom of marine sand and there are no large boulders in the deposit, so that this was not so dangerous as it might otherwise have been. Mr. Anderson will buy new friction clutches of a different make. The shaft in his winch-drums were too small and all were broken as soon as put under strain. He had larger shafts turned, and the drums re-bored in a local machine ship, but this has weakened the stock in the hub of the drums so that he will replace them next season with new ones. His stacker ladder is 36 ft. long and he will lengthen it 10 ft. next spring. He has already lengthened his digging ladder by inserting a 9-ft. section. In the 45 days he ran, he handled about 60,000 cu. yd. He has Metz & Weiss gas-engines and burns 200 gal. of distillate per day. By investing $1600 in 200 oil-drums, he is able to lay his oil down at the boat for about 14c. per gallon. He figures his actual digging cost at about 10c. per cubic yard.

The Arctic Gold Dredging Co., running a 2½-ft. gas-driven dredge on Grass creek, has run all summer without a hitch or stop. This dredge was designed by W. W. Johnson and built by the Union Construction Co. in San Francisco. It was installed last season and has had a remarkably successful record as a digger up to the present time. The bucket-line, trommel, and conveyor are driven by a 50-hp. Standard gas-engine, and the pump is driven by a 35-hp. Western engine. Mr. Middaugh, the manager, tells me that he has handled about 150,000 cu. yd. this season, digging 130 days. The dredge burns 150 gal. of distillate per day and the total operating expense is $105 per day. No time has been lost on account of repairs this season, and the repair bills are practically nothing. Mr. Middaugh says he has the best little dredge in the North, but is sorry he did not put it on richer ground. There is still a long stretch of the Grass valley ahead of him, and he hopes to find the ground better as he goes up the creek.

The Sioux Alaska Dredging Co., having a sister boat to the Grass creek boat, and operating on Moss gulch, has had plenty of trouble this year, working down grade in a gulch that has a 9% gradient. The dredge worked upstream last year, and Mr. Murray, the manager, thought his worst troubles would be over when he reached the upper limit and turned to come back, but in this he was much disappointed. He has found it necessary to build dams about 100 ft. in advance of the dredge and to raise the water-level 5 to 7 ft. in order to get flotation. These dams were made of timber, and about 10,000 ft. of lumber was required for a dam. While digging to one dam he would be building another, and having reached the first one, he would allow the water to escape into the next dam, and then remove the first. His dredge has been aground repeatedly, but he has managed to get down the gulch 800 or 900 ft., and is now in flatter ground, and his "winter of discontent" has been "made glorious summer" by striking some phenomenally rich ground that makes up for his lost time.

The Gold Beach dredge, which was built two years ago on lower Dry creek, in an area almost all of which is permanently frozen, was dismantled last winter and hauled 12 miles to Osborn creek, and was there rebuilt early this summer. It has a 5-ft. open-connected bucket-line and is steam-driven. Its fuel is crude oil, of which it burns 30 bbl. per day. The moving of this dredge 12 miles across country, over the snow-covered hills and valleys, was no small matter. The total weight of the dredge is about 300 tons. It was moved by the C. L. Morris Transfer Co., under contract. The dredge company had to dismantle and rebuild it.

After the machinery was removed, the caps were taken from the gantries and the hull was sawed into two equal parts, from the well to the stern. These hull sections were the most difficult to haul. They were jacked up and placed on two sets of heavy round timber skids, fore and aft, and the skids were firmly chained together. A section weighed 55 tons and was drawn by 66 head of horses. The whole thing was successfully landed on Osborn, and the two parts of the hull were brought together and firmly bolted by a series of rods running clear across the boat. The joint was heavily reinforced with timber, and it is claimed that the hull is as strong and rigid as ever. The machinery was replaced and the dredge was ready to work when the season opened. It has not been smooth sailing, however, as unexpected difficulties have been met. The ground contains many large boulders, which are difficult to handle. The dredge was started in an area that had already been worked over, and it was found that a much larger proportion of the gold had been mined than had been supposed. The dredge ran behind, and creditors finally became so insistent that the company turned it over to a group of creditors, headed by Joe Montgomery of the C. L. Morris Transfer Co., under whose management the boat is now operating. It has worked its way out of the old tailing piles and is now in good ground. Mr. Montgomery tells me that a further three weeks' run will pay all indebtedness, and the dredge will be handed back to the company, which may yet realize a profit on what has been a very badly managed enterprise.

A new dredge was installed on Osborn creek this season by the Julien Dredging Co., of which V. A. Julien is president and manager. This dredge has a 3-ft. open-connected bucket-line, revolving screen, and belt-stacker. A 50-hp. Standard gas-engine drives the bucket-line, screen, and stacker, and a 30-hp. Standard engine drives the pump. There is also a 6-hp. engine that runs the electric-light plant. These engines use 160 gal. of distillate per day. This boat was designed by W. W. Johnson and H. G. Peake, of the Union Construction Co., and was erected under the personal supervision of Mr. Johnson. The dredge construction began on June, and was completed and ready to run July 21. It has now run 100 days and has handled an average of 1000 cu. yd. per day, or a total of 100,000 cu. yd. this season. This dredge cost $43,700 when complete and ready to run.

Mining Conditions in the South of Spain

By Henry F. Collins

At the urgent request of a valued friend I have been induced to write this article, of a type that I dislike. When produced spontaneously, such articles are usually written by comparatively green graduates on the strength of two or three years' residence in a foreign country, often confined to a single district, in the course of which period they have associated as much as possible with their own countrymen and as little as possible with the natives of that in which they are temporarily resident, whose language they have not troubled to master, and whom, consciously or unconsciously, they despise as beings of an inferior order. The more intimate is one's knowledge of a country, the greater the diffidence felt in generalizing about it.

One predominating feature in the conditions is the fact that, compared with the mining regions of Spanish America and many of those in the United States itself, Spain is a highly civilized country. I do not mean 'civilized' in the sense that every adult or even every child enjoys the blessing of being able to read, say, the Sunday edition of the *New York Herald*, for the proportion of illiterate is still, alas, high; nor that all important towns enjoy the benefits of railroad communication, for in old countries towns came ages before railroads, and not afterward. I merely wish to recall the fact that Spain was the most civilized country in the world centuries before those twin pioneers, the 'shooting-iron' and the whisky-bottle, overran the Wild West, and long before the Pilgrim Fathers were, through an obstinate narrow-mindedness at least as great as their own, driven forth to seek a New England across the Atlantic. Since that date and up to the present Spain has assimilated most of the manifestations of modern progress.

Civilization, of course, has its drawbacks as well as its advantages. It is not possible, for instance, in Spain, as it is in many parts of Spanish America (or was a very few years ago), when the stock of ore in the bins is running low, to lay by the heels on Saturday night in the company's lock-up a gang of trammers in order to have them ready fresh and sober on Sunday morning, and so prevent a stoppage of mill or smelter; nor is it always possible to get one's own foreman or clerk appointed Justice of the Peace or Police Commissary. It is not even possible, as in some more favored countries, for the mere possessor of unlimited cash without any political influence, properly so-called, to buy outright a Board of Supervisors, or of Aldermen, or a State Senate. On the other side of the account must be set the fact of comparatively good communications, there being a large number of State-owned macadamized roads for wheeled traffic, uniting important towns and villages even in districts not served by railroads. It is always possible, moreover, even in such remote districts, to contract locally for supplies of every variety, timber and other materials of construction, as well as for all kinds of surface work, excavation, and grading, and it is easy to get (at comparatively low wages) skilled artisans of all kinds who are always ready to feed themselves, even if it be necessary in uninhabited regions to house them and start a store. It is therefore never necessary—as in many parts of Central and even of North America—to commence operations by importing at heavy expense skilled workmen with every kind of material required for building houses for them, to put up boarding-houses, and in some cases to import beasts of burden to handle the company's traffic over the newly built road to the mines, and even the very fodder for these to eat, or to erect saw-mills and lime and brick-kilns; such pioneer work having been done centuries ago.

Spain counts for little at present in the progress of nations, and there is nothing brilliant in her immediate future; but she has at least a great and glorious past; its heritage still overshadows the land, and its traditions still mold, not indeed the everyday life of the people, for that is dependent upon their present necessities, but their instincts, their deportment, and to a great extent their mode of thought, and their resultant actions. Do a Spaniard an injury or put an affront upon him, and he will move heaven and earth to wipe out that affront or to repay with compound interest that injury, if it should take him ten years. Do him a trifling favor and he is yours to command, never satisfied until he has found opportunities of repaying your favor ten times over. Everything that is good in the country, including this exaggerated conception of personal honor, has been handed down from a remote past; with the exception of indolence, ingrained in the race, practically all the evil is of comparatively modern growth, and the socialistic and revolutionary propaganda so much in evidence lately, is purely exotic, having its origin across the Pyrenees.

So long as the feudal system remained a living reality, Spain was a prosperous and a progressive country; it was only when all power became centralized in a corrupt court under the control of ecclesiastical dignitaries, and the close feudal relationship between the great nobility and their dependents degenerated into absentee landlordism (the curse of Spain today as it is of Ireland) that stagnation began, owing to the withdrawal from the rural districts of the element which stood at once for capital, intelligence, and initiative. After the departure of those who should be the natural leaders and rulers in the rural districts, there ensued the development of the present political system, under which local middle-class busybodies and third-rate professional politicians become the agents and henchmen of the party that happens to be in power in Madrid, and control not only the elections, but also the appointment of local authorities, judicial as well as administrative, with the result that exceptionally good codes of laws and bodies of regulations are administered capriciously, the principle of equality before the law being often set aside in favor of private interests, and still more often in favor of political influence.

This does not apply as regards the administration of regulations affecting the mining industry by officials directly responsible to the central Government. The regulations themselves indeed often appear to be vexatious in the complexity of detail which they prescribe, and but little discretionary power is vested in the officials who have to carry them out, but the latter are as a rule reasonable and obliging (more so, in fact, than those of some other countries that might be mentioned) and if treated with due courtesy will invariably be found willing to concede all the facilities possible, and to exercise their discretion in such fashion as to cause the minimum amount of inconvenience.

More especially is this the case as regards the corps of mining engineers, whose duties comprise not only the inspection of mines but all matters concerning the survey and granting of mining concessions and subsequent modification of the grants, questions affecting conflicting rights under different concessions, and the investigation of all cases in which the interests of the mining industry appear to clash with rights of individuals, of corporations, or of the State. For, as in all Spanish America, where mining laws were based on the Spanish law and have followed pretty closely successive changes in the latter, minerals (with certain specified exceptions reserved to the owner of the soil) belong to the State, by whom concession of the right to work them is granted upon definite conditions, chief among which is regular payment of the annual rent.

In the execution of their duties the official mining engineers are hampered by detailed regulations, which, as usually happens with Government regulations in all countries, have been drawn up by officials who are not always in touch with the practical working conditions under which

the industry is carried on. However, as a body, they are cultured, well intentioned, and conspicuously honorable, and within the limits imposed upon them by official red-tape they do their best to oil the wheels and to enforce the law with as little hindrance as possible to the mining companies.

Labor Conditions.—The Spanish workman is, as a rule, sober, steady, and industrious, if under proper supervision; frugal, partly from necessity, he is almost always cheerful, generous to a fault, and improvident in the extreme. His efficiency, under proper control and supervision, is high, and, considering his poor feeding, surprisingly so. Per unit of wages earned, the Spanish miner does more work than any other in existence, save perhaps the Piedmontese and the Hungarian; for his wages are low, the standard rate of day's pay throughout the south of Spain being about 3.5 *pesetas* (say 64c.) per day. This, of course, is only the nominal rate, for practically all are on contract, and the average wage earned is about 85c., out of which each man has to find his own illuminant, either olive oil or acetylene. Laborers at surface earn 45 to 50c.; underground trammers, etc., 55 to 70, or 75c. on contract. At such prices it is not surprising that these efficient workers operate, for instance, in the Spanish pyritic mines, at a cost which under equal conditions as to hardness of ore, complete extraction without loss, and complete filling of excavations, would be utterly impossible in America. The American miner, whether native-born or of foreign nationality, although doubtless somewhat more efficient, man for man, than the smaller and less well nourished Spaniard, is by no means sufficiently better to offset the much higher wages paid in America.

The Spanish miner in the south does not keep nearly as many feast-days as are observed by other classes of workers, particularly in the towns; being sober, he misses fewer Mondays than do most miners in northern climes; moreover, he is always ready to work on Sundays or to do over-time when required at the ordinary rate of pay. So long as he is treated with scrupulous fairness by chiefs whom he can respect for their strict justice and good example, he does not mind being handled firmly; in fact, like the school-boy he appreciates the firm hand when sufficiently discriminating, his unconscious ideal of good government approximating to the paternal or patriarchal. What he most dislikes is to be treated as a mere unit or as "one of the hands" by an unsympathetic superior who not only does not know his name or anything about him, but does not care to find out. This partly explains the undoubted fact that the smaller concerns, in which there is more direct intercourse between individual workers and their chiefs, are able, other things being equal, to get more work done, man for man, than the large companies, even while paying the same wages. Unionism, already a great evil in the north and east, has made no progress in the south, where the more capable of the workers fully recognize that their own exertions will suffice to bring them to the top and keep them there, and do not see why they should be 'levelled down' to the standard set by the less capable. In the north and east of Spain conditions are unfortunately different, partly owing to influences from across the Pyrenees that have been at work for a long while, and possibly also to less consideration for their work-people as individuals on the part of the large companies doing business there.

Methods of Working.—Timber being scarce and dear, and it being considered in Europe inadmissible to leave behind in a mine ore upon which there is even a small margin over the cost of extraction and treatment, it is necessary in the case of almost all lodes and orebodies to employ a system of complete extraction of the ore-shoot with filling of the excavation, except in districts like Linares where comparatively narrow and almost vertical lodes cut through hard granite with good solid walls, in which case filling of the excavations is to a great extent unnecessary, such portions of the lodes as are too poor for removal affording the required support. In a few cases where the lode or pay-streak is narrow and the ore rich, it is worked by 'stripping' or 'resueing', one of the walls being first blasted down and waste material thus obtained sufficient to fill the excavation. In the case of wide lodes and masses, like those of iron ore and the pyritic deposits of the provinces of Huelva and Seville, filling has, of course, to be brought in from outside. Even if the cost of timber did not prohibit the use of square sets, that method would be considered barbarous, as indeed it is. Caving methods do not appear to be applicable when it is essential that the ore should be taken out completely without loss, and without any admixture with waste, even 1% of which mixed with the ore would have a serious effect upon the selling value; moreover, the danger of premature leaching, and the still more serious danger of spontaneous ignition through the heat generated by crushing, are insuperable objections to caving methods as applied to cupriferous pyrite. Complete extraction and filling therefore is the only practicable method under the conditions.

Up to widths of 30 to 40 ft. pyritic lodes are generally mined in successive horizontal cuts 2 metres high and the full width of the lode, the filling being kept some way behind or close up, according as the ore stands well or the reverse. With wider lodes, say, 40 to 75 ft., the method is varied, and often alternate blocks on each temporary level are taken out transversely from the foot-wall across to the hanging, and filled before attacking the intermediate blocks. In short wide orebodies a cut is sometimes taken out from the foot-wall side half-way across for nearly the full length, and filled; a temporary level being established down the middle, the remainder of the cut is then taken out in alternate blocks, each block being cut out first along the hanging wall from the cross-cuts and thence backward to the central temporary level, followed by the filling put in through the same cross-cuts. In one case, of a long and wide orebody, a central tramming level is established upon each floor and from it the ore is taken out right and left in alternate blocks to hanging and foot-walls respectively. These blocks being filled, the alternate ones are attacked and when the whole is cut out, over a height of 2 to 2½ metres, a working level is established on the filling, parallel to the tramming level and one set to either side of it. The next cut is taken out in similar fashion.

The most satisfactory way of mining pyritic masses that are both long and very wide (150 to 450 ft.) has still to be determined. The system of cutting out vertical sections right across from wall to wall on several floors successively, the empty space being filled, with strong masonry walls to support the filling, has been tried and found wanting. No ordinary masonry is capable of sustaining the enormous pressure over such a width; moreover, the localized pressure and movement are often so great as to give rise to spontaneous combustion of the pyrite. At one well known mine where hitherto the work has been done by open-cuts, and where the problem of working by underground mining a mass of ore from 200 to 400 ft. wide is only just being attacked, the method adopted is to take out first only a section along the centre, 75 ft. wide, by means of successive continuous horizontal cuts running the full width and followed by filling in the ordinary fashion, as if the orebody were only 75 ft. wide, the idea being that after some years the filling in the central section will become sufficiently consolidated to permit extracting the remaining side sections by means of transverse horizontal cuts, removal of the foot-wall section presumably preceding that of the hanging-wall part.

The upper zone of all the wide pyritic masses that outcrop or approach the surface is removed by quarrying, the cost of removing the overburden to uncover the ore averaging from 3 to 17 *pesetas* per cubic metre of rock in place, according as it consists of soft easily broken slate or of hard solid 'porphyry' or other igneous rocks. The point at which it ceases to be profitable to remove overburden in order to quarry the ore varies with a number of factors, but in general terms it may be said that provided the rock to be removed does not amount to more than 1 to 2 cubic metres per ton of ore rendered available, it is always worth while to strip, since the resulting

amortization charge of 3 to 5 *pesetas* per ton for removal of overburden is less than the extra cost of breaking underground as against breaking in the open, plus the cost of filling. In special cases it may be worth while to remove even as much as 2½ to 3 cubic metres of solid rock per ton of ore uncovered, but that is about the limit, unless it is a case of getting at ore that has been robbed or partly worked by the old system of pillars, the cost of getting which by any system of underground mining would be much greater than in the case of a virgin lode.

Fiscal Exactions.—The financial contributions levied upon the mining industry are extremely onerous. A producing mine, in addition to general stamps and other duties and taxation paid by everybody, has to pay the following taxes:

(1) Surface claim tax on the area covered by its mining claims, amounting to 6 *pesetas* per hectare in the case of iron and 15 *pesetas* per hectare in the case of other metals.

(2) Land tax on any freehold land.

(3) House tax on all or any buildings.

(4) Industrial tax on each of its workshops separately, namely, carpenters, blacksmiths, etc., etc. In the case of a company owning a workshop with machine-tools driven by steam or other power, assessment may be made, as in the case of a factory, on spare parts of machinery. The tax then levied is heavy, being at the rate of 200 *pesetas* per year per horse-power of the motor installed for driving purposes, whether or not that power be fully occupied. Fortunately there is no uniformity of assessment, and workshops are not always taxed under this head.

(5) Income tax at 10% in some cases and 5% in others on all salaries of employees. These amounts may be collected from the employees if the company so chooses, but in the case of most foreign companies it is not customary to do so. In any case the company is responsible for payment direct, whether it collects or not. This tax is levied not only on employees resident in the country, but on the salaries and fees paid to directors, auditors, consulting engineers, and other head-office employees; in fact, on all who draw fees or bonuses of any description from the company, wherever they may be employed.

(6) Profits tax at the rate of 2% upon the amount of all dividends declared.

(7) Tax on capital. This tax, logically quite indefensible, is levied at the rate of one mil on the total nominal capital of the company, *or* upon the total estimated value of its property and assets of every description, as determined by a special investigation conducted by the Government officials *ad hoc, whichever gives the highest figure!* The object being merely to squeeze out as much revenue as possible, regardless of equity and logic. If one company has a large watered nominal capital, they charge on that, and if the assets of another company are worth far more than its nominal capital, so that the shares stand at a high premium, they charge on their valuation of the assets.

(8) Transport tax. 5% upon the amounts paid for transport of all products by rail, in addition to another 5% collected by the Government direct from the railway company; this the latter adds to every way-bill, thus making in all 10%, which the producer pays the Government over and above whatever is charged by the railway for moving his ores and supplies.

(9) Export tax. This is levied on most kinds of ores and metallurgical products, some of the principal items scheduled being the following:

Description.	*Pesetas* per ton.
Iron ores	0.25
Pyrite with less than 2½% copper	0.25
Ores with more than 2½% copper	1.60
Ores of manganese	0.50
Ores of lead	15.00
Argentiferous lead	10.00
Copper matte	20.00

The duties on ores of lead, argentiferous lead, and copper matte have, of course, for their object encouragement to undertake smelting and refining in the country.

(10) Three per cent production tax. This tax is levied on the gross value of the product as it leaves the mine, and is calculated by deducting from the sale price the bare cost of transport and handling between the mine and the market where sold. In the case of Spanish iron ore and pyrite, the margin of profit on which is so low, the 3% of the gross value of the output at the mine often amounts to as much as 15 to 20% of the working profit on mining the ore, and in some cases it may be more than the whole of the working profit.

Production of Electricity.—Every mine that generates electricity, even for its own consumption, has to pay a tax, which, however, is only one half the amount of that charged to a company producing electricity for sale. The rates are 0.50 *peseta* per kilowatt hour on current for power purposes and 6.75 *pesetas* on current for lighting purposes.

In addition to the production tax on electricity, that used for lighting is also taxed separately, whether or not the current is produced by the consumer for his own use. It should further be noted that all machinery and the bulk of the raw material used by the mining industry, including coal, coke, railway material, wagons, constructional ironwork, explosives, lubricants, illuminants, and tools of all kinds, pay exorbitant import duties. Explosives and petroleum, indeed, are protected monopolies, and, as always happens in such cases, not only are the prices exorbitant, but the quality is bad. Certain kinds of machinery and supplies, including pig and wrought iron, are produced in the country, but except as regards constructural ironwork, which is good and cheap, the prices are in most cases practically the same as those of the imported articles, the duties merely serving to enrich local manufacturers, who, as in some other countries, arrange the tariffs to suit their own interest.

In the case of the smaller pyritic mines of the provinces of Huelva and Seville, the total amount of Government taxation varies from 15 to 30% of the gross value of the ore per ton f.o.b. the shipping port, or, which amounts to the same thing, from 20 to 40% of the value of the ore at the mouth of the mine. This is a crushing load of taxation for any industry to bear, and it will be readily understood that it presses with exceptional weight upon those mines in which, owing to the poverty of the ore, small size of the orebodies, distance from the shipping port, or other incidental circumstances, the working costs bear a higher ratio than usual to the value of the product. In quite a number of such cases indeed it snuffs out the profit altogether, and fiscal exactions transform what might be a small working profit into a substantial loss.

Blinded by the prosperity of Rio Tinto, which is able to stand these and almost any imaginable fiscal exaction, the Spanish Government, with its continual proposals for the increase of taxation and the undiscriminating way in which this is levied, is seriously hampering the development of the smaller mines and impeding the influx of capital to still undeveloped properties. Such a policy appears to be short-sighted.

Copper Surplus

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of the last six months of 1911, with certain other months for comparison.

	U. S.	Foreign.	World.
January 1909	122,357,266	124,716,480	247,073,476
January 1910	141,766,111	244,204,800	385,970,911
July "	168,276,017	232,863,680	401,139,697
January 1911	122,030,195	187,705,280	309,735,475
July "	157,434,164	157,184,280	314,618,444
August "	137,738,858	152,376,000	290,114,858
September "	133,441,501	149,887,360	283,328,861
October "	140,894,856	150,841,600	291,736,456
November "	134,997,642	138,512,640	273,510,282
December "	111,785,188	131,447,680	243,232,868

Japan's Mineral Production

By H. Foster Bain

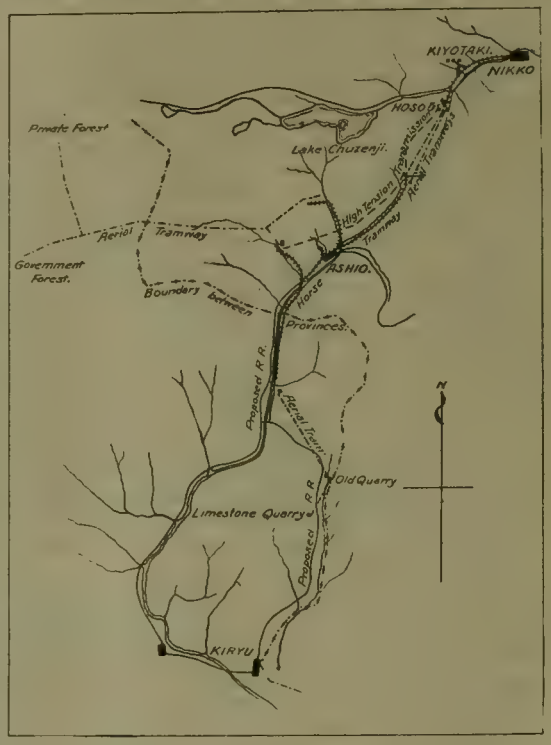
Statistics of the mineral production of Japan in 1911 will not be available for some months. The figures for 1910 are given below:

Mineral Production of Japan, 1910

	Amount.	Value, yen.
Gold .....ounces	140,431	5,671,806
Silver ..... "	4,552,949	4,942,706
Copper .....pounds	111,780,058	26,475,499
Lead ..... "	8,613,457	488,828
Tin ..... "	51,466	34,933
Iron:		
Pig .....metric tons	58,873	2,197,169
Kera ..... " "	474	8,950
Wrought ..... " "	20	630
Steel ..... " "	7,739	588,924
Iron pyrite ..... " "	79,676	465,184
Antimony:		
Refined .....pounds	268,187	30,975
Crude .....metric tons	8	999
Manganese ore... " "	11,255	85,960
Zinc ore ..... " "	21,918	602,566
Coal ..... " "	15,681,324	50,483,238
Lignite ..... " "	100,079	153,960
Petroleum .....gallons	76,572,190	6,880,471
Sulphur .....metric tons	43,847	1,047,764
Graphite ..... " "	147	10,430
Phosphate rock... " "	1,059	8,982
Others ..... " "	.....	183,200
		100,363,174

It will be noted that the total mineral output was worth $50,000,000, of which one-half was derived from the collieries, a trifle over one-fourth from the copper mines, and the remainder divided among petroleum, gold, silver, pig iron, sulphur, pyrite, lead, zinc, and minor items. A review of the figures for the past ten years shows a consistent and gratifying increase in output and value. In 1900 the total was $24,633,727; this had doubled by 1906. Increases since have been offset by decreases in price.

The coal-mining industry continues in a flourishing condition despite the competition of the Manchurian and Chinese mines. In Japan the great bulk of the coal mined comes from the southern island, Kyushu. Here the Chiku-Ho districts produce 52½% of the coal output of the Empire and show a steady increase in output. Contrary to a widespread impression, the known reserves are increasing rather than decreasing, deep drilling having resulted in enlarging the known field. At the well known Takashima colliery of the Mitsu Bishi Co., additional beds of coal have been found, and the engineers of that company now estimate the reserve at 160,000,000 tons; enough to continue the production of 2000 tons per day for over 200 years. Throughout this field large modern collieries with steel top works, excellent pumps, and turbo-electric power stations are to be seen. One interesting feature of the district is the Meiji Higher Technical School recently founded to give secondary instruction in mining and related branches of engineering. It is endowed with 3,000,000 yen by one of the successful coal-mine operators, and is directed by Naka Matoba, formerly of the Engineering College of the Imperial University at Tokyo. Instruction in the higher branches of engineering is also now provided by the Kyushu Imperial University at Fukuoka, where Y. Watanabe, who will be remembered by many American engineers as having been at St. Louis in 1904, is now stationed. A little farther south, at Omuta, is the Miike colliery, the largest in Japan. It alone produces nearly one-eighth of the output of the Empire. The Mitsui firm, to which it belongs, produces, altogether, a sixth of the total output. Of this about one-fourth is exported, aside from that sold as bunker coal. The Miike collieries include six working pits, the deepest and most important being the Manda. This pit has two shafts 930 ft. deep, the larger being 12 by 41 ft. in cross-section. The output from this shaft is 2200 tons per day, and for the whole field 12 tons of water must be pumped to raise one ton of coal. There are many interesting features of the mine equipment and mining practice at this point that must be left for later description, but here, as at the other large mines of the Empire, every advantage has been taken of latest improvements in plant and methods. Coke is made at present in beehive ovens, but a bank of Koppel ovens is now being built, and all by-products are to be saved. At present but half the gas is used, but with the new plant two 2000-kw. gas-engines will be included, to drive electric generators, supplementing the three 5000-kw. Curtis turbo-generators now in use. The total pumping equipment when complete will be capable of handling 22,500 gal. of water per minute from a depth of 1000 ft.



SURFACE MAP AT ASHIO.

An excellent harbor with tidal lock has been built and equipped with three Miike loaders, each capable of handling 5000 tons per hour. The use of mechanical loaders is in line with modern progress, but does away with one of the picturesque features of a stop in Japan, coaling ship by hand. In the latter work the Japanese have become expert. At Nagasaki, the Mitsu Bishi Co. in 1902 put 1210 tons of coal on the *Empress of China* in 3¼ hours; at a rate of 372 tons per hour. At Yawata, where coal is loaded by hand, the cost is about 17½c. per ton; each workman handling two tons at a daily average wage of 35c. It is against such labor costs that machinery must compete in the Far East. In northern Japan large coal deposits are being developed in Hokkaido. The output now equals about 10% of that of the Empire and is rapidly growing. Examinations made this year by Japanese engineers have extended the limits of the known field and developed the presence of especially valuable gas coals. Arrangements are being made to open additional mines. The coal industry in Japan is conducted on a satisfactory basis of profit. Costs are not notably different from those in the United States, good coal being produced as low as $1 per ton at the pit mouth, and averaging, in 1910, $1.61. Selling prices, however, are better, much coal bringing $4 to $4.50 per ton. Roughly, it may be calculated

that excellent Japanese coal can be laid down profitably in San Francisco, duty paid, at about the same price as American and Canadian coals are now delivered, namely, $6 to $6.50 per ton. Actually the Pacific Mail boats use Japanese coal on the east-bound trip, and, except when cargo space is at a premium, bring over enough to burn on the return trip.

Aside from coal, Japan produces petroleum, though not as yet in large quantity. In 1910 the output was 182,000 bbl. The production has not varied greatly for five years, and general opinion is to the effect that large oilfields are

MANDA PIT AT MIIKE COLLIERY.

not likely to be developed, except possibly in Saghalin. Prospecting there is under way. Charcoal remains the main fuel for domestic purposes throughout Japan, though in time coal may be expected to largely supplant this, as it has already done in manufacturing, and in heating the larger modern houses.

Next to coal the most important mineral mined in Japan is copper. The total output in 1910 was 111,780,058 metric tons, and in 1911 will doubtless be larger.[1] While there are a large number of copper mines, three have been de-

ARTIFICIAL GARDEN MADE FROM THE SCRAP PILE AT SUMITOMO SMELTING WORKS ON THE OCCASION OF THE VISIT OF THE AMERICAN ENGINEERS.

veloped on so large a scale as to overshadow the others. These are the Kosaka, of the Fujita firm; the Ashio of the Furukawa firm; and the Besshi, belonging to the Sumitomo firm. The Kosaka, 400 miles north of Tokyo, has been for several years the largest metal mine in the Far East. In 1908 it yielded nearly 16,000,000 lb. of copper, with 1,000,000 oz. silver. Work has been conducted on a large scale with both open pit and underground mining and pyritic smelting. Because of the presence of much barite, the ore is especially refractory, but the metallurgists in charge succeeded in overcoming all difficulties. This mine seems now to have passed its prime, unless additional orebodies be found, and at present the leading producer is the Ashio, where 600 metric tons of metallic copper per month is produced from ore averaging 3% copper produced in two grades: smelting ore with 12%, and concentrating 1%, brought up to 12% by milling. Ten years supply is reported to be available. The general situation and work at this mine have already been described.[2] In 1910 and 1911 important improvements were made, and others are under way. A railway is now being built to the mines, the dressing works at the mouth of the Tsudo adit are being enlarged, a new Ingersoll Rand class P compressor with air cylinders 16½ and 27½ by 24 in. has been put into service, and many other changes made. At Nikko additional water-power has been developed, and the refinery is now being enlarged to double its present capacity. In the new plant the multiple instead of series system will be used. At the Besshi mine, which in 1911 will probably rank first in production—though between any two of the three big mines there is little difference—important improvements are also under way. Up to this year steam-electric power has been used at the mine, but a new 3000-kw. hydro-electric plant is now nearly completed. An unusual feature of this work is that the water is brought from the east side of the mountain through the mine by way of the Hiura adit. It has a total fall of 1975 ft. and 25 cu. ft. per minute is available. A new adit 15,000 ft. long is now being driven to undercut the present workings 1876 ft., and to meet it a round shaft,

BLAST-FURNACE AND STOVES AT THE IMPERIAL STEEL WORKS.

16 ft. in diameter, is being sunk from inside the mine. It is interesting to note that this work is being undertaken without preliminary testing of the lower ground, because of the confidence engendered by the persistence of the ore-shoot, which is 5000 ft. long, to the present working depth of 2000 ft. The average content of the Besshi ore is 10% Cu, and it is so free from deleterious substances that no refinery is necessary. To avoid their introduction into the matter, a barren flux is used in place of the usual gold-quartz ore. Within the year briquetting has been abandoned in favor of pot-roasting, and a unique method of nodulizing the fine ore preliminary to roasting has been developed by Keijiro Nakamura, superintendent of the Sumitomo smelting works at Shisakajima. A number of other improvements are being made, and an excellent future may be safely predicted for this mine. In addition to the three big mines mentioned, there are many others less well developed, a number of which may be expected to become important producers. At present Japan exports copper to the amount of about 80,000,000 lb. per year. While wire, sheet, and pipe plants are in operation and are being rapidly enlarged, it is probable that exports will continue to increase. Japanese companies are able to work copper up into finished products and supply the local market, including the demand incident to a rapid expansion of trolley roads now just beginning, and still export metal. Since the balance of trade is against Japan and foodstuffs in particular must continue to be imported, the mineral products form a natural means of payment for imports not covered by silk and tea while manufactures and shipping are being developed. While costs of copper

[1] For review of the copper production of Japan in 1910, see T. Haga, *Mining and Scientific Press*, June 24, 1910.

[2] Read, T. T., *Mining and Scientific Press*, October 14.

production are not published in Japan, as in the United States, it is evident that they do not differ greatly from those in America, though possibly lower. At the Ashio, against heavy pumping charges, and with all the usual smoke trouble, it is possible to work a 1% copper ore in narrow veins and concentrate it in mills much smaller than those working on similar ores in the United States.

Gold and silver form a much less important element in the mineral output of Japan than in the United States. Of the former the annual production is now about 150,000 and of the latter 4,500,000 oz. Gold mining is, however, increasing, though the placers have proved disappointing. For this metal the Japanese look to Chosen, or Korea, where both old and new mines are being developed on a large scale by both Japanese and foreigners. The principal Korean gold mines have been repeatedly described in the *Mining and Scientific Press*. Within the year steady progress was made at the Oriental Consolidated and other properties. Difficulties between the Japanese and American interests at Chicksan have been adjusted, and, in addition to quartz mining, the placer ground is now being tested. Farther north, Japanese engineers have been drilling placer ground with such encouraging results that it is expected that a dredge will be ordered within this year.

In iron and steel, 1910 marked a turning point for Japan, in that, for the first time, the Imperial works at Yawata showed a profit. This has stimulated the industry, and extensive building is under way both at Yawata and in Hokkaido, where English and Japanese are coöperating in developing private iron and steel works. At the Imperial works the foundation has been laid for an additional blast-furnace designed to increase the capacity 250 tons per day. A more significant event, possibly, is the development of adequate supplies of ore within the limits of the Empire. When the works were established it was necessary to import ore from central China, and even now approximately half the supply is brought from the Tayeh mine. Since, in accordance with the general tendency in mining and metallurgy in Japan, the works were established for the prime purpose of rendering the Empire independent of foreign producers, the disadvantage of this arrangement is obvious. Persistent effort has led to the development of iron ore of 50% grade in Hokkaido and at other points in Japan proper, and the opening of considerable bodies of ore analyzing 52 to 62% Fe, much of it bessemer grade, in Chosen or Korea. At present a considerable amount of ore is coming from these mines, and this is likely to be greatly increased since the Mitsu Bishi Co. has taken important leases in the district.

It may also be noted that among the less important industries of Japan, zinc mining is rapidly growing. The present ore production amounts to about 25,000 tons, the result of five years development. An interesting feature of the industry has been the development of a flotation process which is being successfully applied at the Kamioka mine of the Mitsui company. Not content with producing ore only, the Japanese are already planning to build a zinc smelter, and in a few years may be expected to supply their own needs for spelter. At present zinc to the value of $1,000,000 is annually imported.

Any general review of the year would be incomplete without some reference to the visit of the Empire of the party from the American Institute of Mining Engineers and the generous welcome extended to them by local members, the mine-owners, and the Mining Institute of Japan. The memory of the meeting will always remain pleasant to everyone who took part. In 1899 when, on the initiative of the United States, Japan was invited to join the international conference regarding the seal fisheries, the event was referred to as 'Japan's coming-out party.' In a certain sense the meeting of the mining engineers in Japan this year was similar, since for the first time the local mining industry was thrown open to the full review of a large and representative body of foreign engineers, and for the first time, in any large way, a body of professional men visited the mines to carry away ideas and new methods in practice.

Mining Industry in Italy in 1911

By Charles Will Wright

The statistical reports from the metal mines in Italy for 1911 will not be available for six months or more, and only a few general conclusions as to the results of the present year can be given. The statistical reports for 1910 have recently been published in the *Revista del Servizio Minerario*, and these are referred to in the present review in order to show the relative importance and progress made in various phases of the Italian mining industry up to this year. The sulphur mines in Sicily are of greatest importance. The zinc-lead mines in Sardinia rank next in value of output, and these are followed by the iron mines on the island of Elba. Then follow the quicksilver mines, the pyrite mines, and the copper mines. Other metals, including manganese, antimony, gold, silver, and tin, are produced in small quantities.

Sulphur

The output of sulphur during 1910 was 2,815,511 tons, with an average of 30.03% sulphur. The total value of this product was 32,383,409 *lire*,* or 11.50 l. per ton. A total of 23,063 workmen were employed in these mines, the average wage being 2.37 l. per day. These figures compared with those for 1909 show a slight decrease in output, though an increase in the tenor of the product and a decrease in labor, with an increase in wages of 0.17 l. per day. Electric power is being introduced in these mines for hoisting and transport. During 1911 there was a further decrease in labor, though the output will probably compare well with that of 1910. In recent years no new discoveries of sulphur mines have been made, nor in the methods of ore treatment were there any improvements.

A review of the statistics shows that the sulphur output during the past 10 years has decreased from an average annual production during 1900-1905 of 3,659,819 tons, valued at 42,946,717 l., to an average production during 1906-1910 of 2,910,515 tons, valued at 32,882,770 l. This decrease in recent years is attributed largely to the increased output of silver in the United States, principally from the mines of the Union Sulphur Co. in Louisiana. In 1910 Sicily produced 92% of the total sulphur output, the remaining 8% being derived from the mines in the districts of Bologna and Naples. The output of commercial sulphur in 1910 from Sicily amounted to 394,812 tons, and the exportation was 393,987 tons. The estimate of the stock of sulphur in Sicily at the end of 1910 was 640,647 tons. The value per ton of commercial sulphur during 1910 was 96.97 l. Of the sulphur exported in 1910, 50% went to Germany, 13% to America, 10% to Holland, 9% to England, and 6% to Austria.

Lead and Zinc

Nearly all of the mines producing lead also produce a considerable amount of zinc, and conversely. All of the lead ores contain from 100 to 1000 grams of silver per ton. The total lead output in 1910 was 36,540 tons, containing 80% lead and 400 gm. silver, and valued at 145 l. per ton, or at total value of 5,303,855 l. This shows a decrease of 1405 tons and 453,036 l. from that of 1909. The decrease was attributed to the unfavorable market price for lead. In 1911, on the other hand, the market has been more favorable, and exploration for lead ore has been energetically carried on at many of the mines, and the lead output materially increased. The lead ores consist of about two-thirds galena and one-third carbonate ore.

The zinc output in 1910 was 146,307 tons, averaging 37.76% zinc, and valued at 101.18 l., or a total value of 14,803,100 l. This exceeded the 1909 output by 16,408 tons and 2,298,698 l. This rate of increase has continued during 1911, and for this year the totals will probably show a considerable increase over 1910. The cause of this increase is attributed largely to the steady increase in the

*The *lira* (l.) is worth $0.193.

market price for zinc. About 70% of the ore produced was calamine and smithsonite ore, and 30% blende ore. The largest producing lead-zinc mines are in the Iglesias district of Sardinia, and include the Montepont mines, the Buggerru mine belonging to the Malfidano company, the Gennamari Ingurtosu mines, the Pertusola mines, and those of the Vielle Montagne company. Other mines of importance are Argentaria, Nebida, Masua, and Rosas.

The Iglesias district produced 95% of the total lead-zinc output in Italy. The remaining 5% came principally from small lead mines in the province of Bergamo. The total labor employed in the lead-zinc mines of the Iglesias district during 1910 was 12,598, or a decrease of 475 from the total for 1909, though the output was increased by 8853 tons. In 1911 a similar decrease in labor will be recorded, with a corresponding decrease in the output. This shows increased efficiency in labor, though the results are also due in part to the introduction of rock-drills and improvements in the mechanical treatment of the ores. It is also to be noted that the miners' wages are gradually being increased, the present average being about 2.45 l. per day.

A comparison of the output from the lead-zinc mines during 1901-1905 shows an average annual output of 188,837 tons, valued at 22,240,252 l., and during the years 1906-1910 the average was 190 to 382 tons, valued at 23,075,782 l. The zinc production has been increased during recent years, and it is probable that this increase will be continued, as new reserves continue to be opened up. The lead production, on the other hand, has decreased in late years and no new lead mines have been developed.

Smelters

There are two lead smelters in Italy; the Pertusola smelter at Spezia and the Monteponi smelter in Sardinia. During 1910 the Pertusola smelter was shut down for a few months in order to introduce various improvements, including two Dwight-Lloyd converters. A total of 21,070 tons of ore was treated, and 11,500 tons of commercial lead and 12,000 kg. silver produced. In 1911 the amount of ore treated will approximate 30,000 tons. The Monteponi smelter produced, in 1910, 2995 tons of commercial lead and 2237 kg. of silver. At this plant a new process for making zinc oxide from low-grade ores is used.

Iron

The production from the iron mines in Italy during 1910 was 551,259 tons, containing 53% iron, and valued at 7,619,031 l., or 13.82 l. per ton. Of this amount, 532,671 tons was produced from the Elba mines, the remainder being from small iron mines in Sardinia and the province of Bergamo. These figures show an increase of 49,898 tons above the 1909 output, which was entirely from Elba.

The iron mines on the island of Elba are leased from the Italian Government by the Societa Elba, and their maximum production has been fixed at 500,000 tons per year. The ore is mined entirely by surface workings, and these are connected by overhead cable trams with bins at sea-level from which the steamers are loaded. The ore consists of hematite and limonite, and is especially free from impurities. The ore is supplied almost entirely to Italian iron and steel companies. There were 1571 men employed at the Elba mines in 1910. During 1911 there was a serious strike for some months at these mines, but because of the large stocks of ore at the mines it is not believed that the output will be materially decreased.

Quicksilver

The product of this metal is from cinnabar ores derived chiefly from the mines of Monte Amiato in the district of Florence. These mines produced, in 1910, 87,129 tons of ore containing 1.04% Hg and valued at 3,729,352 l. Some 70,000 tons of this ore was treated, and a yield of 893 tons of quicksilver, valued at 5,358,000 l., obtained. These mines employ 994 workmen. The statistics show an increase in output to the value of 128,704 l. over 1909. No marked change is anticipated in the output of quicksilver in 1911. A small amount of this metal, usually less than one ton, is produced annually as a by-product at the Monteponi smelter in Sardinia.

Copper

The copper mines produced 68,369 tons of ore in 1910, containing 2.90% copper and valued at 1,036,674 l. Of this output, 58,989 tons, valued at 677,193 l., was from the mines in the province of Grosseto in Tuscany, the remainder from small mines in the provinces of Genoa and Torino. The totals are 21,963 tons and 866,733 l. less than in 1909. During 1911 these mines have continued to keep up production as in 1910, but the general decline is attributed to the fall in the market price of copper. Developments are in progress on copper deposits in Sardinia, though these will not be producing for a few years.

Pyrite

The production of pyrite is becoming an important industry in Italy, and during 1910 there was a considerable increase over 1909 in the output. A still greater increase is expected in 1911, as researches have been advanced at the Miniera Vallebria and Miniera di Gavorranno, and aerial trams installed for the transport of ore. In 1910, 135,628 tons of pyrite was produced, containing 44.62% sulphur, and valued at 16.97 l. per ton, or a total of 2,301,851 l. Besides this, 30,060 tons of cupriferous pyrite, with 1.51% copper and valued at 562,680 l., was produced. These figures represent an increase over 1909 in the total value of product of 663,515 l. The pyrite mines employed 1809 workmen in 1910, and in 1911 about twice this number are being employed.

Manganese

The manganese output comes essentially from the Liguria Gambatesa and Nascio-Monte Bianca mines in the province of Genoa, the Monte Argentario mine in Grosseto province, and the Capo Becco and Capo Rosso mines in Sardinia. The total output in 1910 was 29,900 tons of ore, valued at 314,179 l., a decrease from 1909 of 55,601 l. in value. The 1911 production will probably show a slight increase over 1910.

Antimony

The output of this metal showed a large decrease in 1910, though in 1911 the production may show some improvement. The entire production, 2194 tons, containing 25% antimony, and valued at 149,769 l., was derived from the mines in Sardinia, Lu Luergiu and Corti Rosas. The decrease in 1910 from the output in 1909 amounted to a total value of 61,851 l., though the tonnage produced was greater.

Gold, Silver, and Tin

These metals are produced only in relatively small quantities in Italy. The total value of the gold output was but 58,730 l., and this was derived principally from the Valbianca mine in the province of Turin. The ore is pyritiferous quartz. The only productive silver mine in Italy is the Giovanni Bonu mine, near Monte Narba in Sardinia, and from this but 32 tons was produced in 1910, carrying 1.53% silver, and valued at 42,400 l., a decrease of 25,400 l. from 1909. The main silver production is derived from the lead mines already mentioned. No new discoveries of gold or silver deposits were made in 1911. There is also one tin mine in Italy; the Monte Valerio, in the province of Pisa. At this mine exploration is proceeding, principally by diamond-drilling. The output in 1910, which amounted to 170 tons, valued at 41,000 l., was derived by the re-treatment of the old dumps.

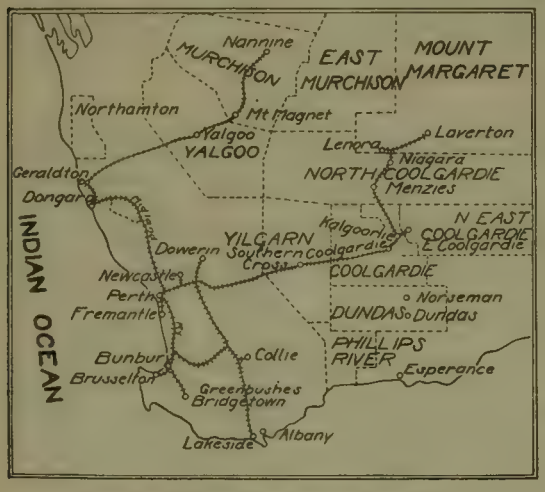
Anthracite Coal Shipments

(Figures in long tons, December 1911, estimated.)

	1911.	1910.
January	5,904,117	5,306,618
April	5,804,915	6,244,396
July	4,804,065	5,202,059
October	6,269,179	5,622,005
Total	70,000,000	64,905,786

Australasian Mining in 1911

The year 1911 was one of unexampled prosperity in Australia. Since 1902-3 the whole country has enjoyed a run of good seasons. The general prosperity of the world, the advance in industry, and the extension of civilization, especially in the East, have been responsible for an ever-increasing demand for the leading products of this country. The greatest recovery has been in the pastoral industry, which, after seven years of drought, is now in a condition hardly ever before approached. It therefore can be said that as far as the great staple products, such as wool and wheat, are concerned, Australian wealth has been immensely added to, by the largeness of the yields and the splendid prices realized in the world's markets. But while good seasons have placed the pastoralist and the farmer on their feet, they have unfortunately not helped the mining industry of the country. When times are bad in Australia the instinct of the community is to go back to mining. When times are good, labor drifts to agricultural pursuits, to orcharding and to dairy farming. The withdrawal of labor for these industries during the past two years has been very great, and it has had the



WESTERN AUSTRALIAN MINING DISTRICTS.

effect not only of closing a number of low-grade mines, but of restricting the prospecting operations in the great unknown districts in the centre of the continent. Therefore the year 1910-11 closed without the discovery of any new field of importance.

Twelve months ago, as will be recalled, it was hoped that the Bullfinch district, near Kalgoorlie in Western Australia, was to provide a second 'Golden Mile'. All that the rush there did was to prove the utter worthlessness of nearly every claim that was floated. The parent property today languishes, and there are not a few who declare that its fate is sealed. The effect of that ill-considered boom was to tighten the purse-strings of a large part of the public and to discourage prospecting in other districts. Western Australia, as far as the Eastern States go, is a name which is associated with heavy losses, and therefore investment in that great tract of country is small and on the most cautious lines. The Kalgoorlie district has nothing fresh to show. Its mines are pushing ahead with work at depth, the leader being the Great Boulder. The stability of the property is marvelous. It is altogether over capitalized, but the mine has developed exceedingly well at different points. While it may be doubted whether the ore reserves exposed equal the value indicated by the market price of the shares, still such confidence is felt in the management and in the general outlook of the property that the claim holds its own in public estimation, not only as a gold mine, but as a pioneer at depth. Taking the leading ventures at Kalgoorlie, it is to be confessed that the majority of them at depth show signs of impoverishment. In the outside districts of the State, little that is encouraging can be stated. A number of small mines are being opened, and everyone lives in the hope that some happy find will once more bring Western Australian mining to the front, but indications today are not stimulating. One of the troubles of the country, of course, is the dryness of the interior. Prospecting means really exploring under the most adverse conditions. A man going out into the arid back territory carries his life in his hands, and with capital shy there has been a shortage in the number of prospectors who are prepared to undergo personal hardship for possible future gain. Another thing that tells against the industry is the exceedingly high price of labor. This is due to the introduction of Wages Boards, which allots a set wage to the miner, and on such a liberal basis that it means the keeping closed of a great number of low-grade mines. A Labor Ministry has just been returned to power in the State Legislature, and it is hardly likely, therefore, that relief from this direction will come to the mining industry. In the northeastern part of the State, it was hoped that the Tanami field would develop satisfactorily. A proved deposit is known just over the border in South Australian territory, but the conditions there are so adverse that, while large bodies of moderate grade gold-bearing material exist, the cost of transport, the difficulty of obtaining water, and the exceedingly high price of labor, have meant that the locality has been deserted excepting by a few.

Taking the Eastern States, the Victorian gold yield unfortunately disclosed a fairly large shrinkage. This arises mainly from the exhaustion of a great number of the deep lead alluvial mines of the State. The famous Creswick district, which yielded millions of pounds worth of gold, is now almost deserted. The magnificent machinery and plant of one of the leaders of the famous Berry group has just been sold. This means that, with the exception of the South Berry company, not a mine is now working on this once famous gutter. At Rutherglen—another important alluvial field—two mines remain out of the big group that once existed there. English capitalists tested ground at the Southern & Prentice, but abandoned the claim after large sums of money had been sunk. Now it would appear that, in the Chiltern field, another property, that within a short time has yielded over £1,100,000 worth of gold, is likely to close down. This would mean that only one mine would remain in this district. The cause of the trouble has been the impossibility of getting an adequate supply of competent labor. Miners have been allured from mining to agricultural pursuits by the high scale of wages offered and the more pleasing conditions of work, or they have been attracted to the State coal mine at Woathaggi. In addition, in the lower levels of the deep-leads system, the average value of the ground is considerably less than nearer the surface. Alluvial mining is conducted at a depth of over 400 ft. below the surface, and as water is heavy, costs are high. With scant and poorly qualified labor available, with heavy charges for pumping, and lower gold returns, it is not to be wondered at that alluvial mining is going a good deal out of favor.

The district that is saving the situation is Ararat, where, in some of the tributaries of the Lange Logan system, rich gold is being obtained. The quartz-mining industry is also being affected by the absence of new discoveries. Great mines, like the Long Tunnel, find the gold content of the ore decreasing as depth is attained. The same thing has happened at Bendigo and Ballarat. At Bendigo what is known as the 'side lines' of saddle formation are worked. They are entitled to be called main lines, as it is from them that the bulk of the gold so far has been mined. In one of these side lines, 'the Sheephead', at a shallow depth, rich gold was found, and the discovery has stimulated the whole field. There are ten or twelve undeveloped lines available for exploration. An old field that has shown very satisfactory signs of revival is Daylesford. There the formations are flat bodies of quartz

running into the slate from vertical leaders. The distinct geological conformation of the country puzzled the old generation of miners. As it now seems to be better understood, mining men set out with the definite object of picking out those leaders and not troubling their heads about vertical leaders. The result is that several fine mines have been opened, and there is every promise of the number of these being increased.

In New South Wales a great part of the State's industry is coal mining. Unfortunately the coal miner is about the most unsettled being on the face of the earth, and in this respect Newcastle has its peck of troubles each week. Sometimes it is the miners, other times the boys or the wheelers who cause mischief. The vast extent of the Greta seam and the size of other coal measures in the State, make coal mining under almost any conditions profitable, but there are signs that the development of the coal measures of Queensland, and the dependence that Victoria is placing on its State coal mine at Woathaggi, will affect trade in Newcastle coal. A good deal of wonder is also expressed as to whether, when the Panama Canal is opened, British coal, or coal from the Eastern States of America, will cut out Australian coal from the market it now enjoys on the eastern coast of South America and also at San Francisco. A considerable quantity of Newcastle coal goes to Chile and Peru, and it would be a great blow to the New South Wales industry to lose this market.

Copper mining in New South Wales has not gone ahead. The greatest claim there is the Great Cobar, but from one cause or another the mine has not done well of late years. What is badly needed is an increase in the price of the metal. Tin mining also is on the down grade for the reason that most of the alluvial deposits are worked out. No gold mines of any importance exist in the country, but to Victorians a most interesting piece of work is being conducted in the Wellington district. Out that way rich gold leads were worked to shallow depths by the old miners, and then abandoned. Ballarat capitalists experienced in deep-lead mining are testing the gutters there, and, in one instance at least, have been rewarded with exceptionally profitable results. It is not beyond the region of a probability that a new goldfield will be developed there.

The most promising development of the year has been made at Broken Hill. There the British mine, which was floated in 1886, by the Broken Hill Proprietary Co., for £500,000, and has ever since been more or less of a waster, appeared to be on its last legs. Boring just done in a block of the ground which alone remained untested has exposed the presence of a magnificent shoot of ore. This has been proved from 900 ft. to within 200 ft. of the surface. Now the outlook for the mine is as bright as that of almost any property on the field. A visit paid quite recently by the mining editor of the *Argos* (Melbourne) resulted in some exceedingly interesting figures being published as to the reserves of ore in the field. It came as a surprise to most people to find that, although mining on a huge scale has gone on incessantly at Broken Hill since 1886, the reserves are larger today than they were five years ago. The following table gives the figures:

ORE RESERVES AT BROKEN HILL

	1906. Tons.	1911. Tons.	Ore treated yearly. Tons.
Proprietary	3,500,000	2,250,000	125,000
Block 10	1,000,000	555,000	100,000
Central	3,623,000	3,600,000	230,000
South	1,400,000	3,500,000	330,000
South Blocks	400,000	500,000	120,000
North	600,000	1,500,000	260,000
Junction	200,000	300,000	.....
Junction North	124,000	350,000	150,000
British	600,000	800,000	150,000
Block 14	220,000	220,000	.....
	11,667,000	13,475,000	

The grade of ore at depth is certainly decreasing, but the field has a magnificent record, as is to be seen by the following figures:

	Authorized capital	Value output	Divs. and bonuses to end 1910
Proprietary	£ 384,000	£11,051,904	£9,818,000
Block 14	155,000	3,286,136	450,827
British	264,000	2,071,243	337,500
Block 10	1,000,000	368,729	1,235,000
Sulphide	1,100,000	11,142,907	797,500
South	200,000	3,620,500	755,000
North	175,000	1,469,487	291,440
Junction	100,000	813,055	85,000
Junction North	180,000	960,401	43,793
South Blocks	200,000	525,176	10,000
South Extended (formerly A. H. B. Consols)	337,500	150,344	50,000

The most remarkable recent development has been in connection with the zinc industry. The flotation process has revolutionized the field, the result being that the income obtained from zinc products has meant a doubling of the returns to shareholders. The way that that branch of the industry has gone ahead is illustrated by the statement that Broken Hill now supplies the world with a sixth of its zinc requirements. This yield is almost exclusively in the hands of the German buyers, although the Broken Hill Proprietary Co. is smelting zinc on a small scale at Port Pirie.

Mining in Queensland has, on the whole, not been altogether satisfactory. The big goldfields there, too, are on the wane, for with depth poor ores are being obtained. On the other hand, the copper-mining industry is developing most satisfactorily. Mount Morgan is becoming more and more a copper producer. In the north around Cloncurry, British capital has developed several undoubtedly fine copper mines, and it is no exaggeration to say that within a short time this part of Australia will be turning out more copper than any other district on the continent. The Chillagoe field has been a disappointment, and the chief English company that controls the interests there, is extending its influence to the Etheridge field, where it is opening up a number of gold and other claims. Tin and wolfram are other products and are being mined on a fair scale, but old deposits are being worked, and these will gradually be mined out. Striking evidence is being furnished that Queensland has great coal measures, and as time goes on, this branch of the mining industry is sure to receive attention. Unfortunately, at present the population is so sparse that the coal seams lie idle.

New Zealand mining has suffered through the cutting out of gold at depth in the Waihi mine. Operation at the State coal mine resulted in a loss for the last year. Generally speaking, the mining industry there is flat. An attempt is being made to prove whether oil exists in New Zealand, but so far without any striking results.

As regards mining in Tasmania, the leading mine, the Mount Lyell, is temporarily under a cloud through the miners having gone out on a strike. The most prominent of the men's several grievances is that contract parties have been allowed to work longer shifts than eight hours, thus breaking away from the eight-hour system. Also, they ask for increased wages. Seeing the small margin of profit made last year, it is difficult to see how much increase in wages can be granted, unless some improvement in the price of copper is forthcoming. The men were out on strike nearly three months. As regards the mine itself, the property looks well, and good ore is being won. The amalgamation of the Mount Lyell with the North Lyell mines in 1903 has been the salvation of both properties, as the basic ore of the one concern serves as a natural smelting flux of the silicious material of the other. The tin-mining industry has been fairly well maintained, and the ample supply of water on most of the properties has permitted uninterrupted work. The biggest disappointment in Tasmanian mining was the falling away in the amount of gold in the ore in the lower levels.

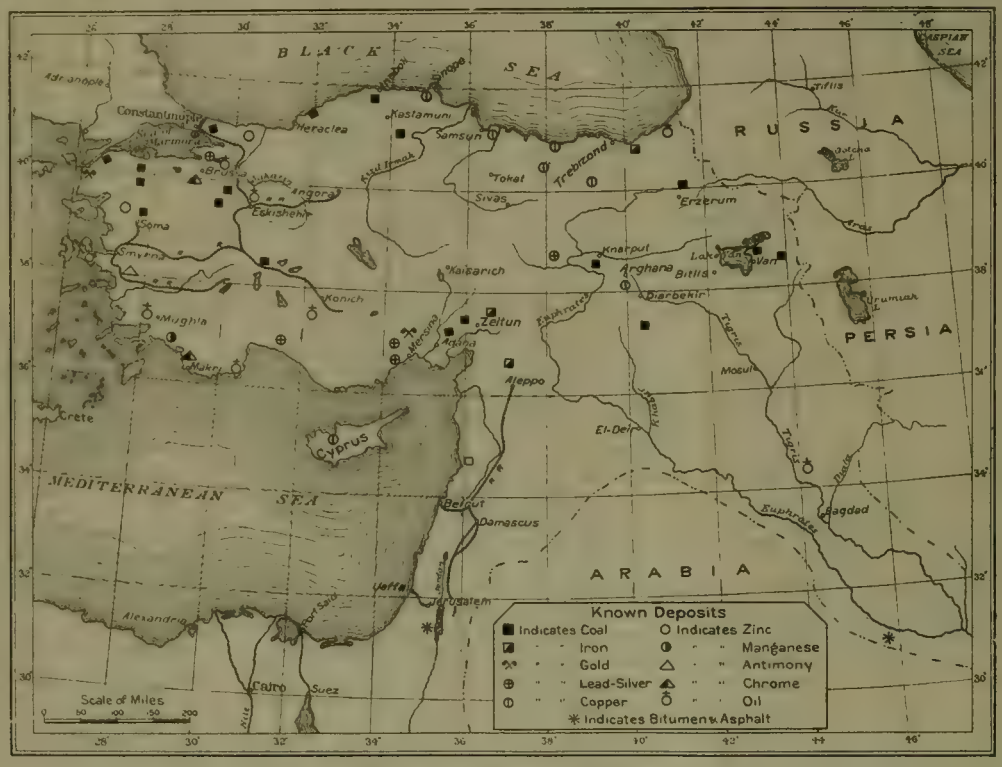
Mining in Turkey in 1911

By Leon Dominian

The growing attention bestowed on prospecting and exploration work constituted the most noteworthy feature for 1911 in the Turkish mining industry. It is now realized in that country that possibilities of wealth exist in the resources of the subsoil, and this added to the newly-felt beneficial effects of a liberal government has led to active prospecting. In previous years it often happened that the prospector's toil went to naught, as his discoveries were usually taken over arbitrarily by some one of the privileged few who stood well with Abdul Hamid. Fortunately, this form of nepotism has disappeared since the downfall of this monarch, and a more equitable state of affairs now exists. The bulk of this exploration work has been accomplished by the natives. It is yet in its infancy, when compared to our knowledge of the country's mineral resources. The larger companies, most of which are foreign, have been content with gathering information from the natives, and it is only in a few cases that they have made show of sufficient interest to actually undertake anything else than general reconnaissances.

Asia Minor has been the scene of the greatest activity in this direction, and, as might be expected, the more accessible regions of the coast-land have received a larger share of attention than the inland districts. In the vicinity of Anamur, on the Mediterranean, about 30,000 tons of iron ore has been mined by an Anglo-French company, in the course of its investigation of a region from which promising reports emanate. This district lies at the foot of the southernmost projection of the base of the Tauric region, where various ores are reported to occur and within which mining has been carried on in a desultory fashion for over twenty centuries. A zinc mine in a very early stage of development is also operated by the same company in the same district, and its output was expected to reach 2000 tons in the year. Here, as with all other producers in Turkey, accurate yearly returns are not yet available.

Somewhat farther east of Anamur, near the seaport of Mersina, and still broadly speaking within the same mineralized area, chrome-ore mines will probably yield about 2000 tons. The ore is of a good grade, containing 51 to 53% chromic oxide. Most of it is shipped, after a rough sorting, to Germany, although a small amount is usually reserved for French buyers. The price paid f.o.b. steamers is in the vicinity of $19.50 per ton. Considerably north of these deposits, in the valley of the Olympus, another chrome-ore mine is operated at Adranos by a Smyrna company. The production for 1911 will probably amount to about 15,000 tons. The ore is higher in grade at this point, assays often giving 55% chromic oxide. It is shipped to the seaport of Gheumlek at a distance of 90 km. from the mine. During 1911 practically all of the transportation was performed by means of wagons instead of the camels which were formerly used. The ore was disposed of as usual, a large tonnage going to Germany.



KNOWN MINERAL DEPOSITS IN TURKEY.

Operating expenses at this locality are stated to be as follows, per metric ton:

Mining	$1.00
Taxes	2.30
Management	0.40
Export tax and miscellaneous wharfing charges	0.23
Loading on steamers	0.46

The selling price of this ore is based on a 50% assay plus a payment of Fr. 3.10 ($0.62) for every additional per cent of chromic oxide. At this price the costs tabulated immediately above allowed a margin of profit of about $6 per ton, on the roughly sorted ore laid f.o.b. steamers during the year.

Another chrome-ore mine in Asia Minor, situated at Karlyer near Inegheul, produced about 2000 tons, under practically the same conditions as those found in the Adranos deposits. The ore here averages about 50% chromic oxide. It is probable, however, that a careful sorting would increase the tenor of the product shipped. Some work was also undertaken by English capitalists in the vicinity of Aleppo, where high-grade chrome ores have been discovered. A deposit which is stated to run high

in chromic oxide was discovered during the year in the vicinity of Arsous, not far from Aintab, northeast of the previously mentioned place. Development was actively carried on in this locality, and the first shipments are expected to be made early in 1912.

The most important of all the chrome ore deposits worked in Asia Minor occur at Dagh Ardi near Broussa. The production for 1911 is estimated to exceed 15,000 metric tons. The ore occurs in large masses and irregular blocks in serpentine, and is sacked without further handling as it comes out of the mine. In this condition it usually assays 50% chromic oxide. It is transported on camel back (a camel will carry 100 to 250 kg. of ore—228 to 570 lb.—according to the nature of the country traversed, the smaller amount constituting the limit for mountainous localities) for a distance of 70 km. or about a three days' journey, to the railroad station of Kutahia, whence it is routed over the Anatolian railway to the seaport of Dernidje, near Ismid. Here it is transferred to steamers and is shipped to one of the following harbors: Glasgow, Liverpool, Antwerp, Rotterdam, Hamburg, Havre, Marseilles, Philadelphia, Baltimore, or New York. It is usual to figure 5 camels to a ton of ore for the trip from the mine to the railway station, and the cost per ton laid f.o.b. steamers varies between $7 and $9, these being the lowest figures for this kind of ore in Turkey. In the European section of the country, mention must be made of the chrome-ore deposits of Oracha, lying close to the Salonica-Uskub railroad. Their production will probably attain about 1000 tons, all of which are shipped to Austria. Some exploratory work was also carried on at Radicha and Caranza near the town of Uskub, as well as near Tikmesh.

The meerschaum mines in the vicinity of Eski-Cheir were operated by the Government during the year as usual. Their production will probably amount to 250 metric tons, valued at about $500,000. This is probably the most important deposit of its kind in the world. The mine lies at a distance of about 22 km. from the railroad station, to which the ore is packed by camel-trains. The deposit occurs in a valley filled with drift material from the surrounding mountains. The sepiolite is scattered through the drift in rounded nodular masses with fragments of magnesian and hornblendic rocks. As a rule, the nodules do not exceed three inches in diameter, but a few attain larger dimensions. In the raw condition the mineral is soft, light, and non-transparent. The color is white, with occasional blending of yellow, red, or gray. It is richer in silica than that found in Utah or North Carolina. The thickness of the meerschaum-bearing strata varies between 3 and 40 metres. Mining is carried on under the leasing system, both in open-cut and underground work. About 4000 men were employed in 1911. After extraction the product is sorted and cleaned. Six grades are prepared for export, mostly to Austria. The ore is shipped in boxes of a capacity of from 30 to 35 kg. of meerschaum. The following prices per box f.o.b. cars Eski-Cheir prevail at present according to grade, this classification being based entirely on the beauty and purity of the specimens:

Class.	Local Name.	Per box.
1	*Sari Mali*	$160
2	*Bir Nebrilk*	135
3	*Pamoukly*	115
4	*Dane Dukme*	70
5	*Orta Dukme*	25
6	*Giliz Dukme*	10

A new deposit of coal was discovered at about three and one-half hours' ride from the city of Aintab. Samples seem to indicate that the coal is bituminous. The assay reveals rather high ash contents.

The oil district adjoining the Persian boundary, in the extreme southeastern section of the Empire, was the object of considerable attention during the year. The public press voiced the unanimous opinion of mining men in calling the attention of the Government to the necessity of undertaking a thorough investigation of the belt. No appropriations could be devoted for this purpose, however, owing to the still precarious condition of Turkey's finances. An attempt was made by the Department of Mines to have the oilfield examined by the engineers of the more important railway companies. The matter is still pending, mainly because nothing short of a concession will be considered by a company undertaking such work, and there appears to be considerable reluctance on the part of the Government to grant any concessions until a better knowledge of the conditions prevailing throughout the oilfield enables the officials of the mining department to form an idea of the approximate value of what is suspected to be an important oil district. To judge from the satisfactory developments taking place on the Persian side, where an English syndicate is carrying on a systematic plan of development, it appears that it might be worth while to explore the Turkish field. A very small amount of the oil oozing above the soil, and which is collected on the surface of pits dug for the purpose, was gathered by the Arabs for their local needs all the way from Mossul to Bagdad and Bassorah.

No attempt was made, however, to transport the oil away from the immediate vicinity of the occurrence. The country's supply is derived from Russia, Rumania, the United States, and Austria. In many Turkish towns, as in Harput, for instance, petroleum sells as high as 30c. per gallon. All told, about $5,000,000 worth of the oil was imported during the year. It therefore seems that there exists good reason for the endeavor to supply the 35,000,000 inhabitants of Turkey with the only means of illumination which will be available to them for many years to come. Attention is here called to the possibility of competing with foreign oils in the other markets of the East as well as those of the Far East. Aside from this, some of the most important Turkish railway companies finally decided, in the course of the year, to use oil as fuel in their locomotives. Trials which were made on the Anatolian railroads for the past two years have been so satisfactory that 100 locomotives are to be transformed. The Bagdad Railway Co. has also decided to adopt this fuel, and is about to build its storage tanks at Alexandretta.

The revision of the Turkish mining law was also undertaken during the year. The new provisions were to have been submitted to Parliamentary approval in the fall session of the year, but it appears that unexpected political events prevented their discussion by the legislative body, which found itself suddenly confronted by the necessity of attending to political matters of more immediate importance. It was not known at the time of writing (November 1911) whether the new law would be adopted before the end of the year or not. The changes proposed are believed to be of a nature tending to facilitate operations. In the main, the object sought was to have the Turkish mining law conform to the practice in vogue among the more advanced nations. The old text had been definitely promulgated in 1906 before the inauguration of the constitutional form of government and at a time when the country still labored under the mismanagement of its former ruler. As such, the various clauses of the law were framed so as to hamper as much as possible the free and natural development of the industry. Prospecting and exploration could be undertaken only by means of special permits, which were granted under conditions that were so restrictive as to be devoid of any practical value. These research permits, as they were called, were granted for a year and for small zones. Only the minerals specified in the permits could be sought, and a new permit had to be obtained for any ore that might be discovered and which was not specified in the document. Considerable 'pull' at headquarters was required for the issuance of these permits, and only a favored minority composed of Abdul Hamid's creatures could get them. Added to this, the Government taxes were abnormally high in some instances, and thus prohibited the undertaking of any work. The revision of 1911 has eliminated these obnoxious features, and while the final text of the new law will not be known until after Parliament has passed on the subject, there is no doubt of the fact that its provisions have been inspired by the same spirit

of enterprise which has characterized governmental action in the past two years. One of the results of this revision has already been felt in the increasing demand for mining concessions. It is believed that over 400 concessions will be granted by the end of the year, this number being about double the one granted formerly.

In the absence at this date of any precise figures for the year's mineral output, the following estimates compiled from data available so far, represent fairly accurately the year's production:

Antimony ore	metric tons	1,500
Asphalt	" "	12,000
Bituminous coal	" "	700,000
Boracite	" "	16,000
Chrome ore	" "	40,000
Copper	" "	1,500
Emery ore	" "	72,000
Gold	kilograms	45
Iron pyrite	metric tons	80,000
Lead	" "	13,000
Lignite	" "	35,000
Manganese ore	" "	18,000
Meerschaum	" "	250
Mercury	flasks	4,500
Silver	fine ounces	8,000
Zinc ore	metric tons	40,000

Nome in 1911

The report of R. W. J. Reed, Deputy Collector of Customs at Nome, Alaska, for the navigation season of 1911, gives an interesting insight into the business of this far northern community. The principal items are listed below:

Vessels from U. S. ports	36
Vessels from foreign ports	31
Passengers arrived from States at Nome	1,514
Passengers arrived from States at St. Michael	778
General merchandise received, tons	21,685
Coal received, domestic, tons	1,650
Coal received, foreign, tons	6,010
Lumber received, feet, B. M.	2,173,695
Live stock received, head	31
Sailings of vessels for U. S. ports	31
Sailings of vessels for foreign ports	36
Passengers outward, ocean vessels, from Nome	1,998
Passengers outward, ocean vessels, from St. Michael	1,741
General merchandise shipped, tons	507

Gold-dust and bullion shipped:

	Ounces.	Value.
Through Custom House	142,013.44	$2,612,219.12
Through postoffice	22,400.43	415,986.02
Totals	164,413.87	$3,028,205.14

Since a census showed the population of Nome last winter to be 2602, and 484 more people left this season than came in, the present winter population may be taken at 2118. The coal received covers stocks at close of navigation.

BORAX.—Virtually the entire product of borax in the United States is derived from two mines in California, one in Inyo and the other in Los Angeles county. The ore now mined is all colemanite. Marsh material no longer can be mined at profit, and the crude refining on the ground has given way to better work in large refineries. The industry is closely controlled. The output in 1910 was 42,357 tons, valued at $1,201,842, according to figures collected for the U. S. Geological Survey by Charles G. Yale. This is about the average yearly production since 1903, except for the year 1907, when high prices stimulated mining, and 1908, when, following a drop in price, most of the smaller mines closed. About one-half the borax is consumed by the enameling industry in making kitchen and sanitary ware. New uses are constantly being found for the material and search is as steadily being made for new sources of supply.

Central American Mines in 1911

By T. LANE CARTER

Central America is generally considered to consist of the five republics, Guatemala, Honduras, Nicaragua, Costa Rica, and Salvador. Panama should be included in this list, but sometimes it is put in as South American. Mining in this part of the world has not yet come into its own. Unsettled and unsatisfactory political conditions, together with the lack of transportation, have been the principal causes for the backward state of development. The year 1911 shows some advance, and during this time the attention of capitalists has been more attracted to the mining possibilities of Central America than for many years past.

On account of the revolutionary troubles in Nicaragua and Honduras, the attention of the world was turned more to these two republics than to their more quiet neighbors. During 1911 Nicaragua settled down to comparative peace, after one of the worst revolutions in its history. Everyone recognizes the tremendous help that the United States rendered to the revolutionary movement in an indirect way. Had it not been for this indirect help of the United States, ex-President Zelaya would still undoubtedly be in power. During the year, General Estrada, the leader of the revolutionists, was succeeded in the presidency by Adolpho Diaz, a distinguished citizen of the city of Bluefields. President Adolpho Diaz has been connected with mining in eastern Nicaragua for many years, having been employed by the La Luz y Los Angeles Mining Co. As he is well acquainted with the needs of the mining industry, it is highly probable that he will do all in his power to advance the mining interests. During the year 1911 a fundamental weakness in the mining law of Nicaragua was brought to light. This cropped up over the negotiations for the Bonanza mine in the Piz-Piz district. This is in regard to the deep-level claims. Under the present law titles to deep-level claims are uncertain. Now that the weakness has been pointed out, there is no question but that the Government will change the law so that large companies going in there will be sure of their deep-level claims. One of the difficulties has been the existence of the Dietrich concession, which blankets a considerable district. No doubt this matter will be amicably adjusted in time.

NICARAGUAN MINING DISTRICTS.

At the beginning of 1911 there was a deal on for the Bonanza mine in the Piz-Piz district between the owner, Joseph La Pierre, and some influential capitalists in California. At first it looked as if the deal would go through, but there was a hitch somewhere, and about the middle of the year, after spending a considerable amount of

money in examination and development, the American capitalists decided not to go on. The failure of the sale seems to have been really acceptable to the owner of the Bonanza mine, and now that he is still to own the property, Mr. La Pierre has decided to put in new machinery and to work the mine on a larger scale. Negotiations are going on for the sale of the Lone Star mine, which is next to the Bonanza mine, and it is possible that this mine will be sold during 1912. The biggest mining deal during 1911 in Nicaragua was the purchase of the 18⅞% of the La Luz y Los Angeles mine for $185,000 by the majority shareholders. This property is now entirely owned by some Pittsburg capitalists, and the price which they have given for the minority interest shows that they place a value of $1,000,000 on this mine. The output of gold in Nicaragua in 1911 amounted to a little over $1,000,000. At the present time this is the only metal of economic importance produced in this republic. It looks as if the mineral wealth of Nicaragua would prove to be principally gold.

Revolutionary troubles in Honduras were straightened out during the year. This republic groans under a terrific national debt of more than $100,000,000. It is significant of the growing importance of Central America and the interest these republics are now exciting, that such a strong banking firm as J. P. Morgan & Co. is arranging to take over the debt, not only of Honduras, but to loan a large sum to Nicaragua as well. If the future of these republics seemed dubious, a firm as cautious as the one involved would never consider the lending of so much money. Recent revolutionary troubles have proved that the agreement entered into between the republics, not to war the one against the other, is to be strictly respected in the future. The United States will see to it that there is no more inter-republic strife. Whatever fighting is done in the future will be confined to internal revolutions in each republic. The outlook for permanent peace in Central America was greatly improved during 1911.

Mining in Honduras in 1911 did not make much progress. The premier mine of the country is, of course, the Rosario at San Juancito near Tegucigalpa, which has been in continuous operation for thirty years and has produced over $16,000,000 in gold and silver. At present there is in sight about $4,000,000. The milling plant is up to date and the mine is a dividend payer. There are other mines in the same district, and with better conditions they should develop rapidly. The Gigante, under development by San Francisco capitalists, has been under examination on behalf of English investors. Honduras seems to be rich in silver, but there have been recent denouncements in gold, lead, copper, kaolin, iron, marble, saltpeter, aluminum, chalk, coal, antimony, zinc, and nickel. While the figures are not yet completed for the production of 1911, the indications are that the gold and silver output for the year from Honduras will amount to nearly $2,000,000, United States currency. A small amount of iron ore was also shipped.

Salvador is the most populous country of Central America, but as its people do not indulge in frequent revolutions, the world does not hear as much of this republic as Nicaragua and Honduras. During the year 1911 mining has been carried on successfully, the total product of gold and silver amounting to about $1,300,000. It will be some time before the official figures are published, so this amount is only approximate. Conditions are more settled in this republic than in any of the others, and it has been more prospected than either Honduras or Nicaragua, two republics which in many sections are still unknown.

The Republic of Panama is known to the world more by its canal than as a mining country. Gold mining has been carried on in the Darien and Veraguas provinces for a long time. One company has closed its works on account of a defective cyanide plant having been built. The ore at this property is rather low grade, but with a suitable cyanide plant it could be made a success. The outlook for mining in Panama is fairly good. The country has not as much promise, however, as Nicaragua and Honduras seem at present to hold out.

Costa Rica has developed more in agriculture and fruit growing than in mining. There are one or two properties, however, owned by close corporations of American capitalists, that are making good profit. As far as stability of government is concerned, Costa Rica is the most fortunate of the Central American republics and during 1911 there were no political disturbances. The effect of the serious earthquake in 1910 was still felt during 1911, and mining did not make any marked advance.

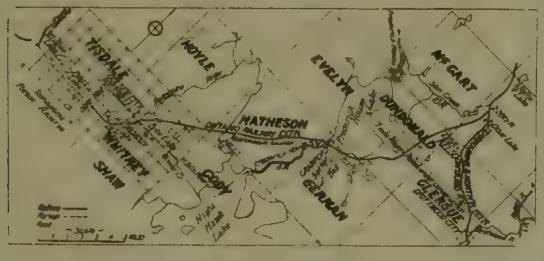
Mining in Guatemala is at a low ebb, not because the country is without mineral resources, but on account of unfortunate conditions, principally the lack of transportation. The small amount of gold now being produced in the republic comes from placer mines. Some prospecting was done during the year, and Guatemala is now known to contain deposits of gold, silver, copper, iron, lead, zinc, and antimony. An interesting deposit of mica not far from Guatemala City was brought to my attention recently. Not sufficient is yet known of this deposit to tell what its value will be. A most interesting and promising district in Guatemala attracted some attention during the year, namely, Alotepeque, about 65 miles south of Puerto Barrios in the eastern part of the republic. A map of the region will show that this district is near the corner where the three republics, Salvador, Guatemala, and Honduras, join. In the Middle Ages a considerable amount of mining was done here, and there is an old silver mine with a great record as a producer of white metal. Some years ago the Venture Corporation of London had an option on these properties, but never took over the mines. The indications for the opening up of a large amount of zinc, lead, and silver ore are most favorable, and during the year 1911 there were several inquiries on the part of big owners regarding these mines. The railroad people in Guatemala have intimated that they will build into this district whenever they see a crowd of financiers big enough and earnest enough to make a success of the venture. This district of Alotepeque is one of the most attractive in Guatemala. Being so near the railroad, the ore can readily be shipped to the smelters of Europe, and no doubt in time this district will contribute a great deal of lead-silver and zinc ore to Germany and Belgium. The freight from the mine to Hamburg will be remarkably low, and if these prospects develop as they promise, ore from this district will be able to compete with almost any for the European trade. It is probable that during the next year or so there will be considerable development in this part of Guatemala.

Mining in Central America is dependent to a large extent on railroad development. There has been progress made during 1911 in this direction. The proposed railroad from Bluefields, Nicaragua, by way of Rama to the lake will probably aid agriculture as much if not more than mining. Those best acquainted with the mining resources of Nicaragua would have preferred to have a railroad into the Piz-Piz district, as this region is the most promising of the gold areas of Nicaragua. The proposed line will serve one old mining district, at any rate, namely, the Libertad district in Chontales, where gold has been mined for over sixty years. In Honduras it is proposed to connect the capital, Tegucigalpa, with the coast by means of a railroad. The construction of this road will greatly stimulate mining in Honduras. It will not be many years now before the traveler can go by rail from New York City through Mexico, Guatemala, and the other republics to the Panama Canal. This line will mean as much to the people of Central America as the Cape-to-Cairo line means to Africa.

It is a satisfaction to state that during 1911 real progress has been made in Nicaragua in the improvement of the gold metallurgy of the country. At the Siempre Viva mine, the manager, H. B. Kaeding, has attacked the slime question with energy and ability, and it looks as if under his guidance this property will become a dividend payer, as it promised to become when first examined by Courtenay De Kalb about twenty years ago.

Mining in Eastern Canada in 1911

The year just closed has been characterized by marked progress in the mining industry, more especially in the Porcupine district. The rapid development of this field has been largely due to the extension of the Temiskaming & Northern Ontario railway, owned and operated by the Ontario Government, to Porcupine Lake, previous to which great difficulties were experienced in transporting heavy machinery and supplies. In the month of July the surrounding country was ravaged by extensive bush fires, which swept the camp, causing great loss of life and destroying or seriously damaging the buildings and plant on most of the mining properties. This disaster considerably delayed production, but the work of reconstruction was begun as soon as possible and actively carried on throughout the fall, with the result that the hastily erected temporary structures of the early days have generally been replaced by permanent and substantial buildings suited for operations on a larger scale. Prospecting has also been rendered easier by the clearing up of the country by the fire, and many important discoveries have been made. Underground work and diamond-drilling have also proved several of the mines at depth, assuring the occurrence of sufficient milling ore to justify the erection of stamp-mills. The actual production of gold has as yet been small, but



RAILWAY TO PORCUPINE.

considerable quantities of ore have been accumulated in readiness for the machinery, and it is announced that the mills of the Dome, the Hollinger, and the Vipond will be in active operation early in the year. During 1911 the known gold-bearing area of the district has been considerably extended by discoveries in outlying areas, including Swastika, West Shining Tree, and Bristol township, the most promising of these being the Swastika, where development on an extensive scale has been undertaken on several properties. Porcupine has attracted widespread attention from both American and British investors, and much capital has been drawn from these sources. The principal drawback, however, has been the extravagant prices placed by the owners upon improved prospects, which has done much to retard development.

There has been a considerable revival of interest in the gold-mining districts of northwestern Ontario, more especially the Lake of the Woods and Manitou Lake areas, where several mines which were formerly producers have been reopened, after having been closed for many years. Some of them had ceased to be remunerative owing to the antiquated methods then in vogue of mining and ore treatment; but it is anticipated that with the use of modern machinery and the latest processes, they can be profitably operated.

While the silver-mining industry at Cobalt has made steady progress, the leading mines continuing to yield fair returns upon their capital, this field has been eclipsed in public interest by the greater prestige of Porcupine. The industry suffered during the winter and early spring from a shortage of electric power, but when this difficulty was overcome by the return of open weather, normal conditions were resumed and the output of silver showed a satisfactory increase as compared with the previous year. The most noteworthy feature was the extensive substitution of concentrating and refining processes for the shipment of low-grade ore, resulting in a steady diminution of the tonnage output. Statistics for the nine months ended with September show that while the ore shipments, as compared with the corresponding period of 1910, have decreased from 23,824 to 18,592 tons, the quantity of concentrate sent out has increased from 4633 tons to 6915 tons, and the output of bullion has risen in value from $247,263 to $1,116,571. The Nipissing company has for some time been successfully treating its high-grade ores by a combined system of amalgamation and cyanidation, and has arranged for the erection of a 200-ton plant, in which the low-grade output will be treated by a modification of the same process, which will largely increase the value of its ore reserves. The same company has erected a hydraulic pump for the purpose of removing the overburden on its property, in the hope of discovering new veins. During the later months of the year the La Rose Consolidated materially improved its position by important discoveries on several of its properties. The company continued the conservative policy of accumulating a large reserve fund instead of increasing the rate of dividend. While the prominent mines have generally maintained their shipments, the stock market for some months previous to the close of the year showed great depression, and a number of the weaker issues entirely disappeared from the list. The outlying districts of the Cobalt field contributed comparatively little to the silver output, the figures for the first nine months of the year being: Cobalt, 22,272,783 oz.; South Lorraine, 626,131 oz.; Gowganda, 286,925 ounces.

The earlier part of the season witnessed increased activity in the production of iron ore and pig iron. The slackness of the iron and steel industries in the United States, however, seriously affected conditions in Canada, and some months since several of the iron ore mines in Ontario and Nova Scotia were closed for the season. Production has been actively carried on, however, at the Helena mine in the Michipicoten district of Ontario, with an output of about 1100 tons per day, most of which is consumed in the furnaces of the Algoma Steel Works at Sault Ste. Marie, and other mines in that district have been active. The iron-manufacturing industry was adversely affected by the withdrawal of the bounties on iron and steel, given for some years by the Canadian Government, and a movement for their restoration has been set on foot. Meanwhile, the manufacturers have been endeavoring to meet the change of conditions by effecting greater economy in production. Important extensions have been made to the plant of the Dominion Steel Corporation, at Sydney, N. S., which will largely increase the output, and the Steel Company of Canada is preparing to make additions to its plant at Hamilton, Ont., at a cost of $2,000,000, including a rod, blooming, and billet mills, and two 60-ton continuous open-hearth furnaces.

The coal output of Nova Scotia has considerably increased. The Dominion Coal Co. is increasing the number of its collieries from four to twenty, and has broken all records for production during the season from May to November, its output amounting to 2,480,000 tons, as against 2,363,970 tons in 1910. Of this quantity 1,501,000 tons was shipped to the St. Lawrence ports, the total coal shipments from Nova Scotia to that market aggregating nearly two million tons.

Production has been steadily carried on in the nickel-copper mines of the Sudbury district, though the latest available returns show a comparatively slight diminution in the output as compared with 1910. The asbestos industry in Quebec province is at present under a cloud, owing to the failure of Amalgamated Asbestos, Ltd., a merger embracing many of the leading mines, to meet the interest on its bonds for $8,000,000, by reason of the depressed condition of the asbestos market. A financial reorganization will be necessary. Mica mining was slack during the greater portion of the year, many properties in Quebec and eastern Ontario being closed down with accumulated stocks on hand on account of the low prices prevailing. Recently, the market has improved and the prospects for the industry are favorable.

Transvaal Gold-Mining

By Rowland Gascoyne

General Conditions

The year in South Africa, despite the chronic shortage of native labor, was marked by steady progress in many important particulars, of which there is room to mention but a few. Extensive drilling under expert guidance seems to have finally dissipated any large hopes of discovering new areas of gold bearing banket comparable to the Rand, or any considerable extension of the present known area. In this, and in other particulars, the Rand is settling down into the period in which the best possible use must be made of known resources and less expectation based upon the unknown. Outside the Rand there have been no important gold discoveries, and in the Barberton and Lydenburg districts 1911 has brought little change. The year has chronicled the entrance of the Randfontein Estates into the struggle for the position of the largest gold producer on the Rand and in the world, but while the company has on several occasions beaten the East Rand Proprietary Mines, it was not until October that it succeeded in passing the Crown Mines and taking the top position on the list. The entrance of the Bantjes mine into the producing list has been an important feature of the year, but for some reason or other, the results have not come up to expectation. Another interesting new producer was the City Deep, and there have been numerous other changes in rank among producers. The metallurgical record is one of much interest, and is briefly sketched elsewhere by Alfred James; the share market is discussed by T. A. Rickard; these pages will be devoted, therefore, to improvements in mining technology.

Rectangular *Versus* Circular Shafts

During the year the amount of vertical shaft-sinking carried on has been below the average. The starting of the four large rectangular shafts on the goldfield known as the Government Areas without any previous boring to prove the position of the Main Reef series caused some comments in mining circles, especially in such a variable area as that of the Far East Rand. When, however, it is recognized that this huge field has been practically proved on all sides by neighbors such as the different Modderfontein properties, Van Ryn Deep, Brakpan Mines, and Geduld, there does not appear to be much necessity for preliminary bore-holes. Drilling in the same neighborhood has shown that bore-holes are valueless as indicators of the probable average yield of a deep-level goldfield. At Geduld they gave excessive assay values, and at Brakpan much less than actual mining operations have shown. As indicators of the strata to be passed through and the depth of the reef, bore-holes are undoubtedly valuable, but practically all this information was, in this case, available. This is another instance of the closer relation deep-level mining on the Rand now bears to coal rather than metalliferous mining. Sinking of circular shafts on the Rand has also emphasized the relation. This is not by any means the first time a circular shaft has been sunk on the Rand; in fact, there are several circular shafts in existence already at Rand gold mines. Nor does it indicate that all the shafts in the future are likely to be circular. Shaft shape on the Rand will probably be more governed in the future by the surrounding conditions than has been the case in the immediate past. The advantages and disadvantages of both circular and rectangular shafts have been largely discussed on the Rand during the past year. Late in the year the Welgedacht Exploration Co. was compelled to cease sinking a rectangular shaft owing to the excessive water, which was officially stated to be less than 2,000,000 gal. per 24 hours. In twelve months the shaft had been sunk only about 200 yards, at the somewhat excessive cost of £170 per yard. At the Grootvlei mine, only a few hundred yards away, a similar monument to the difficulty experienced in sinking a vertical rectangular shaft through heavily watered strata is to be seen. In both instances, before sinking operations were commenced, it was anticipated that large bodies of water would be met. It is well known and recognized that a circular-shaped shaft can better deal with large bodies of water than one of rectangular shape, and that quantities up to 10,000,000 gal. per day have been handled with comparative ease, but here are instances of rectangular shafts disabled and stopped after the expenditure of double the amount probably required to sink and line a circular shaft. Then, too, in these deep level vertical shafts designed to work enormous areas, the ventilating advantages are all with the circular shaft, and ventilating difficulties are coming to be recognized on the deep-level properties on the Rand. It is principally on these two grounds that the reappearance of circular shafts during the year is to be welcomed, but their introduction is naturally meeting with some opposition from engineers who have always used rectangular shafts. No one will

SOUTH AFRICA.

deny the many advantages a rectangular shaft possesses where the ground is strong, a moderate amount of water is made, and the property is small and of uncertain value, but the experience on the Rand during the last twelve months seems to indicate that where the Witwatersrand beds are overlain by a considerable thickness of soft ground and dolomite carrying heavy flows of water, circular-shaped shafts may be necessary, while for ventilation purposes in some of the deep and extensive mines, they may even become indispensable. A somwhat premature start was made on the West Rand Estates to sink a circular shaft through bad and wet ground, but owing to difficulties with the special pumps designed for the purpose and insufficiency of capital, work was suspended after reaching a depth of only 20 ft. At the Government Area mines on the Far East Rand, where four large deep shafts are being sunk to the Main Reef series, the question of the shape of the shafts seems to have been fully investigated, and, after all the advantages and disadvantages of both circular and rectangular shafts were considered, it was decided to continue the almost general Rand practice of sinking rectangular shafts. These are now making rapid progress.

Ventilation and Health

During the year a goodly number of ventilating fans have been installed at several of the older mines and, owing to the air having to pass through rectangular shafts of small dimensions, it has been found necessary in some cases, owing to the excessive resistances offered to air currents in these rectangular shafts, to place the fan underground. Underground ventilation has, indeed, attracted much attention this year. Some time ago a system of fan ventilation was introduced at the East Rand Proprietary mines with such satisfactory results that quite a number

of fans were installed during the year just closing, the Sirocco type perhaps being the greatest favorite. It has been found on the Rand that where operations reached a depth of 3000 ft., natural ventilation aided by compressed air is insufficient to keep the mines in a healthy condition, or meet the requirements of the mining regulations. According to Section VI of the Transvaal Mining Regulations, not less than 70 cu. ft. of air must be provided for each person employed below ground, a requirement not always insisted upon in the past, and one, moreover, that natural ventilation cannot, under all circumstances, be expected to supply. Owing, probably, to more attention being bestowed on ventilation, there have been apparently fewer 'gassing' fatalities than usual during the year. If the provisions of the mining regulations were carried out, especially those providing that all working places and traveling roads shall be in a fit state for persons to work and travel therein, these 'gassing' fatalities would altogether disappear. There seems to be a stronger tendency to carry out the mining regulations since the responsibility for complying with them was placed on the shoulders of the mine managers, but there is still room for improvement. In the Transvaal no inquests are held and no particular attention is called to mine accidents, although they are published monthly by the Government Mining Engineer. Up to the time of writing, no unusual accident of any magnitude as regards loss of life has occurred during the year.

Mine Dust and Miners' Phthisis

During the current twelve months miners' phthisis has attracted unusual attention, especially in the Union Parliament, where an ill-considered and somewhat premature measure on the subject was introduced and afterward withdrawn. Legislation has been postponed until further knowledge is available. It was known, however, that the disease had secured a good hold on the mining population, one official of the Mines Department and a mining expert fixing the proportion at one in four of the underground miners, but this is probably an exaggeration. So many cases are known to exist that the Government felt compelled to pass a scheme of relief for advanced cases to which the Government as well as the mining companies were called upon to subscribe. The fine Rand quartzitic dust is perhaps the most prone to cause miners' phthisis of any known mine dust in the world, and what seems equally striking is the fact that the miners on the Rand are the most careless and negligent of any in taking effectual steps to guard them against the disease, even if every appliance is supplied them for that purpose. According to the mining regulations, every dry development place and dusty stope must be provided with a continuous adequate supply of water for damping the broken ground and allaying the dust caused by drilling operations. No persons are allowed to drill holes unless a water jet or spray or other device is provided so as to prevent the escape of dust into the air or to remove broken ground before it has been effectively damped. The complaints that miners neglect to take any precautions to prevent the spread of the disease, particularly with regard to the use of water, are all the more remarkable, seeing that by its use drilling operations underground are considerably facilitated. So striking is this neglect on the part of the miners that a paper on the application of water to underground drilling operations and the advantages accruing therefrom at the Nourse Mines, was read by one of the assistant mine inspectors. It led to an interesting discussion in which frequent mention was made of the aversion of the miners underground to the use of water as provided for in the regulations. Even at the Nourse Mines it was stated that the system had not been introduced without considerable coercion on the part of the management.

Concentration of Underground Work

The most important step taken during the year with regard to actual underground operations on the Rand appears to be that of concentrating as much as possible of the work. In the past, when the areas worked by the same company were smaller than they are today, the vagaries of the yield and the higher costs did not allow this to be done, and the higher average yield also allowed operations to be scattered in order to secure the highest regular monthly yields, because at that time working costs were not considered of such primary importance. Today the amalgamated concerns on the Rand face a different aspect, each mining large areas where the yield varies considerably in value. Some of these amalgamated concerns are operating at enormous depths, and it is becoming necessary to adopt a systematic method of working, which in itself means concentration, and it is hoped a much lower average working cost per ton. Briefly, it has been decided, in order to facilitate deep mining, to adopt stage winding, and on all the large properties, main levels of large dimensions are being driven as straight as possible from one end of the properties to the other, the first at depths not exceeding 3000 ft. These main levels are intended to act as feeders to the shafts, and outputs carrying up to 6000 tons per day of 10 hours from one shaft are expected. These are supplied with ore from above as well as below by subordinate levels, as much as 300 to 500 ft., according to the dip of the reef and other conditions. These principal levels will also be fitted with electrical or mechanical haulage, as may also be the subordinate levels where conditions are favorable, so that underground tramming expenses ought to be reduced to at least one-half of their present figure. Similar main levels will be driven as greater depths are attained, the second stage of winding being thus fixed at something less than a depth of 6000 ft. This, however, is at present all anticipation, as the deepest workings have not as yet exceeded 5000 ft. Another proposal is to work the reefs on the Far East Rand, where they run fairly flat on a modified system of longwall; the most recent proposal being to construct the principal drives in the foot-wall and at considerable distances apart. It was several years ago that the longwall method of working was first suggested for the flat reefs at Geduld in the Far East Rand, but it has never been adopted. More recently a modified system of longwall has been suggested for some of the neighboring properties. In both these methods of working, operations underground will be closely concentrated, and the ore removed at one operation. Under these circumstances, the cost of mining per ton ought to be materially reduced. Whether these systems of working the Rand reefs will be sufficiently cheap to withstand the effects of varying yields or the desire for uniform monthly results, and at the same time compensate for the variation in ore values by a large reduction in the working costs, remains to be seen.

Decline of Grade and Costs

During the year the question of a gradual impoverishment of grade with depth on the Rand has been much discussed, one mechanical engineer putting forward the view that at an average depth of 4000 ft. the grade would have fallen and the working costs increased to such an extent as to render further mining unprofitable. There is, however, nothing to show that the Rand will suffer as much general depreciation in depth as other mining fields in the world, while the idea that working costs must necessarily increase with depth is most distinctly opposed to what has actually occurred during the past twenty years on the Rand. There are numerous instances on the Rand where the grade has fallen with depth, and it may continue to fall for some time to come, but there are also other instances where after declining it has recovered. In almost every instance, working costs have declined with depth; perhaps not so much on the average as the grade milled, but it is becoming palpably clear that while a mining engineer cannot introduce a higher yield, he can and does bring about lower working costs when same are absolutely needed. In other words, he can adapt himself to surrounding conditions, and nothing seems more calculated to reduce the working costs on the Rand than the stern necessity which will be created by a lowering grade. On this and general grounds, the attempt to limit profitable mining on the Rand to a depth of 4000 ft. must therefore

be regarded as quite unjustified by the short history of the Rand.

Sand Filling Stopes

The practice of sand-filling the exhausted stopes is gradually being extended, but it is far from being generally used. In no case, however, where it has once been started, has the practice been abandoned. To support buildings and shafts where careless mining has caused a movement, sand-filling has proved an unqualified success. It is found that a vertical 4-in. pipe can convey 100 tons of sand per hour quite easily in a mixture of 3 tons of sand to 1 ton of water. One ton of water to 4 tons of sand may be used in most cases, but with well arranged launders and bins on the surface, 1 ton of water to 5 of sand may be used. Special bore-holes for conveying sand to the stopes have been made, one at the Robinson Deep extending over 1600 ft. deep from the surface. If lime is used, it is found that ordinary bare pipes or porcelain-lined pipes are best; wood-lined pipes have been abandoned. For straight inclined runs, wooden launders are the best. The Rand tailing is very destructive to pipes, and their cost, including renewals, runs from $\frac{3}{4}$d. to a penny per ton of sand delivered into the stopes. The wooden barricades necessary to retain the sand in position along the levels until drained and set, are the cause of great trouble and also largely contribute to the cost, which might be avoided if mining operations were conducted in the first instance with a view to sand-filling. The total cost of sand-filling varies considerably. Where things are well arranged at the surface and conditions favorable, it may be as low as 3d. per ton of sand filled. Generally, however, it costs about 6d. per ton, and in one case where the surface arrangements are anything but good, it costs 10d. per ton. Even at this high cost, in this particular instance it pays for itself, and the impression is gaining ground that if primary mining operations were conducted with a view to subsequent sand-filling, and so the leaving of pillars rendered unnecessary, a direct profit rather than additional cost would result.

Electric Power

Perhaps the most important feature of the year has been the success attending the general application of electrical power to mining operations. For pumping, surface haulage, and lighting purposes, electricity has been in use for many years, but during the year it has been successfully applied to milling, hoisting, air-compressing, underground haulage, and all the hundred and one processes on the mines needing the application of power. Today there are few mines where electrical power is not in use, and had the Victoria Falls & Transvaal Power Co. been in a position to meet the demand, or even to carry out its contracts, the use of electrical power on the Rand would have been far more general than it is today. Many of the mills on the Rand during the year have been changed over from steam to electricity, and when the power supply has been ample and uniform, the millmen prefer using electrical power to steam. Electrical hoisting has also come much into vogue on the Rand during the year. The Eckstein group of mines has adopted the three-phase system, while in the majority of other cases the Ward-Leonard system has been chosen. There is considerable discussion going on at present, with regard to the different merits of the two systems. The three-phase system is the cheaper in first cost, and for slow hoisting and shallow depths has many advantages over the Ward-Leonard system. Its principal drawback is that its control is less perfect and reliable than the Ward-Leonard system. On this account, where the shaft is deep, loads heavy, and speed anything approaching or exceedingly 2000 ft. per minute, the Ward-Leonard system is generally preferred. The advocates of this system point out that, although its first cost is greater, there is not much difference when running costs are taken into consideration. At no time and under no consideration, they urge, should general safety of life and limb and better control be sacrificed, even to save capital expenditure.

Rhodesian Mining Development

The unskilled labor problem in Rhodesia is as acute as ever, and mining concerns, individual workers, and farmers throughout the country are putting their heads together and endeavoring to discover new ways and means of augmenting the labor supply. With a view to improving the situation, the Labor Bureau has been reorganized, and the new concern has a capital of £75,000 in debentures bearing 5% interest. The new Bureau proposes spending a considerable amount in establishing new rest depots and routes, and in exploitation of areas which have not as yet been visited by labor-recruiting agents. Meantime, work at the various mines progresses, even if not at the most desirable speed. Developments at the Shamva mine in the Abercorn district of Mashonaland continues satisfactorily, and there are now about 1,600,000 tons of ore developed, the average assay value being in the neighborhood of 4^{3}_{1} dwt. per ton. Provision for a railway has been

RHODESIA.

arranged and plans for the equipment of the mine and battery are therefore being prepared. The Kansanshi copper mine, which is situated on the Congo-Rhodesian border, has delivered close on 500 tons of copper to the Northern Extensions railway. The Kafue Copper Co. is also conducting productive operations. The smelter of this latter concern was worked for 23 days during September and produced 327 tons, 73.5% matte. The British South Africa Co. has announced the flotation of a mines development company with a capital of £250,000, which has been hailed with satisfaction throughout Rhodesia. The avowed objects of this flotation are (*a*) assisting to bring about the more rapid development of mining in Rhodesia, (*b*) consideration of prospecting schemes, and (*c*) formation of subsidiary companies. It is hoped that this will lead to more rapid development of the country. Another Rhodesian flotation of importance is the Planet-Arcturus Gold Mines, Ltd., which possesses a capital of £475,000 in £1 shares. Of this sum, £150,000 has been set aside for working capital, and shares to this amount will be offered at par to shareholders in the Rhodesia Exploration & Development Co., of which Planet-Arcturus is a subsidiary. The properties to be acquired by the new company are situated in the Enterprise district of Mashonaland, and at no great distance from what are known as the Gold Schists of Rhodesia Mines.

Gold-Dredging in Russia

By Charles Janin

*Statistics of the dredging industry in Russia and Siberia have been collected yearly since 1906, by the permanent consulting board of the Gold and Platinum Producers Association. Translations of the published reports in *Zoloto i Platina* appear, from time to time, in the technical press, and show that the dredging industry plays an important part in Russian mining. The number of dredges in Russia has increased steadily from 40 in 1906, to 66 in 1910, and a number of new ones are reported for 1911.

Dredges Operating in Russia, 1906-1910

	No. of dredges in existence	Dredges reporting	Average No. of working days	Average hours worked	Cu. yd. handled per dredge	Approximate recovery per dredge	Approx. value per cu. yd.
1906	40	32	173	2837	159,600	$19,205	12.0
1907	64	46	137	2259	139,300	20,235	14.5
1908	64	49	149	2502	166,400	25,380	15.2
1909	64	41	164	2771	188,805	32,185	17.0
1910	66	55	...	2914	182,486	31,357	16.0

Dredges, with buckets of 4½ to 5-cu. ft. capacity, predominate, though there were 22 having 7-ft. buckets, in 1909, and many of the newer ones are of this size. The average yardage handled per dredge in 1910, for 55 dredges reporting, was 182,486, on an average working time of 2914 hours. This gives 62.6 cu. yd. per dredge per hour, which is small, compared to the 500 yd. per hour sometimes reached by the modern 15-ft. California boats. Dredging, in Russia, seems particularly characterized by the small percentage of dredges that are reported as working at a profit. Though the average value of the ground worked in 1909 was 17c. per cubic yard, only 25% of the dredges operating that year made a profit, and, according to a translation by W. H. Shockley, in the *Mining and Scientific Press* of May 20, 1911, "if attention is given to the royalty paid, several dredges must be excluded from that list." According to the data furnished by the commission, in order to pay the operating expenses of a dredge, allowing for amortization, it is necessary to work ground of the following value, the figures being in cents per cubic yard:

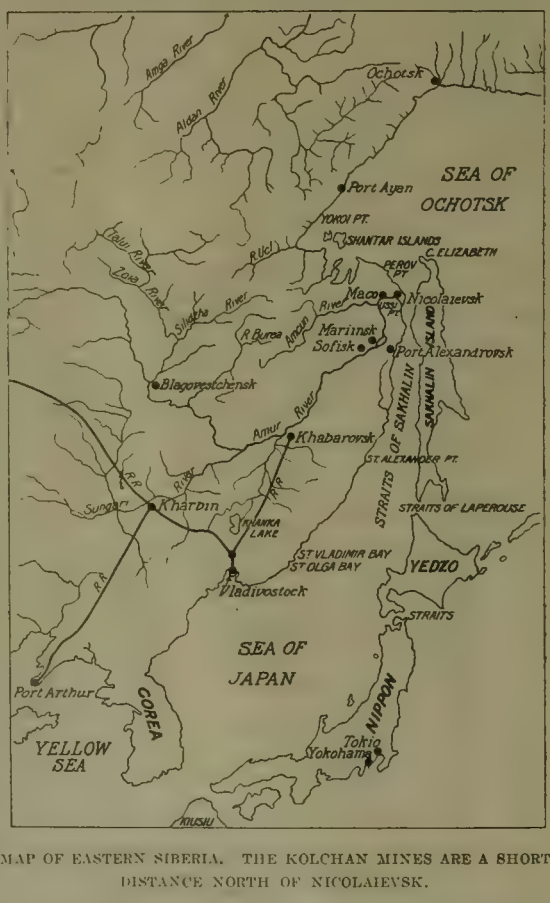
Bucket capacity, cu. ft.	Urals.	Western Siberia.	Eastern Siberia.
2	22.96	28.04	32.72
4	15.15	17.96	20.40
5	12.18	14.35	16.24
6	10.59	12.62	14.14
7	9.55	11.56	12.98

According to S. I. Littauer, 46 of the dredges operating in 1909 dug material exceeding the gold content indicated as necessary for commercial success, yet many of the dredges actually worked at a loss. In the report for 1910, in many cases the names of the dredge builders are given, and, while the list is not complete, it is interesting to note that out of 36 dredges, 7 are of foreign make. It is admitted that the Russian-built dredge cannot compare in material used, construction, and efficiency with the foreign-built boats, especially those of American manufacture, and there has been considerable agitation among those interested in the Russian gold placers to have the duty again taken off gold-mining machinery. For a period of ten years, this duty was remitted, but a few years ago the Government, acting in the interests of the dredge builders, put the duty on again, though the free importation of machinery is, I understand, still permitted in the Amur and Primorsk districts in Eastern Siberia. The dredges built by the Russian builders are of lighter construction, and made of material much inferior to that used in dredges following the best American practice. An instance of lighter construction in the case of steel hulls may be mentioned. According to Ross B. Hoffmann, the hull of a 7-ft. Russian-built dredge weighed 190 tons; this is only about one-half the weight of the steel hull on the American-built Kolchan dredge, described below.

Among the new installations for Russia, in 1911, are two Werf Conrad dredges in the Amgun district, Siberia. One

FORWARD VIEW OF STEEL HULL, KOLCHAN DREDGE, SHOWING ROUNDED BILGES.

of these has buckets of 7-cu. ft. capacity and is designed for a working depth of 25 ft. The total engine power is 160, and the dredge hull is of steel. The other dredge is a small prospecting machine, with a bucket capacity of ½ cu. ft., and is said to be driven by hand-power. The Kolchan dredge, of the Orsk Goldfields, Ltd., was put in commission October 25, of this year. This is an installation that has attracted wide attention among those interested in the Siberian dredging industry. The ground was prospected by C. W. Purington and J. Power Hutchins, with Empire hand-drills, and a stacker scow, was put in operation on the property in August 1909. This was described by Mr. Purington, in the *Mining and Scientific Press*, February 4 and



MAP OF EASTERN SIBERIA. THE KOLCHAN MINES ARE A SHORT DISTANCE NORTH OF NICOLAIEVSK.

*Reviews of gold-dredging in other countries will appear in a later issue.

11, 1911, and was also mentioned in my article in the number of October 14. Figures of operation for the entire past season are not available, but for the greater part of the season the plant has been averaging about 1000 yd. per day, and has produced during the past five months, $121,000, gross. The total operating cost, exclusive of administration, amounted to $10,050. The difficulty of disposing of the tailing, the cause of many failures on plants of this character, was overcome by mounting the machinery for washing and stacking the gravel on a scow and floating it behind the excavating machine. The washing apparatus was specially arranged to meet the conditions, the gravel containing much clay. The plant was designed and built by the New York Engineering Co., which also designed and built the Kolchan dredge.

The Kolchan dredge has buckets of 8-cu. ft. capacity and a steel hull 95 by 40 by 9 ft., weighing 375 tons. The dimensions of the hull are as follows. It is 95 ft. long, 42 ft. beam, and 9 ft. deep. Frames are spaced 28 in. apart, with 10-in. floor beams, and 6-in. deck beams. These beams consist of what is commonly known as ship-channels. Two solid bulkheads of ½-in. steel plate, reinforced by 4-in. angles run throughout the entire length of the dredge and form each side of the well. Cross bulkheads of solid plate extend across the pontoons at the different points, and the hull really has a double stern. The last frame, placed 28 in. from the stern, is built up of solid plate so that a separate compartment is formed at the rear of the dredge, and in case the spuds break through the shell at any time, this affords ample protection. The hull weighed about 350 tons, which is about twice as heavy as the same size hulls that are now in the course of construction by some others. A 500-hp. steam-plant generates electric power. This plant consists of a cross-compound, medium-speed, 4-valve engine, directly connected with a 400-kw. generator wound for 6600 volts, 3-phase alternating current. The power is transmitted ten miles to the dredge, where it is stepped down to 440 volts. A complete machine-shop equipment, a wood-sawing and splitting plant, together with two 700-ft. conveyors for stacking and conveying the fuel to the boiler, a complete pneumatic riveting plant, besides dredge extras and traction engines for hauling material, were included in the plant equipment, and the complete plant, weighing 2000 tons, was built to design and shipped in four months and ten days; a noteworthy record.

The number of dredges working in Russia seems small in comparison with the vast placer areas in that country, and may be partly attributed to the high operating cost, and inefficiency in general, of the Russian dredge, which would tend to discourage further installations; also to the lack of capital, which is perhaps the most important circumstance retarding the development of the dredging industry in Russia. The Russian capitalist is well known for his timidity in entering unknown fields in the development of a new industry and it will be due to the initiative taken by American and English capitalists, that any great advance will be made in gold dredging in Russia. The field should be particularly attractive to American investors. The gravel is rich, the climate and physical conditions somewhat similar to Alaska. While the low operating cost obtained by the California dredges are for various reasons impossible in Russia, the introduction of the modern California type dredge will unquestionably show that thousands of acres of auriferous gravels that are at present considered unprofitable, or that are not yet exploited, can be worked at a profit. Mining engineers, familiar with the conditions, and dredge builders in general, are devoting attention to the dredging possibilities in Siberia. The success of the Kolchan dredge, which, so far as I know, is the first modern American type boat in Siberia, will undoubtedly encourage the investigation of new areas, in the interests of American and English capital. To those interests, when associated with influential Russians, and under the direction of competent engineers, Siberia offers, in my opinion, one of the most attractive fields for the mining capitalist.

KOLCHAN DREDGE, EASTERN SIBERIA, BUILT BY NEW YORK ENGINEERING COMPANY.

Diamond Mining in Africa

There is not much new regarding African diamond mines. No new profitable mines appear to have been discovered during the year, but better prices have ruled, and the large producing mines at Kimberley and Pretoria have done better. The Premier mine near Pretoria is the only mine of any importance in the Transvaal. The output shows but little change, the improvement in price for the stones has, however, benefited the company, but the Government impost of 60% of the profits is one the company finds burdensome. Attempts have been made during the year to revive interest in several abandoned diamond areas in the Pretoria district, but without success. The Montrose diamond property continues to be worked at considerable loss to the shareholders, with little prospect of any change for the better taking place, and why work should be continued on this property under the circumstances is difficult to understand. In the Free State diamond fields the year has brought no important change, even the alleged discovery of the new pipe at Roberts Victor mine has turned out disappointing. At Voorspoed mine no change can be noted, the Crown diamond mine continues closed, but the old Monastery mine has changed hands during the year and operations on a small scale are being started. Altogether the year has been a better one for the diamond-mining industry than the preceding one and closes with encouraging prospects.

Metal Mining in British Columbia

By E. Jacobs

Viewed from the standpoint of production only, the year 1911 was not a good one for mining in British Columbia, but speaking generally, satisfactory progress was made.

Cariboo and Cassiar.—Barkerville district and Quesnel division, Cariboo, and Atlin division, Cassar, are the two important placer-gold producers of British Columbia. Both report a decreased production in 1911 as compared with 1910—about $460,000 from the two districts, as compared with $522,000 in 1910. A shorter season for gravel-washing is the reason for the decrease; the season opened late, and there were no fall rains to help out. In both districts there are large beds of gravel available for hydraulicking. A feature in Cariboo was the commencement last summer of operations by the Quesnelle Hydraulic Gold Mining Co., which under the direction of Howard W. Dubois, of Philadelphia, expended nearly $1,000,000 in preliminary work and equipment, and the resumption of work near Quesnel

MINERAL DISTRICTS OF BRITISH COLUMBIA.

Forks by John B. Hobson, the veteran hydraulic placer miner of Quesnel division.

East Kootenay.—Metal mining did not make much progress during the year. Exhaustion of the known orebodies of the St. Eugene lead mine, from which an aggregate of about 1,100,000 tons of ore has been taken, is near at hand, the production of concentrate having decreased yearly from 28,000 tons in 1905 to less than 6000 tons in 1911. The Sullivan has in part taken the place of the St. Eugene, but its enormous ore reserves contain much ore in which the percentage of zinc is too large to allow of profitable treatment of the ore in this province at present. The Kootenay Central railway, now being built, will eventually give transportation to silver and lead mines in parts of the district now without it.

Ainsworth.—This and the following named divisions in West Kootenay appear to have a brighter immediate future. Spokane men have secured and are opening several Ainsworth properties, and the Consolidated M. & S. Co. has bonded others. Arrangements are being made to resume work and ore production at the Bluebell, which is a big lead mine situated across the Kootenay lake from Ainsworth. The Utica, 12 miles west of Kaslo, is shipping ore, and The Deep Mine, Ltd., is extensively developing the deep of the Whitewater group properties, with the object of making tonnage available when concentrating and transportation facilities, destroyed by forest fires in 1910, shall have been replaced.

Slocan.—The mine not having a railway connection, production of zinc ore from the Lucky Jim was not practicable, so development only was undertaken. No. 6 level, 400 ft. below No. 5, was driven 1134 ft., entering the 'lime dike', in which search for zinc is in progress. Rambler-Cariboo opened three shoots of silver-lead ore on each level at 900, 1000, and 1200 ft., respectively, and is extending the 1400-ft. level to find the same shoots. The concentrating plant is being removed down to a new millsite near the railway being constructed to provide transportation for this mine and the Lucky Jim. The development of much ore of good grade in lower levels of the Rambler-Cariboo is considered to have a most important bearing on the future of the Slocan district, this having proved that ore continues to depth. The Washington was further developed; it has much lead-zinc ore in its workings. The Payne is having a cross-cut driven 3300 ft. to cut the vein at 675 ft. below the lowest old level. Cody camp was active. Shoots of silver-lead and zinc ore were found in the Noble Five. The Reco opened a new shoot of ore in virgin ground on No. 11 level. The Twilight also found ore in its No. 2 adit. The Sunset continued driving No. 8 level 1600 ft. to reach a long shoot of ore worked for 300 ft. in length on higher levels. The Surprise passed through good ore when raising from adit at 1100-ft. depth to connect with the bottom of the old shaft 830 ft. above. About Sandon, at the Ruth-Hope the upper levels have been extended, and a lower adit driven 800 ft., while more than 500 tons of silver-lead ore has been shipped. The Richmond-Eureka has continued development and shipped about 2300 tons. A new company has been organized to work the Slocan Star, on which the old workings have been reopened, and a deep-level adit is being driven to cut the vein in 2300 ft. at 630 ft. below No. 5 level. Four-Mile creek mines are flourishing. The Standard has cut good ore in No. 6, which is 190 ft. vertically below the big galena showing on No. 5; has constructed an aerial tramway 8000 ft. from mine to millsite near Slocan lake, equipped a 100-ton concentrating mill, put in a water-line and an air-compressor, and has commenced production on a larger scale. The Silverton Mines, Ltd., has opened much ore on four levels down to No. 7, connected by raises up to No. 4, found rich ruby silver occurring freely in the ore, renovated the Wakefield concentrating mill, and been making experimental runs with one unit of the Elmore vacuum process plant on zinc middling from jigs. The Van Roi, which commenced concentrating at its new mill in March, put about 30,000 tons of ore through the mill and made two marketable products, namely, silver-lead and silver-zinc concentrates. The British Columbia Copper Co. bonded a gold property situated above Slocan lake and commenced developing it. Many other mines in Slocan and Slocan City divisions were worked, as well as those above mentioned.

Nelson.—In this division, further development of the Molly Gibson has been favorable, and the outlook for the mine much improved; it is owned by the Consolidated company, which has put its mill in running order and increased the power available for mining purposes. No information has been received from the Granite-Poorman gold mine, in connection with which some sensations were sprung on the public in 1911 by a local newspaper. The Wilcox, Yankee Girl, and Dundee, all in Ymir camp of this division, were worked. The Yankee Girl sent 1350 tons of ore to the smelter before it passed into the hands of a receiver; it has since been acquired by Spokane men. The Emerald, near Salmo, shipped nearly 2000 tons of lead ore. The Consolidated company bonded some claims in this district on which there is a big surface showing of lead carbonate ore. The Queen opened its gold-bearing vein down to greater depth; the Nugget milled between 3000 and 4000 tons of gold ore having a gross value of $20 per ton; the Mother Lode proved its veins down to 500-ft. depth and put in a modern 10-stamp gold mill; and the Kootenay Belle and others were further developed.

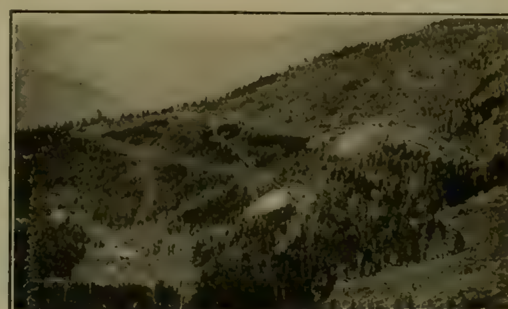
The Arlington and Second Relief, at Erie, were also producers of gold ore.

Rossland.—The chief developments here were in the Centre Star group, owned by the Consolidated company, and the mines of Le Roi No. 2, Ltd. The former found the high-grade ore opened in the bottom of the War Eagle develop into quite a large body, and the average grade to keep up beyond expectations. Smaller orebodies were opened in other parts of the Centre Star group. The Le Roi No. 2 discovered and developed the Holywell vein on the 300 and 500 ft. levels, and opened much ore in the Rodney vein on the 1200 ft. level. The 1300 ft. level was extended, and preparations were made for going deeper. Le Roi No. 2 shipped 27,000 tons of crude ore to the smelter and concentrated 18,000 tons, producing 1600 tons of gold-copper concentrate. The Le Roi was sold to the Consolidated company; lately it has been shipping 100 tons of ore per day, and an early increase in tonnage is expected. The Bluebird and other small properties were also worked. At the Trail smelter and lead refinery the Consolidated M. & S. Co. of Canada put in two Dwight-Lloyd sintering units, rearranged the Huntington-Heberlein plant, and made numerous changes to facilitate handling and sampling ore.

Other West Kootenay Divisions.—In Revelstoke division, mining is largely restricted to development of mica deposits and hydraulicking for placer gold, both in Big Bend district. In the Lardeau, the Beatrice shipped 310 tons of ore, and in Trout Lake division the Silver Cup made an output of about 500 tons, also of silver-lead ore. Development was carried on at the Winslow, a gold claim, but there was little else worthy of note.

Boundary.—Tonnage of ore mined and smelted was the smallest for this district since 1907, due chiefly to the Crow's Nest miners' strike. The total was about 1,200,000 tons, as compared with 1,600,000 tons in 1910. The Granby company's production was 583,000 tons, as against 1,075,000 tons in 1910; the Snowshoe also produced less—31,000 tons, as compared with 147,000 tons in 1910. On the other hand, the British Columbia Copper Co. increased its output 95,000 tons, making it 533,000, as compared with 438,000. Little development was done in the Granby mines during the calendar year, for they were closed for several months, but in the fiscal year, ended June 30 last, the estimated additional tonnage of ore blocked out was 1,248,000 tons, while only 957,000 tons was shipped, consequently, ore in sight was increased 291,000 tons, making total ore "estimated in sight" 6,720,000 tons. Notwithstanding the reduced tonnage treated, smelting costs were three cents per ton lower. A new method for the disposition of slag, previously dumped molten, was arranged for while the furnaces were out of blast. This consists principally of granulating the slag by water, sluicing it to central storage bins where it will be dewatered, and conveying it on belts up to 100 ft. above the old dump. Dump room for six to ten million tons is thus provided. Most of the B. C. Copper Co.'s ore treated came from its Mother Lode mine, in which a different method of mining was adopted. The orebody was divided into a series of transverse stopes of a maximum width of 25 ft., thus making available a greater percentage of the ore and reducing costs of extracting it. Under this system more than 100,000 tons of ore was broken down at one time last autumn. In this connection, 2433 holes were drilled, these averaging approximately 14 ft. each in depth. These were charged with 425 boxes of 40% dynamite, a total of 10⅜ tons; 2525 low-tension No. 7 electric detonators were used connected in series of 25; connection was finally made to 550-volt current, and the whole exploded. The year's tonnage from the Mother Lode was about 315,000 tons; while from the New Dominion Copper Co.'s Rawhide mine, 172,000 tons was obtained, and 46,000 tons from three other Boundary mines owned by the company. In addition, 15,000 tons from two mines in Washington, also owned by this company, was smelted. Three furnaces were kept in blast nearly all the year, using Pennsylvania coke until November, when one was blown out to economize in coke consumption until a supply could be obtainable from Alberta. Work was resumed in the [illegible] after [illegible] shut down, and about 2000 tons of ore shipped to [illegible]. During the year several properties were bonded and exploration carried on, among them was the Voigt group of 63 claims in Similkameen district, which, it is hoped, will develop into a big copper mine. The Greenwood-Phoenix Tramway Co. extended its adit to 3000 ft. from the portal, and the Argo company also drove a long tunnel, but there was little else noteworthy.

Similkameen.—In metal mining, the Hedley Gold Mining Co. was the only one that produced ore. Tonnage from its Nickel Plate group of mines was approximately 57,000 tons, milled at its 40-stamp mill at Hedley, as compared with 46,800 tons in 1910. Average value per ton was $12.10 and percentage of extraction 92. This shows a recovered value four cents per ton higher than in 1910. No gold is saved on amalgamation plates, but about 75% recovered is by concentration, and 25% by cyanidation. The treatment process includes crushing by stamps, tube-milling, cyaniding, and saving of gold in Merrill standard 36-in. filter-presses with Oliver filters for the slime. The production of concentrate is about 300 tons per month. The product, which runs high in gold, is reduced at Tacoma. Development during the year added largely to known reserves. The lower levels of the mine look well, and prospects for 1912 are bright. Coal was shipped from a small colliery at Princeton, and a promising new coal mine was opened above Granite creek, Tulameen.



NICKEL PLATE MINE, HEDLEY, BRITISH COLUMBIA.

Coast.—Quite a transformation has been effected in the Britannia mine, Howe sound. Two years ago the outlook for this property was discouraging; now there is in sight a large tonnage of ore running 4 to 5% copper, and it is believed the development in the early future will greatly increase known good ore. More than 100,000 tons of ore was extracted; most of this was passed through the graded crushing and concentrating mill. Extraction was good, for chalcopyrite ore, about 80%. A full-sized working unit of the Elmore vacuum process plant gave excellent recoveries, indicating that treatment of fine material and slime, following hand-sorting and jigging, will bring the total extraction of value up to a high percentage.

Another important advance made was that of the Granby Con. M. S. & P. Co., at its Hidden Creek copper mine, Observatory inlet. Reports of six engineers show an estimated reserve with a minimum of 6,000,000 and a maximum of 12,000,000 tons, averaging 2% copper for the smaller and 1.65% for the larger tonnage. Since their examinations of the mine, further development has given additional reserves estimated to include at least 200,000 tons of 5% copper ore besides that of lower grade. The company has had up to 270 men preparing the mine for stoping and production, and carrying out surface improvements. Establishment at Goose bay, near the mine, of a copper smelter, with blast-furnace capacity of 2000 tons per day is planned. The year's results in Portland Canal district have been disappointing. The only mine that made production on a commercial basis was that of the Portland Canal Mining Co., from which ore was extracted that, when concentrated in the company's mill, gave rather more than 2000 tons of concentrate, the bulk of which was a product

running 12 to 15 oz. silver per ton and 7 to 11% lead. The year's results demonstrated that to be profitable, milling operations must be on a much larger scale. The Red Cliff was reported to have developed much copper ore of good grade, but bulk shipments to the smelter, frequently talked of, were not made. Other properties were stated to be looking well, but they are without transportation facilities. In Skeena River district, numerous silver-lead claims were more or less prospected; in some cases development into shipping mines is confidently expected. Most of these are within a radius of twenty miles of Hazelton. Railway transportation will likely be available for some of them in 1912.

The Tyee Copper Co.'s smelter, which is situated at Ladysmith, Vancouver Island, was operated intermittently throughout the year, but the available supply of ore was insufficient to keep the furnaces in blast continuously. The ore smelted came chiefly from British Columbia coast mines, and others in southern Alaska.

Prospects for Future.—For metal mining, the outlook is fairly encouraging. More gold and silver should be produced from Nelson, Rossland, Boundary, Similkameen, and the Coast mines; silver and lead in larger quantity should be mined in the Slocan district especially, and to a smaller degree in East Kootenay and Skeena district; the Coast mines promise a greater output of copper, but known inland mines will hardly make any increase; zinc production was so small in 1911 that it will not be difficult to make a considerable advance.

Gold-Dredging in the Philippines

By Charles Janin

The Paracale district was the only field in the Philippine Islands up to a short time ago in which dredges had been even partly successful, for none of the present boats can be properly classed as entirely successful. As to the present time, according to R. Y. Hanlon, in the *Mining and Scientific Press* of August 26, there is only one dredge working in the district and another dredge idle on account of litigation. Both of these dredges are of New Zealand design and manufacture. They are equipped with 5-cu. ft. open-connected buckets, work on a headline, and are operated with steam-power, each using about 3 cords of wood per day. Their efficiency is low, less than 1000 cu. yd. per day. The dredge of the Paracale Gold Dredging Co. has worked about six acres of an average depth of 45 ft., making a total of about 450,000 cu. yd. The gold won from this acreage has been, according to Mr. Hanlon, $20,000, showing a saving of about 45c. per yard. The extraction is estimated from 50 to 75%. The property of this company, including the Melville, Fingal, and Nueva California properties, was acquired late in the year by New Zealand capitalists, who have had the ground drilled and are preparing to build additional dredges. The Malaguit river in Ambos Camarines offers some opportunities as a dredging field. The depth of the ground where the Philippine Gold Dredging Co.'s dredge is working on the river, about four miles from the sea, is from 18 to 24 ft. The dredge is a Risdon boat with 3½-ft. buckets. The average amount handled per month is between 15,000 and 20,000 cu. yd., and the gold content of the ground is about 25c. per yard, of which approximately 75% is recovered. The working cost, exclusive of depreciation, office expenses, and interest, is about 10c. per cubic yard, but, owing to the fact that no record is kept of anything except the actual amount of gold won, an accurate estimate is impossible here as on the Paracale dredge where the same methods are employed. A new installation for the Islands, now under construction by the New York Engineering Co., is a 5½-ft. steam-driven dredge for the Gumaus river in the Paracale district. This will be the first large modern dredge in the Islands, and its success will undoubtedly give an impetus to dredging in that country. According to the builders, the ground was prospected with Empire drills, and sufficient gold found to warrant the erection of this equipment. The dredge will cost about $150,000 complete, and will be fitted with a wooden hull, as the life of the property with the one dredge is estimated at five years. It is believed that with a company with sufficient capital to operate several modern dredges under efficient management, a large portion of the district could be profitably dredged, and, under these conditions the working cost should not exceed 7c. per cubic yard.

Coal Mining in British Columbia

By E. Jacobs

Substantial advance was made in coal mining during the year. The Western Fuel Co., at Nanaimo, made the largest output in the history of its mines—about 586,000 long tons, as compared with nearly 513,000 tons in 1910. This company is opening a new shaft mine about four miles south of Nanaimo. Main and air-shafts are being sunk to a depth of about 1000 ft., and it is expected that coal will be reached next autumn. Thereafter, the mine will be rapidly developed to a producing capacity of 1200 to 1500 tons per day. The company's mines are in excellent condition as regards equipment, development, and prospects, and it is expected that 1912 will prove a record year. Distribution of coal produced was approximately as follows: Sold in British Columbia, 59%; in California, 32%; elsewhere, 9%. The Canadian Collieries (Dunsmuir), Ltd., maintained production at about the same rate as in 1910, when the output was nearly 900,000 long tons, of which 122,000 tons was exported to the United States and 26,000 tons to other countries. The distribution of the 1911 production was somewhat similar. The company has let contracts for construction in connection with the development of a hydro-electric water-power, initial capacity to be 11,000 hp. Contracts let include that for a dam and a water-line about three miles long. Power will be used at the company's several Union Colliery mines in the vicinity of Cumberland, Comox district. A new shaft is to be opened, but as the shaft, sinking of which has been commenced, will have to be sunk about 1000 ft., no production from here will be made for about 12 to 18 months. Many changes and improvements have been authorized, and these are being carried out as rapidly as practicable. Production is to be materially increased and more of the company's large deposits of coal utilized. The Pacific Coast Coal Mines, Ltd., has increased production at its Fiddick colliery to about 20,000 tons per month, and has active demand for all the coal it mines. At its Suquash colliery, development is being continued to get the property in shape for shipping coal. The Vancouver-Nanaimo Coal Mining Co. is providing shipping facilities at tidewater for the coal it mines at its New East Wellington colliery.

The chief development in Nicola was in the coal mines. The Nicola Valley Coal & Coke Co. erected and equipped new tipples, increasing the coal-handling capacity to 1000 tons per day; put in new machinery and plant; extended railway trackage; much improved outlets from mines; and found, by means of diamond-drill, important extensions of coal deposits. The output tonnage was in excess of 200,000 tons, as compared with 141,000 tons in 1910. Development of several other properties was continued, but production was small.

In the East Kootenay production of coal was practically stopped during the eight months the coal-mine employees were on strike, but in that period coal deposits were developed at a level 500 ft. above the main entry to the Hosmer mine. Several new seams were opened at the Crow's Nest Pass Coal Co.'s Coal Creek colliery, and others at Carbonado. The Corbin company opened an enormous deposit of coal occurring 3000 to 4000 ft. along the surface and 300 to 400 ft. wide, which will be mined in open workings.

More work was done on coal properties in the Telkwa and Morrice River district, while in the northern part of Skeena district much anthracite coal was found and partly developed. Prospecting for coal and oil on Graham island of the Queen Charlotte group was done on various holdings.

Review of Mining in 1911 in the Various States and Districts

California's Mineral Industry

By William H. Storms

Although the statistics of the mineral production of California for 1911 are not, and will not be available for several months, there seems little doubt that the aggregate output for the past year will equal, if not exceed that for the year 1910. There was during 1911 a noticeable increase in activity in gold mine development and operation, the impetus being partly to the surprising developments in old mines on the Mother Lode, where new orebodies have been exploited at great depth in unexpected places. Another stimulus to gold-quartz mining has been the successful operation of several rich mines in the northern portion of the State, particularly in Shasta and Sierra counties, and at least one gold mine has been brought under successful operation in Modoc county near Fort Bidwell. To these may be added several new and successful drift-mines in various parts of the north end of the State, and the encouragement resulting from the promising development of new prospects in numerous old districts. Ever since the early days of gold mining in California, prosperity in this industry has swept over the State in a series of waves. The successful outcome of many of the earliest ventures resulted in a general organization of mining companies and the equipment of a large number of prospects, good and bad. The natural result followed. Some were successful, many were not, and in a few years gold mining came into disrepute. After a lull in mining investment, much of which has been ill advised or not advised at all, new successes were achieved, and again gold mining became popular. This has been the history of gold mining in California throughout the past six decades. In recent years a wave of this character was distinctly observable. In 1890-91, gold mining in the State was at a very low ebb. Then came the fortunate development of the Kennedy mine at Jackson, and the phenomenal discoveries in the Rawhide mine near Jamestown, in Tuolumne county, followed by rich developments in the mines at Angels, particularly in the Utica group. These, and several other notable successes, together with the stimulus given gold mining throughout the world by the important operations at Cripple Creek, Colorado, and the wonderful developments on the Rand in South Africa, gave the gold-mining industry of California a decided impetus, and a campaign of development, particularly on the Mother Lode, was inaugurated which was without precedent, since the days between 1850 and 1865. As a result of this unusual activity numerous valuable properties were developed, and as usual a far greater number proved unsatisfactory. An analysis of the numerous misadventures will show, in most cases, good and sufficient reasons for the lack of success; nevertheless, some of the failures of those years have since developed into the bonanza mines of today, and it is these latter that have done more than any other thing to instill confidence in the minds of investors. There are so many instances of success where the enterprise has been in competent hands, that deep mining for gold in California is now considered as not only legitimate, but as offering as safe an investment, in many cases, as can be found in any other kind of business. At the same time, viewed from the speculative standpoint, there is nothing else that offers anything like as great possibilities in the form of profits. Deep mining anywhere, whether for gold, copper, salt, coal, or any other mineral, requires large capital, experienced management, and a fair amount of good fortune. Those of limited means cannot hope to equip and develop mines where a quarter to half a million dollars, or perhaps twice the latter sum, will be required. There are, however, many opportunities for the smaller investor where a few thousand dollars will prove a property to be either valuable or worthless, and unusual activity in mines of this class is now noticeable. Generally speaking, therefore, gold mining throughout the State is in a decidedly healthy condition, and it is my belief that this branch of our mineral industry is going to forge ahead, with the result of a largely increased output within the next few years.

LILA C. BORAX MINE IN SOUTHERN CALIFORNIA.

For several years past the oil industry has steadily increased in importance, until it has become the most important of the several branches of the local mineral industry. Just at present there is a noticeable retardation in development as compared with two or three years ago. This is due to various causes, partly to the attitude of the Government in the matter of locating oil lands, and partly to the tremendous and unexpected production of several spouting wells, among these latter the famous Lake View gusher. A few more wells of this description would put small producers out of business. Fortunately, for the industry, perhaps, these abnormal wells are generally short lived. That all of the oil-bearing territory in California has been discovered, I do not believe, and such belief is strengthened by recent developments in several fields. As long as eighteen years ago, I asked a prominent oil operator if he did not think there were still splendid chances for oil in certain undeveloped districts. His reply was to the effect that if the untried territory was worth anything, he and his company would know of it. Since that time, in the territory referred to has been developed some of the most productive fields in California.

The copper industry of the State is among the most important, the output for 1910 having been 53,600,000 pounds. The closing of certain smelters by the courts because of damage by smelter fumes has reduced the output of copper somewhat, but the problems involved are, apparently, in a fair way to be solved. Several experienced engineers are working industriously in an endeavor to abate the nuisance, and if these efforts are successful, it will undoubtedly result in increased activity in the copper mining industry in California.

The structural materials of the State, of which there is a large variety, and of which the quality is excellent, are constantly coming into more extended use as their merits become better known to those contemplating building. Undoubtedly the Panama-Pacific Exposition will do much to call world-wide attention to the advantages of employing California building stones, ornamental marbles, porphyries, and other varieties for interior decoration; also cement, magnesite, and the several varieties of terra-cotta and bricks. At the present time there is being erected in the State Mining Bureau in the Ferry building at San Francisco, a most interesting exhibit of structural materials. The collection includes several varieties of granite, sandstone, marble, terra-cotta, cement, magnesite flooring, and a beautiful fountain constructed of California cement. These materials have been cut and dressed or otherwise prepared to form parts of several independent structures. All who contemplate the erection of a building of any sort, are invited to visit the Mining Bureau and inspect this exhibit, aand they will gain thereby valuable knowledge concerning the possibilities of structural materials of California. The several portions of the exhibit have been donated by the various concerns actually engaged in producing or manufacturing them from crude materials, all of which are obtained in California. On the whole, the outlook for the mineral industry of the State is most encouraging, and a noticeable expansion may confidently be expected along many lines.

Gold-Dredging in California

By Charles Janin

The total amount handled by the California dredges during 1911 will closely approximate 65,000,000 cu. yd. This will be the more appreciated when it is stated that it is equal to, and perhaps in excess of, the total combined yardage handled by all the dredges in the world, outside of California. In this connection the following table of approximations for 1911 for gold dredges in different countries may be of interest:

Country or State.	Dredges working.	Approx. yardage.	Approx. value.
California	61	65,000,000	$7,850,000
Victoria	57	14,000,000	1,500,000
New Zealand	100	14,000,000	1,500,000
Alaska and Yukon	40	8,000,000	3,200,000
Russia	60	11,000,000	2,000,000
Montana	7	6,000,000	700,000
Colorado	3	3,000,000	350,000
Idaho	7	2,000,000	200,000
Other fields	..	6,000,000	1,000,000

During 1910, the production of gold won from dredging operations in California was $7,550,254, being an increase of $173,304 over the output of 1909. There were 61 dredges in operation during the year, and the combined yardage handled approximated a total of 60,000,000 cu. yd., which would indicate an average recovery of 12½c. per cubic yard. The production of Butte county, as prophesied in the review of last year, fell behind that for 1909, and the first place was taken by Yuba county. Butte will probably show a still further decrease for 1911, as much of the best ground has been worked over, and several of the dredging companies are fast approaching their end. The new 15-ft. boat of the Feather river division of Natomas Consolidated will add materially to the yardage handled for that company, but for the reasons above stated it is not expected that the total gold production of the county will be increased. The highest production for Butte county was reached in 1908, and since then there has been a considerable decrease.

Yuba county showed an increase of $730,557 over that of 1909. The Yuba Consolidated Gold Fields had a most successful year, their 12 dredges handling for the 12 months ended February 28, 1911, 13,970,728 yd., which yielded $2,927,246. Yuba No. 13 dredge was put in commission August 10. This dredge is equipped with 15-cu. ft. buckets and is the largest dredge in the world, digging to a depth of 65 ft. below water-level. The dredge was built by the Yuba Construction Co., the Bucyrus company furnishing much of the machinery. The actual capacity of the dredge has exceeded at times 65,000 cu. yd. per week. Yuba No. 10, a 7½-ft. dredge, was destroyed by fire November 10. The details have not been made public, but it is thought that the fire occurred at the transformers. Electric current was taken on the boat at 4000 volts and stepped down to 440 volts at the transformers for use on all motors. The Marysville Gold Dredging Co. dismantled Marigold No. 2 during 1911, which was said to be too light for the deep ground, and put in commission in April, No. 4, an 8½-ft. boat built by the Union Iron Works. This dredge has been fully described in the *Mining and Scientific Press*, December 9, by R. E. Cranston.

In Sacramento county the Natomas Consolidated put two 15-ft. dredges in commission, Natoma No. 8 in January, and No. 9 in August, and is constructing Natoma No. 10. No. 8, after operating successfully on Rebel hill, in ground which, on account of partly cemented gravel, and the presence of considerable clay, was formerly considered too difficult to be economically dredged, was destroyed by fire October 23. This dredge, differing from Yuba No. 10, also destroyed by fire, took electric current on board at 2200 volts for all motors. The fire was, as near as could be ascertained, caused by an explosion at the oil-switch. The seavalves were opened when it was found impossible to extinguish the fire, and the hull sank. The digging ladder dropping down prevented the front end, and the sand tailing the rear end, of the dredge, from a total submersion, so that much of the machinery was destroyed. It is now being wrecked by the Yuba Construction Company.

The loss of dredges by fire in California has not been great. These two dredges are the first lost from this cause for several years. Viloro No. 1 was destroyed in September 1909, and the Shasta Dredging Co. lost a dredge in June 1908, both being from fire caused from some derangement of the electric current. In connection with the fire on Natoma No. 8 and Yuba No. 10, it is interesting to note the different manner in which electricity was taken on the dredge. On Natoma No. 8, current was supplied direct to the motors at 2200 volts, while on Yuba No. 10, it was stepped down on the dredge from 4000 volts to 440 for use at all motors. There was pointed out in Bulletin 57 of the State Mining Bureau on 'Gold Dredging in California,' written by William Winston and myself, the advisability of keeping sand within easy reach for use in case of electric disturbance at transformers, and a suggestion was also made that an automatic sand-box arrangement for extinguishing any fire at the transformers be provided. It would certainly be advisable to use one of the varieties of asbestos board in building a fireproof shelter around the transformers, or oil switch. This practice is being followed on some dredges since the fire. In addition to this, I believe that liquid stone paint can be advantageously applied to exposed woodwork in the vicinity of the oil-switch, etc. The best safeguard would be to have the dredge hull and housing made of steel, and this practice will probably be adopted on future large boats. On the old dredges, I believe, in addition to the precautions suggested, that an auxiliary fire apparatus consisting of a gasoline engine with fire pump and hose which could be started at a moment's notice, would be advisable. At the present time, if a fire occurs from the electric current, the motors are of course out of commission and the pumps are of no use.

Besides the dredges of the Natomas company, the Ashburton company is operating a 7-ft. dredge in Sacramento county; details of operations are not made public. The boat is reported as digging approximately 800,000 cu. yd. per year. The Union Dredging Co. is constructing a 9-ft. boat for its property. This will be in operation in 1912. Reports of dredging from other counties have indicated a prosperous season. Of the outside counties, Trinity is perhaps attracting most attention. The Alta Bert company has started its dredge, and two other dredges are in course of construction; besides this, several areas are being

prospected in the county with a view to installing dredges if results are satisfactory. The record of dredges in California for 1911 is as follows, 8 put in operation, including 2 that were moved, 2 dredges destroyed by fire, 1 sunk or put out of commission by accident, 3 shut down, and 6 under construction at the end of the year. Following is a table showing the distribution of dredges in California at the close of 1911, also those constructing, and those that were dismantled or destroyed during the year:

County	Dredges operating	Destroyed or shut down.	Under construction.
Butte	26	3	1
Yuba	13	3	..
Sacramento	9	1	2
Calaveras	2	1	1
Siskiyou	1	..	..
Shasta	1	..	..
Merced	1	..	..
Stanislaus	1	..	..
Placer	1	..	..
El Dorado	1	..	..
Trinity	1	..	2
Total	57	8	6

Hulls.- One interesting feature of dredge construction during the year is the fact that Natoma No. 10 is being built on a steel hull. Until recently there has been little inducement to resort to steel hulls in California, but with the growing scarcity of timber and the demonstration that the wooden hull has a shorter life than was anticipated, more attention is being paid to steel construction. In a number of cases where timber is readily available the wooden hull will still be found preferable, and the selection of the hull will be a matter of judgment after studying the conditions and the advantages possessed by each material. While the steel hull has been used for years on foreign dredges, and has been supplied by the Bucyrus Co., the Yuba Construction Co., and the New York Engineering Co. on dredges for foreign service, Natoma No. 10 is the first dredge with a steel hull built for the California field, and it is expected that any future large dredges will be built with steel hulls. Aside from the danger from fire, which has been particularly emphasized this year, the difficulty of getting suitable timbers for a hull of the larger size is becoming greater every year. While the first cost of a steel hull for the small and medium-size boats will be greater than for a wooden hull, steel hulls for the large dredges will probably cost no more than the wooden hulls in the first instance, and no doubt less in some cases. A few years ago it was customary to estimate the life of the wooden hull at ten years, but time has proved this a fallacy in many cases. The old Continental had a life of 10 years and 4 months, after having been refitted and overhauled several times, but wooden hulls in general require considerable attention after a few years of service. The ventilation of hulls has been greatly improved of recent years, and the life greatly increased thereby. Ventilator pipes at the stern force air currents through either side of the hull, the air passing out through stand pipes on the roof of the dredge. On Yuba No. 13, an experiment has been made of placing salt in the hull, to take up excess moisture, etc., six tons of salt being used for this purpose. Three accidents in California and one in Oregon, due, or partly due, to defective hulls, are reported for this year. Lava Bed No. 3, which had been operating nearly seven years, was put out of commission August 8 by the tailing pile sliding down on the dredge. The old hull could not stand the strain and the dredge sank. The hull of Pacific No. 1, in Oroville, after a life of 5½ years, sank December 3; and Calaveras No. 1, near Jenny Lind, after a life of 8 years, sank December 11. The Champlin dredge on Foote creek, Jackson county, Oregon, sank in November, also from a defective hull.

YUBA No. 13, ONE OF THE NEWER BOATS BUILT BY THE YUBA CONSTRUCTION COMPANY.

Another interesting change in construction is shown in the spud arrangement on Natoma No. 10. The steel spud will be placed directly in the centre of the stern end of the boat. The strain will thus be more evenly distributed. A second spud of wood placed on one side will be used for stepping ahead, as on the other dredges. Dredge construction of recent years has not, with the exception of increasing the size of the buckets, which was discussed in my paper of October 14, been so much a matter of radical change in design as it has been an endeavor to use better material and to strengthen all wearing parts of the dredge, thus increasing the working time, and lowering the operating cost. To this end operators and builders have worked in coöperation and have succeeded in building, if not a perfect dredge, at least in establishing a type that is recognized as the standard dredge the world over. It is interesting in this connection to note the total number of dredges built by the different American companies. According to what information I have, the Bucyrus company has built or furnished machinery for 80 dredges, the Risdon Iron Works built 70 and reconstructed 2, the Union Iron Works 7, the Marion Steam Shovel Co. about 30, the Yuba Construction Co. 28, the New York Engineering Co. has built a number, and several have been built by smaller construction companies whose output is not known at the present writing.

All dredges now built in California are equipped with close-connected buckets, revolving screens, and belt-conveyor tailing stacker. While a dredge of the same general design as that followed in the California fields can be built of lighter material, it is obvious that the life of those parts subjected to great wear, as proved by California experience, will be shortened. Perhaps in some districts a light well constructed dredge might be the most suitable, but experience in general has demonstrated that strengthening the wearing parts in the first instance is better policy than frequent renewals. The first cost of a dredge should not be considered a matter of such vital importance by the intending purchaser as is often the case. If by strengthen-

FOREST HILL DREDGE, A 3½-FT. BOAT BUILT BY THE RISDON IRON WORKS AND OPERATING ON AMERICAN RIVER.

ing and increasing the weight of certain parts that are subjected to great strain or wear, the first cost of a dredge is increased $15,000, or $20,000, or even more, it is obvious that a saving of even ½c. per cu. yd. in working cost, by reason of greater capacity, made possible by less loss of time for repairs, etc., to say nothing of the greater cost of repairs for the light boat operating under the same conditions, would soon compensate for the increased initial outlay.

Dredges Being Constructed.—The Gardella dredge being built by the Union Iron Works for Lawrence Gardella on the Downing tract at Oroville, will not be quite finished in 1911, but will probably commence operations early in January 1912. This is a 5-ft. boat, designed to dig 35 ft. below water-level. The construction of the 9-ft. dredge of the Mokelumne Mining Co. was delayed on account of financial difficulties, and the property has recently been taken over by J. W. Goodwin, who has had considerable prospecting done during the year on the Mokelumne and nearby properties. It is expected that the dredge will be operating early in 1912. The construction of the E. L. Smith dredge at Weaverville, Trinity county, has also been delayed, and this dredge will not be operated until 1912. The dipper dredge on the Poker property, in Trinity county, will also be in operation in 1912. The Bucyrus Co. is building a 9-ft. dredge for the Union Dredging Co. on the Fassler ranch near Folsom, adjoining properties of the Natomas Consolidated. This dredging company has invited some criticism by the methods employed in promoting its property, but it is said that the management has been taken out of the hands of the original promoters, and it is proposed to have the operations under competent technical direction. Natoma No. 10, which will be put in commission in April or May 1912, is the first dredge to have a steel hull in California fields. This dredge will be equipped with 15-cu. ft. buckets. The steel hull will be 150 by 56 by 10½ ft., and will have a total weight of 920,000 lb. This is about one-half of the weight of a wooden hull to carry the same machinery. The Scott River dredge, which was moved by the Union Construction Co. from Siskiyou to Trinity county, commenced work in December. This is a 7½-ft. boat, and its previous operations proving unsuccessful, the dredge was shut down. It was afterward bought by the Alta Bert Dredging Co. for ground near Trinity county. The Butte Dredging Co., having worked out its ground near Oroville, moved the dredge to Jenny Lind, Calaveras county. The dredge has been equipped with a new bucket-line of 4-ft. buckets, and commenced operations on the new ground in December. The Poker Bar Dredging Co. moved a Marion dipper dredge, which had formerly operated at Oroville, to Poker Bar, Trinity county, but has not yet completed the new boat.

Dredges Dismantled.—The Marysville Gold Dredging Co. shut down Marigold No. 2. It is said that this boat proved too light for the ground being dug. The Yuba Consolidated Gold Fields shut down Yuba No. 2, using some of the machinery in repairing No. 1, which is of similar design, and will probably also be dismantled in the near future. L. & J. Gardella dredge was dismantled, part of the machinery being used on Gardella No. 4. Lava Bed No. 3, Pacific No. 1, and Calaveras No. 1, were sunk or put out of commission by reason of accidents to defective hulls. Natoma No. 8 and Yuba No. 10 were destroyed by fire. Machinery from the dismantled Bear River dredge has been moved to Oroville, where it is expected it will be utilized later in the construction of a new boat. The Bear River property has been a great disappointment to the English stockholders of Oroville Dredging, Ltd. Originally expected to yield 12c. per cu. yd., three dredges have been tried on this ground without success. The last dredge, a 7-ft. boat, handled, for the year ended July 31, 1910, 994,876 cu. yd. at a stated cost of 6.26c. The ground worked gave an average recovery of 4.71c. per cu. yd., so the operating loss was 1.53c. per cu. yd., or about $1200 per acre.

Working Costs.—Mere figures of operating costs may be of some interest, but are really of little value unless accompanied by detailed statements, and such are not always made public. The working cost of a dredge might show considerable variation for different years, and the cause not be apparent unless such information was furnished. In this regard the following example is pertinent: In the report of Oroville Dredging, Ltd., for 1910, mention is made of Exploration No. 3, a 7-ft. dredge which handled 1,228,110 cu. yd. during the year, working to an average depth of 34.5 ft. The average working time was 19 hours and 56 minutes per day, and the operating cost 4.16c. per cu. yd. "The cost of operation was reduced 1.54c. per cu. yd. (over that of the previous year), practically all of which reduction was due to the fact that the bucket-line had been overhauled and charged against the previous year's work." The average cost of the dredging operations of Oroville Dredging, Ltd., in handling 5,661,612 cu. yd. for the year ended July 31, 1910, was 5.05c. per cu. yd. The Yuba Consolidated Gold Fields handled for the year ended February 28, 1911, 13,970,728 cu. yd. at a total cost of 5.67c. per yd. The Natomas Consolidated Co. has dredged, from January 1, 1909, to June 30, 1911, a total of 44,542,141 cu. yd., with an average recovery of 9.82c., and an operating cost of 4.13c. per cu. yd. Of this, 15,989,525 cu. yd. was dug during 1910, at a cost of 4.52c. per cu. yd., and 10,793,891 cu. yd. during the six months ended June 30, 1911, at a cost of 3.77c. per cu. yd. The lowest operating costs of record are those of a 13½-ft. dredge operating in the Sacramento valley under extremely favorable conditions. This boat handled, from May to December, 1908, 1,830,201 cu. yd. at a cost of 2.3c. per cu. yd., and from January 1, 1909, to November 1, 1910, a period of 18 months, 5,814,975 cu. yd. at a cost of 2.74c. per cu. yd. None of the 15-ft. boats have as yet been operating long enough to make the figures of operating cost of permanent value.

While most of the gravel areas suitable for dredging in California have been examined in the interest of dredging companies, there are areas which a few years ago were considered too low-grade for economic dredging, that will, on account of the great advance made in dredge construction, and the consequent reduction of working costs, be again considered. In this connection it is interesting to note that a number of examinations were made during 1911. The success attending the moving of the Scott River, the Butte, and the Poker Bar dredges, will no doubt encourage some of these dredging companies, whose property is fast approaching an end, to look for other areas. On some properties coming under my own observation, there have been certain parts which, if segregated from the balance and offered at a reasonable price, would be worthy of serious consideration by a dredging company, which having exhausted its own holdings, was in the possession of a good dredge, valuable experience in dredging matters, and what, perhaps, is the most important, money in the treasury. The machinery of a dredge, if in good condition, can be moved and refitted on a new hull in some cases at less than one-half of the cost of a new boat, and the resultant dredge be well suited for the conditions under which is is to operate. Altogether, with the advance made in dredge construction, the reduction of working costs and the probable increase in size of the dredge buckets to one cubic yard, enabling the working under favorable conditions of areas that could not have possibly been previously considered as dredging ground, and the possibility of working over some of the ground that was first dredged, the outlook for dredging in California is decidedly good.

ONYX deposits have been known to exist in east Tennessee for a long time, and attempts have been made at recurrent intervals to utilize the material. Thus far no success has attended these efforts, but with persistent frequency hopes are aroused over some new find and glowing announcements are made of the possibilities of this industry. The onyx found is of cave formation and for the most part represents the remnants of vanished caves. The character and extent of the deposits and the possibilities of their commercial development were discussed at the recent meeting of the Geological Society of America by C. H. Gordon.

The Year Among Nevada Mines and Mills

By L. F. Adamson

While the statement that Nevada owes her prominence today to her mining industries is trite, it cannot be truthfully gainsaid. In the past Nevada has suffered greatly from the 'wild-catter' and stock manipulator. They have probably done more to discredit the State and her paramount industry than all other opposing influences combined. But now, by legislative act, they have become possible to control, and may only apply their nefarious methods at such great personal risk that it has ceased to be attractive or profitable. The mining industry is therefore on a sound and attractive basis.

Complete official data of the mineral output of the State is not yet obtainable for the third and fourth quarters of 1911. The statistics here given are compiled from the sworn quarterly statements of the various operators, for bullion-tax purposes, and may be considered as very conservative.

The State's tonnage produced during the first six months of 1909 was 1,371,027, and during the same period for 1910, 1,930,977, an increase for 1910 over 1909 of 559,950 tons, or 41%. During the first six months of 1911 the tonnage production was 2,148,901, an increase for 1911 over 1910 of 217,924 tons, or 11⅓%, and for 1911 over 1909 of 777,874 tons, or 57%. Tonnage produced during the second six months of 1909 was 1,535,796, and during the same period for 1910, 1,824,051, an increase for 1910 over 1909 of 288,255 tons, or 18⅘%. The gross value of the ore production for the first six months of 1909 was $13,234,692.77, and for the same period of 1910, $15,026,432.35, an increase for 1910 over 1909 of $1,791,739.58, or 13½%. For the first six months of 1911 the gross value of production shows $16,372,746.63, an increase for 1911 over 1910 of $1,346,314.28, or 9%, and for 1911 over 1909 of $3,138,053.86, or 24%. The gross value of ore production for the second six months of 1909 was $11,734,838.40, and for the same period of 1910, $16,576,750.19, an increase for 1910 over 1909 of $4,841,911.79, or 41%. Statistics of tonnage and value by quarters from January 1, 1909, to June 30, 1911, are as follows:

1909.	Tons.	Value.
First quarter	649,222	$ 6,343,635.19
Second quarter	721,805	6,891,057.58
Third quarter	786,888	4,920,837.03
Fourth quarter	748,908	6,814,001.37
Totals	2,906,823	$24,969,531.17

1910.	Tons.	Value.
First quarter	930,282	$ 6,953,851.14
Second quarter	1,000,695	8,072,581.21
Third quarter	912,802	8,131,375.47
Fourth quarter	911,249	8,445,374.72
Totals	3,755,028	$31,603,182.54

1911.	Tons.	Value.
First quarter	1,075,139	$ 8,455,543.30
Second quarter	1,073,762	7,917,203.33
Totals	2,148,901	$16,372,746.33

Clark County.—During the year ended December 31, 1909, Clark county produced a tonnage of 11,317, of a gross value of $66,723.44; during the same period for 1910 the production was 36,894 tons, of a value of $190,791.43; for the first six months of 1911 showed a tonnage of 2345, valued at $36,447.23. The falling off evidenced at this time is largely due to the temporary suspension of the Quartette mine and mill of Searchlight. This is operated by a close corporation, and facts for public information are difficult to obtain. The property is a gold and silver producer and has thus far yielded over $150,000, and, it is contended, still has large ore reserves in sight. Besides numerous attractive gold prospects, this county, in the Searchlight, Eldorado, Yellow Pine, and Sunset mining districts, is liberally sprinkled with large deposits of silver-lead and zinc ores that will eventually bring it into great prominence.

Churchill County. During 1909 the Churchill county product totaled 715 tons, of an aggregate value of $54,228.03; during 1910, 54 tons, $8209.30; and for the first six months of 1911, 12 tons, $823.94. During the past two years, production in this county has scarcely been attempted, but extensive preparations have been made, particularly in the Fairview and Wonder districts, for future operations.

Esmeralda County.—Esmeralda county produced, in 1909, 627,870 tons of ore, of a value of $11,466,677.85; in 1910, 459,801 tons, $9,587,833.59; and during the first six months of 1911, 280,333 tons, $6,022,210.71. It is

NEVADA, SHOWING COUNTY BOUNDARIES.

impossible to do this county justice in a limited paper of this nature. The Goldfield Consolidated Mines Co., here, is probably the richest gold producer of the world today. Its wonderful group of mines has much high-grade milling ore blocked out and a large acreage of undeveloped territory that doubtless contains untold wealth. Its new $1,250,000 gold mill is now turning out bullion from 900 tons of ore per day, and the property has maintained a dividend rate of 50c. per share per quarter for a considerable time past. Other properties of exceptional promise in the Goldfield district are those of the Florence-Goldfield Mining Co., The Goldfield Combination Fraction Mining Co., The Merger Mines Co., The Atlanta Mines Co., the Jumbo Extension Mining Co., and the C. O. D. Mines Co. The Diamondfield district has but recently come to the front with a find on the Goldfield-Belmont of vast importance. This is giving new life to the district. The Rawhide district has many promising prospects. In the Silver Peak district the Pittsburg-Silver Peak Mining Co. is maintaining a large, steady, and profitable production of low-grade milling ore, of which there is an immense quantity in sight. The Gold Mountain district is particularly worthy of mention as a highly mineralized

section and will doubtless be heard from in a substantial manner before a great while.

Eureka County.—Eureka county produced, during the year 1909, 102,622 tons of ore of a gross value of $815,098.96; during 1910 the output was 29,578 tons, valued at $181,146.53; for the first six months of 1911, 9832 tons, $41,237.04. The great falling off in the production as shown by these figures is due to the complete demoralization of transportation facilities occasioned by an unprecedented series of cloudbursts and floods in the year 1909. The famous Richmond Consolidated and Eureka Consolidated properties, which were for a number of years the greatest lead-silver producing properties in the world, are now owned by the United States S. R. & M. Co., and several years ago this company expended over a million dollars in placing the mines on a producing basis. The figures for 1909 show the effects of this effort, and as soon as transportation is resumed considerable production may be expected, not only from this property, but many others. Active work is now in progress on the reconstruction of the railroad.

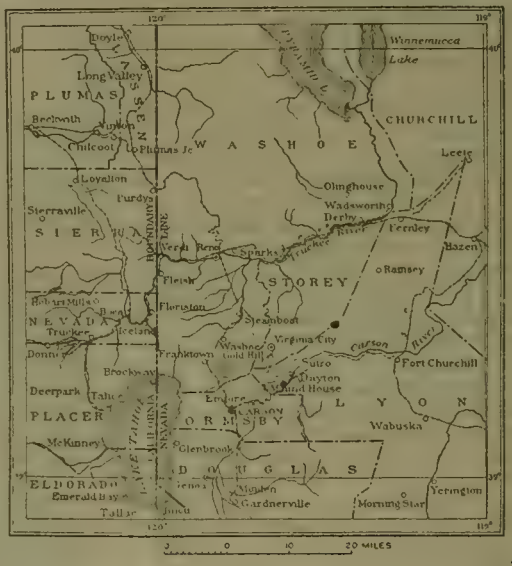
Humboldt County.—This county produced, during the year 1909, 8846 tons of ore, of a value of $350,798.96; during 1910, 4260 tons, $1,415,203.59; and during the first six months of 1911, 9166 tons, $748,448.97. I want particularly to call attention to the almost unbelievable grade of the small quantity of ore extracted during 1910. Humboldt county, one of the largest counties in the State, has been but little prospected in comparison with others, but what has been done along these lines has been productive of most astounding results. In the National district are the mines of the National Mines Co., one of the richest producers of high-grade ore in the State. Certain stopes there are veritable treasure chambers, and development has been but fairly begun. There are a number of other excellent prospects in this district. Humboldt and Gold Run districts are worthy of especial mention and will show tangible results within a reasonable time. Three camps of wonderful richness have but recently been established in this county, Awakening, Barrett Springs, and Rexall. There is great activity in all, and the ore being extracted is extraordinarily rich in free gold. Particularly does this apply to the camp of Rexall, on the northern slope of Winnemucca mountain, where ore has been taken out that ran approximately 90% pure gold. This camp has been prospected to a depth of less than 100 ft., and, while the final outcome of any such mining venture is problematical, Rexall shows most flattering indications. A good deal of development is being done at both Awakening and Barrett Springs, and current reports indicate encouraging increases both in the size and richness of orebodies as depth is attained. In my opinion Humboldt county may reasonably be expected to prove a formidable rival for first place among the large producing counties of Nevada.

Lander County.—This county showed an ore production for the year 1909 of only 361½ tons, of a value of $1892.05; during 1910 this was increased to 11,763 tons, valued at $49,613.22; for the first six months of 1911 it produced 1688 tons, of an aggregate value of $56,512.72. A very recent find of apparent magnitude has been made in Lander county 45 miles directly southwest of Austin, at what is known as the camp of Carroll. While no official returns for bullion tax purposes have as yet been made from this property, I am informed from what I consider reliable sources that three shipments have already been made, the lowest returns from which went $270 to the ton. My last information was that a shaft approximately 4 by 8 ft. had been sunk to a depth of over 50 ft. on the deposit, and at several points therein the sides had been gouged out for a distance of 6 ft., and every inch of the surface exposed was in this same grade of ore. One of the original owners informed me, several weeks ago, that the property was under lease and bond to Salt Lake men for $50,000, of which $5000 was cash. A few days later I was told that the property had been taken over for cash. Lander county boasts a production during the early days of over $36,000,000 in gold and silver, and its mineralized territory has scarcely been touched.

Lincoln County.—During the year 1909 Lincoln county produced 113,938 tons of ore valued at $511,331.33; in 1910, only 760 tons, $10,640; and for the first six months of 1911, 7326 tons, $46,775.69. The same evil influence of cloudbursts and floods that proved temporarily so disastrous to Eureka county, figured largely in the decrease of Lincoln county's output; but, in addition, there must be added internal dissentions in the ranks of some of the larger operators. The flood damage in Lincoln county has been repaired, and indications point to an adjustment of the personal differences.

Lyon County.—This county produced, during 1909, 21,578 tons of ore, of an aggregate value of $78,186.79; during 1910, 18,469 tons, valued at $79,672.66; and during the first six months of 1911, tonnage not given, but of a value of $18,848.66. The Lyon county product is largely in silver. There are large deposits of copper around Yerington and Mason. A standard-gauge road has been built into the district, and a smelter built near Wabuska. A large output of copper is anticipated.

Nye County.—This county produced, during 1909, 374,827 tons of ore, of an aggregate value of $5,740,581.15; during 1910, 501,435 tons, $9,051,441.27; and for the first



WESTERN NEVADA AND EASTERN CALIFORNIA.

six months of 1911, 363,401 tons, $4,852,952.44. Nye county boasts the greatest number of producers of any county in the State. The Tonopah Mining Co. is, so far, the heaviest producer. The Tonopah Belmont Development Co. has found recently large new bodies of milling ore, and is a rival for first place. Other properties in the Tonopah district worthy of especial mention are the Montana-Tonopah, the Tonopah Midway, the Tonopah Extension, the McNamara, and the West End Consolidated. All of these are heavy producers. In the Manhattan district the maintenance of the present activity is bound to bring favorable results. The Round Mountain district is holding its enviable position as a producer of merit, largely through the efforts of the Round Mountain Mining Co., which is turning out high-grade gold ore. In the southern part of the county the Bullfrog, Rhyolite, Pioneer, and Johnnie districts offer a great field for exploration. The Mayflower, in the Pioneer district, and the Johnnie Mining & Milling Co. should be particularly mentioned.

Storey County.—This county for 1909 shows an ore tonnage of 83,048, valued at $643,511.78; during 1910, 115,890 tons, $548,866.16; and for the first six months of 1911, 43,515 tons, $301,890.51. While the exciting times of the old Comstock days will probably never be revived, when that fabulously rich lode was pouring its king's ransom into the lap of an otherwise impoverished nation, yet every indication points to its taking a new lease on life and giving

up additional treasure with a bountiful hand. Recent important discoveries made in new territory have given marked impetus to prospecting operations. A considerable tonnage of commercially valuable ore is now being extracted by the Consolidated Virginia Mining Co., the Ophir Silver Mining Co., the Mexican Gold & Silver Mining Co., the Comstock Phoenix Mining Co., the Belcher Silver Mining Co., the Challar Mining Co., the Crown Point Gold & Silver Mining Co., the Gould & Curry Mining Co., the Yellow Jacket Mining Co., and the Union Consolidated Mining Co. The Mexican, the Ophir, and the Phoenix have but recently reclaimed the dividend paying class. The new mill recently erected by the Mexican has begun operation, and a large amount of development has resulted in opening considerable bodies of milling ore. The capacity of the new mill is estimated at 100 tons per day. Current reports credit the Ninnis lease on the Gould & Curry property with a find of much importance. The Comstock district is now furnishing employment to approximately 1000 miners.

Washoe County. This county produced, during 1909, 1200 tons of ore of a value of $5000; during 1910, 543 tons, $8510.62; and during the first six months of 1911, 623 tons, $20,069.23. So far Washoe county has been a slight producer of metals of value. There are known to be large mineralized zones within her borders, but little prospecting has ever been done. The effect of honest persistent endeavor is evidenced to some degree by results recently attained on the property of the Nevada United Mines Co., some five miles in a northeasterly direction from Reno. What is known as the Arkell find on this property, after three years of unremitting labor without practical results, has at last brought it into what appears to be a just reward. The orebody has not as yet been opened sufficiently to warrant any broad assertions as to its size or value, but its general character and the surrounding conditions are most encouraging. The ore content is largely lead-silver, with a small proportion of galena, zinc, and gold.

White Pine County.—White Pine county produced, in 1909, 1,678,895 tons of ore (principally copper) of a value of $7,114,354.19; during 1910, 2,407,462 tons, $8,582,409.81; and during the first six months of 1911, 1,430,651 tons, $4,326,529.49. This county, which during the late '60s and early '70s was the second largest silver-producing county in the State, and which for over twenty years lay dormant, is today one of the largest producers of copper in the world. The copper belt lies in the Robinson mining district close to the town of Ely, and it is here the famous Nevada Consolidated and Cumberland-Ely properties are found. Several years ago these properties were consolidated. The copper production from the Nevada Consolidated during 1909 was 57,964,477 lb., valued at over $7,000,000, and in 1910 the production was 64,359,398 lb., valued at $8,173,643. These figures represent 99.3% of the entire State's production of copper. During the years 1909 and 1910, it is understood, a curtailment agreement was in existence between all of the large copper companies, which had the effect of lessening the production of the Nevada Consolidated materially, but notwithstanding this agreement, this company handled close to 10,000 tons of ore daily, some of which carried but 0.8% copper, being the lowest-grade copper ever worked at a profit. Adjoining the Nevada Consolidated is the Giroux, the property of the Cole-Ryan interests, and which is credited with carrying the highest percentage of copper of any property in the Robinson district. The Giroux was purchased by its present owners several years ago, since which time development has been carried forward to place the mine on a large producing basis. The surface improvements on the Giroux are said to be the most modern and complete of any property in the United States. Notwithstanding several years' time and many millions of dollars have been expended on this property, it is not considered probable that the extraction of ore will be commenced before another year.

Douglas, Elko, Mineral, and *Ormsby counties* offer many excellent opportunities for development.

South Dakota Gold and Tin Mines

By R. L. Daugherty

The output of the Black Hills mines from Nov. 1, 1910, to Nov. 1, 1911, was as below:

Company.	Tonnage.	Production.	Men emp.
Homestake	1,510,302	$5,875,000.00	2,700
Mogul	1,35,000	181,700.00	240
Golden Reward	66,899	392,701.91	134
Wasp No. 2	148,700	295,907.75	75
Lundberg Dorr-Wilson	21,018	75,754.00	22
New Rehance	8,300	31,492.62	40
Small mines, est.	55,110	379,950.00	793
Placers		83,000.00	....
Totals	1,945,329	$7,625,506.28	3974

*The past twelve months have found the Homestake company in operation without interruption of any sort. The labor question is apparently settled, and there seems to be no difficulty in securing all the labor needed for the different branches of the company's operations. This company has nearly completed the construction of a magnificent electric-power plant on Spearfish creek, at a cost of about $1,250,000, which will have a possible horsepower of 7500. Spearfish creek is taken up at a dam about nine miles from Spearfish and the water carried through concrete tunnels to the power buildings, which are built in the upper part of Spearfish.

The Homestake, Golden Reward, and other large companies enjoyed a prosperous year, as is shown by the tabulated output. The year was marked by the beginning of dredging operations at Mystic, which has attracted renewed attention to the placers of the Black Hills. Prospecting has been active throughout the Hills, and the foundations are being laid for a renewed activity in mining gold and silver throughout the region.

Much is expected from the new smelter that is being erected at Galena by the Black Hills Smelting Works. The plant will have a daily capacity of 300 tons of charge, with pyritic smelting. The Burlington company has extended its narrow-gauge track to the plant. The management expects to be able to handle profitably ore that carries but $4 per ton in gold. One of the principal contributors of ore will be the Gilt Edge-Maid mine, which is near by. The mine has been undergoing extensive preparations for a large tonnage production. The ore will be hauled over the Burlington track to a new concentrating mill which the new Gilt Edge-Maid company has built near the smelter. The plant will be able to handle 250 tons daily of raw ore, which will be concentrated to about 50 tons, and this will furnish the flux for the smelter. There are a number of mines in the Galena district within a radius of three miles, which will be given an opportunity to furnish ore for the smelter.

Progress has been made in the development of the tin resources of the Hills this past year. The Tinton Tin Co. has kept a small force of men at work most of the time in the mine, but no mill-run has been made. In December 1910 the company shipped 86,000 lb. of black tin to Liverpool, England, which made 48,250 lb. of metallic tin. This was sold at 37c. per lb., or $13,027.50. The company has a considerable amount of tin concentrate on hand. There is apparently an abundance of tin-bearing ore, and the milling should not be a difficult metallurgical problem.

One new company has been organized to operate in the Tinton district during the year. It is known as the Scotland Mining Co. It has purchased the A. J. Johnson ground, which carries an extension of the Tinton tin veins to the north. Active development of these tin veins on the property is now in progress. A number of well known mining engineers have examined and made reports on these tin properties the past few months, and it is known that some very favorable findings were made, which will undoubtedly mean more activity in this camp during the coming year.

*Abstract from annual report of State Mine Inspector.

Colorado Metallurgical Progress

By P. H. Argall

In reviewing the metallurgical processes in operation in Colorado at the close of the year 1909, I emphasized the following changes then taking place: (1) The decline of the smelting industry, due to the scarcity of high-grade ore; (2) the decadence of the chlorination process as a factor in the treatment of Cripple Creek ores; (3) the rejuvenation of the cyanidation process. At the close of the year 1911 the corresponding situation is: (1) The smelting industry is about holding its own at the 1909 tonnage; (2) the chlorination process is no longer a factor in the treatment of Cripple Creek ores, the Standard mill, handling about 8000 tons per month, having closed December 1; (3) the cyanidation process now occupies first place, with the Golden Cycle and Portland mills at Colorado City and Stratton's Independence and the new Portland mills at Victor. The Golden Cycle has treated an average of 25,000 tons per month throughout the year, the Portland 6000 or more, the Stratton's Independence 8000 to 10,000, and the new Portland 6000 to 10,000 tons. Both the Portland and the Standard plants have been re-working the tailing from old chlorination mills by the cyanidation process at substantial profits, and the Portland is now eliminating chlorination and changing the entire mill to cyanidation.

Cripple Creek

The past two years have been active ones in the metallurgy of Cripple Creek ores. The valley plants still treat 80% of the ores produced, though division according to lower-grade ore, and treatment methods must be devised to meet this condition. The valley plants, with a dollar a ton freight for a 30-mile down-hill haul, have about reached their limit in the matter of freight and treatment charges, as a comparison of the following tables will show:

Freight and Treatment

1909 Oz. Au	Per ton	1911 Oz. Au	Per ton
Up to ½	$4.00	Up to ½	$4.00
½ to ¾	5.25	½ to ¾	4.50
¾ to 1	6.00	¾ to 1	5.00
1 to 1¼	6.50	1 to 1¼	5.50
1¼ to 1½	7.00	1¼ to 1½	6.00
1½ to 2	7.50	1½ to 2	6.50
2 to 3	8.50	2 to 3	7.00
3 to 5	8.75	3 to 5	8.00

That this scaled rate, at best, no more than covers expenses on the lower grades is borne out by the following significant statement from the last annual report of the United States Refining & Reduction Co., operating the Standard mill: "An increase in tonnage was not possible, nor was the management able to obtain treatment charges giving any material profit over and above actual expenses."

Of the mills in the district, the Jo Dandy, Wild Horse, and Anaconda are simple cyanidation plants, and having oxidized ores to deal with, present nothing new. Stratton's Independence and the new Portland, being designed to treat low-grade sulpho-tellurides, mark the new metallurgical strides, hence more or less detailed accounts of these two mills will be presented.

Stratton's Independence.—The process, or combination of processes, elaborated by Philip Argall in the spring of 1907, and laid before and approved by the directors of Stratton's Independence, Ltd., in June of that year, provided for:

1. Crushing the ore in cyanide solution instead of water in order that the cyanide should begin dissolving gold from the moment that fine crushing began.

2. Removing the rebellious tellurides as completely as possible by a careful concentration conducted alike on sand and slime.

3. Leaching the sand in ordinary tanks to effect a further extraction and to wash out the remaining traces of cyanidation.

4. Treating the slime by air-agitation and bromo-cyanide or other oxidizers as and when required. (A long and thorough series of full working tests has since established

Mills for Treating Cripple Creek Ore

Name.	Tons capacity.	Process.	Remarks.
Lawrence	100	Chlorination	Destroyed by fire
Gillette	100	"	" " "
Economic	300	"	" " "
El Paso	150	"	" " "
National	100	"	Dismantled
Philadelphia	250	"	Obsolete; closed
Union	300	"	Closed
Standard	400	"	About 60% capacity
Portland	300	Roast-cyanide	About 75% capacity
Golden Cycle	1000	" "	To capacity
Metallic	350	" "	Dismantled
Doreas	100	" "	Destroyed by fire
Brodie	120	" "	" " "
Isabella	100	Cyanidation	Closed
Wild Horse	100	"	About capacity
Anaconda	100	"	About half capacity
Independence	350	Concentrating-cyanide	To capacity
New Portland	350	" "	" "
Jo Dandy	100	Cyanidation	" "
Ajax	200	Clancy process	Starting
Trilby	100	Roast-cyanide	Closed
Little Giant	50	Cyanidation	Starting
Homestake	50	"	"

processes shows a change. Of the ore sent to the valley plants in 1909, about 50% was treated by chlorination; in 1911 fully 70% has been cyanided at the Golden Cycle mill. The small cyanidation plants in Cripple Creek district proper, those designed to treat oxidized ores, have not accomplished much. The Wild Horse was the only one in fairly continuous operation throughout the two years. The Wishbone roast-cyanide mill closed down early in 1910 and was destroyed by fire August 13, 1910. The Trilby roast-cyanide mill has not been operated at all during the period, and the Anaconda has been but lately re-started. The Kavanagh mill on the Jo Dandy, and the Ajax Clancy-process mill are new.

The big feature of the two years in the Cripple Creek district has been the increase in milling of low-grade ore. Each year the district is producing a larger tonnage of

ough series of tests demonstrated bromo-cyanide as the best solvent, though even bromo-cyanide is at times useless, and at all times requires the most careful chemical application.

In Mr. Argall's report of April 19, 1907, made after the completion of his tests on the dump ore, he showed that an extraction of 70% could be obtained at a total cost of $1.52 per ton treated, on a basis of milling 10,000 tons

tract, the new Portland began operations in June 1910 with a secret process, of which details have not yet been made public. After various changes during a "break-in" period, the mill settled down to steady work. The process now used includes crushing and concentrating in cyanide solution, discarding the sand after concentration and water washing, air agitation of the slime aided by a halogen cya-

STRATTON'S INDEPENDENCE MILL, WITH AJAX IN BACKGROUND.

NEW PORTLAND MILL, CRIPPLE CREEK, COLORADO.

per month. This is not a high recovery, but anyone who has struggled with Cripple Creek sulpho-telluride ore will admit it is quite a feat to obtain 70% from $2.75 unroasted ore, yet, as a matter of fact, actual milling results have bettered the estimates made before the plant was designed, full details of which are given in *The Mining Magazine* for November 1911.

New Portland.—The second important mill of the district, the new Portland, began operations in June 1910 with a secret process, of which details have not yet been made public. After various changes during a "break-in" period, the mill settled down to steady work. The process now used includes crushing and concentrating in cyanide solution, discarding the sand after concentration and water washing, air agitation of the slime aided by a halogen cyanide when necessary. The concentrate produced in this mill is shipped to the Colorado City plant of the Portland company for roasting and cyanidation; the cyanide precipitate is also worked up into bars at the same plant. The costs and the recovery are closely guarded; in the annual report of the company receipts at the mine and the two mills are lumped together in one item, "cash receipts from operation of mine and mills." The local

papers, however, under date of October 19, 1911, give the following: "In the last three months, ending September 30, 29,599 tons were treated, resulting in a profit of $33,110.78, averaging better than a dollar a ton for the owners." The Portland is now a splendid mill, well managed, successfully operated, and will proceed in time to greater successes, but not greater than the expenditure deserves, or than all metallurgists wish the able and energetic staff.

Ajax.—The big experiment of the year, the Ajax Clancy-process mill, started early in November and is still undergoing alterations and adjustments. The Clancy process is a radical departure from standard practice on Cripple Creek low-grade ores, in that concentration is to be eliminated and the recovery to be made by straight chemical methods aided by electricity. This is the most recent Clancy process, and its merits or demerits remain to be seen. Mechanically the mill is rather complicated, which is to be regretted, since a new process is to be tried, but this apparently does not dampen the enthusiasm of A. W. Warwick, the chief metallurgist, who has already predicted the chemical consumption at 12c. per ton and the total cost per ton at $1.20. The formal beginning of continuous milling operations at the Ajax mill is awaited with expectant interest. Everyone in the district wishes a success may be scored by the new process, fully up to the claims made by Mr. Warwick, as in that event a notable advance will be marked in Cripple Creek metallurgy. None of the methods now in use is perfect, and the profession will welcome any improvement to increase the profit in milling low-grade ore. One of the cyanidation-concentration mills producing a high-grade smelter product has got the cost of treating the concentrate down to 10c. per ton milled; this, plus the small cost of concentrating, is an expense the Clancy process seeks to avoid, and to do so it may be necessary to crush the ore to pass 150 or possibly 200-mesh screen aperture. Hence, unless much higher extractions are obtained, the gain is not worth the candle.

Isabella.—An attempt was made during the year to work over the tailing accumulation of the Isabella mill, but without success, the plant now being idle.

Summary.—Taking the district as a whole, the following general summary may be made. There is an ever increasing quantity of low-grade ore being produced which will lead to the building of many more mills in the district. From present indications the method in use at the Independence mill is the most likely to be followed, due to its cheapness and ease of application. The valley mills will soon suffer a decrease in ore-supply due to home milling, and to the fact that concentrate, to be produced in the low-grade mills, is a smelter product. A further point to be noted in the cyanidation mills is that the mechanical means employed have about reached their highest stage of usefulness, and that any further progress must be along chemical lines.

Leadville

Sulphide ores form the bulk of Leadville's production, the chief ore being iron pyrite carrying a little gold and silver with frequently some lead and copper. The ores are sent direct to the Colorado smelters. The second largest tonnage is made up of the mixed sulphide ores, that is, zincblende, pyrite, and galena. The higher-grade zinc sulphide ore is shipped direct to the zinc smelters at points in Kansas and Oklahoma, while the lower-grade and mixed sulphide is sent to the concentration plants at Cañon City, Pueblo, and Denver. Of the oxidized ores, iron oxide, carrying about 10% manganese, forms the greatest tonnage, with zinc oxide ores coming next in point of production. Lead oxide ores proper now form but a small proportion of the total output. Iron and lead oxide ores are smelted locally, while the oxidized zinc ores are sent to the zinc smelters for treatment. Silicious sulphide ores, carrying gold, silver, and copper are now being mined in greater quantity, and this material finds a ready market at the Colorado smelters.

The Arkansas Valley smelter at Leadville has been in continuous operation throughout the year treating about 600 tons per day in four furnaces. This plant is equipped with eight blast-furnaces, and is therefore running on approximately one-half its normal capacity, as indeed is the case with most of the Colorado smelters. Practically the only mechanical improvement effected at this smelter during the year has been the addition of several sintering pots to increase the roasting capacity of the Huntington-Heberlein plant. This added roasting capacity was made necessary by the constant increase in the proportion of sulphide ores coming to the plant. In order to handle the silicious ores carrying a low sulphur content, Dwight-Lloyd sintering machines are soon to be installed.

The milling of Leadville's low-grade mixed sulphide ores has never been locally conducted with any marked degree of success, and, of the various mills and concentration plants erected in the district, not one is now in operation. The failure of these mills may be attributed both to the complex nature of the crude ore and to the high cost of operation. The past year witnessed the closing of the Rowe mill, of the American Zinc Extraction Co., owing, it is said, to the lack of a sufficient supply of suitable ore to keep it in successful operation. This mill was erected to treat low-grade iron-zinc sulphides and had been in continuous operation since 1905. As originally designed, the ore was crushed and sampled when dried and further reduced to pass a 0.043-in. screen aperture, after which it was fed to International separators, where a magnetic separation of the blende and iron was effected. With a change in the nature of the ore received, the operation of these separators upon the raw ore did not prove satisfactory. They were consequently eliminated and the process was altered to include a magnetic roast in White-Howell furnaces, followed by cooling prior to magnetic separation on Cleveland-Knowles machines. These machines picked up the magnetic iron, the zinc, with its associated minerals and gangue, passing as zinc product. While running on iron-zinc sulphide ore the last described method of treatment was profitable, and was later extended to handle ores containing some galena and a more highly silicious gangue. This was accomplished by the addition of a wet-concentration plant, where the product from the Cleveland-Knowles separators was passed over tables obtaining a resultant product of lead sulphide heading, a zinc sulphide middling, and leaving the gangue to pass off in the tailing. It was at first found difficult to obtain a clean separation between the galena and blende, while considerable zinc losses occurred in slime, but these difficulties were finally, in a large measure, overcome. During the life of the mill it had done much toward solving the problem of concentrating the low-grade mixed sulphide ores of Leadville, and its keen competition in bidding for an ore supply resulted in materially advancing the price paid the miner for such ores. The low-grade iron-zinc and zinc-lead sulphides are now being shipped to the Cañon City mill, of the Empire Zinc Co., and to the plant of the Western Chemical Manufacturing Co. at Denver. The crude ore does, however, receive some preliminary preparation for the market, as hand sorting has been adopted at most of the mines with highly satisfactory results. The common practice is to pick out the silver-bearing pyrite and galena, and also the higher-grade zincblende, which separate products are then shipped direct to the various smelters, leaving the bulk of the mixed sulphide to be sent to the zinc concentration mills as noted above.

The production of oxidized zinc ores is now an important feature of Leadville's mining industry. Although the valuable nature of these ores was not recognized until late in 1910, so rapid has been their development that shipments of zinc carbonate ore have already reached a monthly output of some 12,000 tons. This tonnage is sent direct to the Eastern zinc smelters and shipments are limited to ores containing an average of 30% zinc. The general schedule upon which these ores are purchased has been extended to all producers alike, and is as follows: $15.60 per ton, dry weight, f.o.b. standard-gauge cars at Leadville, Colorado, for ores containing 35% zinc, when spelter sells at $5.50 per hundred pounds St. Louis; the variation per unit to be at the rate of $2 per unit above 35% zinc and down to 30% zinc, and at the rate of 90c. per unit below 30% zinc; as

the spelter market varies from $5.50 per hundred pounds, the price per ton of ore to be changed for each 1c. variation in spelter per hundred pounds. Excessive deposits of low-grade zinc carbonate ores have also been developed, that is, material averaging 25% zinc, which at present is not a marketable product. Several trial shipments of this material, in lots of about 500 tons each, have been sent to the various zinc smelters and oxide plants for testing purposes. The results obtained in these experiments were evidently unsatisfactory, as no demand for the low grade ore has yet been created. It would therefore appear that these ores cannot be profitably smelted direct according to existing methods of treatment. The problem then is to bring these ores up to the standard required by present market conditions, and numerous metallurgists are now in the field working toward the successful solution of this problem.

Salida

The Ohio & Colorado Smelting & Refining Co. at this place is running two blast-furnaces and treating an average of 9000 tons of ore per month, drawing its ore supply from Leadville and the San Juan region. Many mechanical improvements have been introduced during the past two years, and this plant is now regarded as one of the most up to date in Colorado. The chief improvements have been made in the roasting department, where hand-worked reverberatory furnaces have been eliminated and three Godfrey mechanical roasters installed. These latter have a daily capacity of 30 tons each and reduce the raw sulphide ores to about 20% sulphur. This partly roasted product is fed to four Dwight-Lloyd sintering machines, where the roast is completed. This plant was one of the first to adopt the Dwight-Lloyd machines, and it was largely through the efforts of the management here that many of the early mechanical defects were corrected and the whole process worked out to a successful conclusion. An electric haulage system for handling the slag has just been installed.

Pueblo

The Pueblo smelter has increased its Huntington-Heberlein plant somewhat to accommodate the increased tonnage of concentrate received, and has been operated at a little better than one-half capacity throughout the year. The zinc smelter has been run at full capacity, with nothing new along metallurgical lines to report. The steel works has had three blast-furnaces and twelve open-hearth furnaces in operation throughout the year. The prices on all products except rails have been much lower than in years, yet a substantial gain is shown in the net earnings, speaking well for the metallurgists in charge. The principal ore supply is in Wyoming, a heavy tonnage also comes from New Mexico.

Denver

The Globe smelter has operated at one-half capacity this year, the only changes noted being the contemplated installation of Dwight-Lloyd machines. The Argo smelter has passed into history. The past year witnessed the working over of the dump with considerable profit to the lessees. The Modern smelter, as predicted two years ago, is extinct, having been literally smothered in its own flue-dust, and leaving certain misguided ones $700,000 out.

Golden

The plant of the North American Smelting Co. at Golden has run at full capacity throughout the year on ores from Georgetown and Idaho Springs.

Idaho Springs

The Hudson Reduction Co. at this place has during the year remodeled the old Hudson concentrator and applied electro-amalgamation and cyanidation. The ore is stamped, run over amalgamating plates, and further amalgamation accomplished in tank electro-amalgamators. The resulting pulp is concentrated on Card and Wilfley tables, followed by agitation in cyanide solution, the concentrate being shipped to the smelters. Excellent results are said to have been obtained.

San Juan

The famous mills of this district, the Liberty Bell, Camp Bird, Smuggler, and others, have been operating steadily. Certain minor improvements and changes making for lower costs have been introduced, and the general practice is up to date and thorough.

General Summary

In conclusion, the coming year is apt to witness considerable metallurgical activity. The crying need is for some method of handling the low-grade zinc ores of Leadville, and this problem I expect to see solved in 1912. The smelters face a chronic decrease of high-grade siliceous ores and a constantly increasing production of concentrate; indeed, this shortage of silica may become a vital problem during the coming year. Cripple Creek will witness the trial of the Clancy process, and many contemplated mills are being held up until the results of this trial are known. The United States Reduction & Refining Co. is turning its attention to the cyaniding of its various tailing dumps; the one at the Union Plant at Florence is now being so treated. On Friday, November 10, a great flow of water came into the Roosevelt deep drainage tunnel at Cripple Creek, marking practically the completion of this enterprise. Deep mining will therefore be possible early in 1912, with a greater number of men employed and renewed activity in both mining and metallurgy.

Eastern Oregon

By Our Special Correspondent

During 1911 there was a pronounced revival of mining operations in eastern Oregon, which applies principally to Baker and Grant counties, for which Baker, Sumpter, and Granite are centres. One feature of the year's progress was the renewal of operations on the North Pole mine, at Bourne. This property was operated successfully for ten years by Baring Brothers through E. Melzer as manager. After a period of idleness lasting two years, it has been reopened by a Portland company under a bond and lease. It is a gold mine, the veins of ore in which are in a zone of slate. On the same belt is the Columbia mine, which has been operated steadily for fifteen years. The property is well equipped, the mill including stamps, amalgamation and cyanidation departments. During the period named there has been no change in the management, which has been in the hands of Frank S. Baillie. The Golconda, situated on the same zone as the Columbia and North Pole, was started up by Spokane operators after having been closed a number of years. The Red Boy, a big producer ten years ago, is situated near Granite. It passed through a period of idleness, but within the past two years has been explored and developed extensively, whereby its prospects have been much improved. The Red Boy is well equipped with air-compressor, hoist, and mill, and is supplied with water-power. The operations in the Greenhorn district have been marked by good progress, several mines being at work on a small scale. The Highland mine, situated between the old Baisley-Elkhorn and the North Pole mines, has been under development during the past three years. Some ore of good grade has been shipped, and a large tonnage of ore of milling grade has been exposed; the Highland G. M. Co. is now erecting a mill for jig and table concentration, the valuable metals consisting of gold and silver associated with iron pyrite. Tests show a recovery of 85% by this method. The Rainbow mine, situated in Mormon basin, was developed and put on a paying basis within the past eight years by the Commercial M. Co., which sold the property about ten months ago to the United States S. R. & M. Co. Since the consummation of the purchase the mine and mill have been in charge of the exploration department of the latter company. The Humboldt mine, in the vicinity of the Rainbow, has been in course of development during the year, with encouraging results. The Dixie Meadows mine and mill, situated at Prairie City and controlled by New York men, have been in operation during the year. The ore consists of gold-bearing quartz, containing sulphides; the milling method consists of stamp crushing, amalgamation, and concentration. Experiments are being made with the view to cyaniding the tailing.

Arizona

By C. F. Tolman, Jr.

In reviewing mining conditions in Arizona for the year 1910, some indirect benefits accruing from the cautious attitude of capital toward mining ventures were mentioned, and attention was called to the decline in wild-catting, and the forced advances in mining and metallurgy. These tendencies have been still more in evidence during the year just finished, and those companies that have been able to weather the financial storms of the past few years are reconstructing their plants, developing more economical methods of mining, or combining with adjacent properties; the last for economically working the deposits, rather than with a view to stock manipulation. The list of companies building or rebuilding reduction plants includes all but two of the important copper producers. In addition to the great Cananea plant just rebuilt, which lies south of the Arizona boundary line, the new concentrator at Miami has been finished, its last unit having been set to work. The concentrator and new smelter at Ray are nearing completion. A 5000-ton mill for the Inspiration M. Co. is being planned, as well as a reduction plant for the Ray Central. The construction of an entirely new plant has been authorized by the Arizona Copper Co. at Morenci, and the reconstruction of the Calumet & Arizona plant at Douglas has been begun. Finally the United Verde has decided to build a new smelter in the valley below the mine. All of this reconstruction work is under the charge of three noted engineers, L. D. Ricketts, H. Kenyon Burch, and C. H. Repath. After all the experimental work on the ores at the mines, and with the advantage of having the results of the concentration of similar ores in Utah and elsewhere, the 65 to 70% saving at Ray and the reported 75% saving at Miami is far from cause for congratulation when the value of the lost product is considered. The query will not down: 'Has not wet-concentration for the chalcocite ores been thoroughly tried and been found wanting?'

The work of the past year at Ray and Miami has taught its lessons regarding the saving of ores, and much more will be learned next year. The combination of properties for the economical working of the deposit is much more difficult to effect than the solution of engineering problems of mining and metallurgy. During the past year preliminary steps have been taken for such combination, and much will probably be accomplished along this line this year. Where claims interlock and caving stopes in one mine injure the neighbor, as at Morenci, the demand for combination is evident, but as far as known, no combinations are contemplated in this district. The expense of pumping and the depth to the sulphide ores, demand the combination of all companies on the Old Dominion and parallel lodes at Globe. The combination of two of these (the Arizona Commercial and the Superior & Boston) is practically consummated. At Ray, the Hercules and the Ray Central are planning to combine, possibly to make the task of swallowing both easier for the Ray Consolidated. The Miami-Keystone-Inspiration-Live Oak combination, so much discussed, was a logical one, and would have covered all that has been developed of the great ore zone, with approximately 60,000,000 tons of proved ore. It would have been at some loss, however, of the most important stimulus for advanced engineering work—competition of adjacent mines working under the same conditions.

Little has been made public during the past year of technical and scientific interest regarding the developments in the older camps. At Bisbee the deeper sulphide orebodies developed by the Calumet & Arizona company are of interest and should be described. The purchase by the Copper Queen of properties covering the 'ore trough' toward the southeast beyond any of the workings, is interesting. At Globe, the satisfactory results of further exploration in the Old Dominion are reported. The Miami-Inspiration ore zone has been developed actively as noted above, and the discovery of ore on the Southwest Miami is interesting in that it extends the zone in that direction. The great depth at which the secondary sulphides are found at this end of the orebody (1000 to 1400 ft.) is the result of peculiar structural relations, and of past topographies. These will probably be discussed in F. L. Ransome's report on the re-survey of the district. At Ray the interest centres in reduction plants and mining methods, and it is to be hoped that the results of the experiments along both lines will be made public.

The paralysis that has affected the mining operations of all but the larger companies has extended to prospecting, so that new finds of importance are hardly to be expected. There seems, however, but little chance of finding a new disseminated deposit of anything like the size or value of the Ray orebodies or the Miami-Inspiration ore zone. The Bagdad Copper Co., operating north of Hillsdale in Yavapai county, is reported to have developed a 2% disseminated copper deposit containing five to six million tons of ore. The disseminated deposits in the neighborhood of Silverbell, Pima county, have been developed to a considerable extent, but the results have not been made public. It may be stated, however, that the ore is concentrated along silicified fissure zones in the porphyry and granite, and therefore lacks the continuity of the Ray orebody. The reported tonnage and the value of ore given out by the Copper Creek company in the Galiuro mountains, Pinal county, would receive more attention if vouched for by an engineer of standing. This property is reported to have been taken over by a French company. The famous Ajo properties have been bonded by the Calumet & Arizona. The possibility of a disseminated deposit here has been recognized for a number of years, and an attempt to drill was made by engineers connected with the Ray Con., but it was abandoned on account of the difficulty of churn-drilling. The development on the large number of copper prospects has been cut down in most cases to the assessment work necessary to hold the claims.

The Copper Queen Consolidated Mining Co. is busily pushing development on claims it has bonded in the Old Hat district, 30 miles northeast of Tucson. The claims cover a part of the extensive garnet zones of the Marble Peak contact, and the result of the work is reported to have been satisfactory. A story has been told about the bonding of these claims that has a moral, even though it cannot be vouched for as authentic. It was said that these properties are the first that have been offered the Copper Queen at a reasonable figure, and, to encourage this unusual attitude of mind, the company took the bond and unexpectedly found ore. Failures are seldom reported in a yearly review, but they are as much history as the successes, and often as instructive. The closing down of the Clara Consolidated smelter and properties was not unexpected to those who had some acquaintance with the project. The shut-down at Tombstone has been a disappointment to all mining men on account of the historical association of the old camp and admiration for the courage of the Development Company of America in going against such odds. The shut-down at Imperial is generally considered to be only temporary, in spite of foreclosure proceedings. The only happening in the 'high financing' of Arizona mines that has met with general censure is the turning over of the Ray smelter to the A. S. & R. Co., the feeling being that the Ray company would have done better to keep for itself the profit on smelting its ore.

There is little new in regard to the development of gold, silver, lead, or zinc deposits. The unexpected size of the coalfields of northern Arizona, as appears from the recent reports of the U. S. Geological Survey, would attract more attention were there some satisfactory way of getting hold of large enough holdings to justify the development of these isolated deposits. Oil development is active throughout Arizona, and while oil indications have been encountered during the drilling, no commercial quantities of oil have as yet been developed. It is to be hoped that the undisturbed Tertiary formations of the desert valleys will be found to be oil bearing in places and that productive fields may be developed.

Montana

Copper is still the most important metal produced in Montana. In 1911 the production is estimated at close to 275,000,000 lb., including the output of all the independent properties. The production of the smelters of the Anaconda company, with December output estimated, totals 258,152,000 lb., and that of the East Butte smelter, with the months of November and December estimated, amounts to 12,580,699 lb., making the total production of the Washoe, Great Falls, and East Butte smelters 270,732,699 lb. In the production of the Anaconda company is included the output of the North Butte and Tuolumne companies, as both concerns have their ore treated at the Washoe smelter, while in the East Butte figures are included the output of the Butte Alex Scott, which has been shipping about two cars per week. The production of the North Butte for the year will average about 2,000,000 lb. per month, and that of the Tuolumne 500,000 lb. per month. In connection with the production of copper there is an important output of silver from the Butte mines, and some gold. The large number of gold-silver mines proper are in counties other than Silverbow, as will be seen by the review of the State by counties, by Mr. McGee.

Gold-Silver Mines of Montana

By George T. McGee

In this review the gold and silver production given is for eleven months, ended November 30, 1911. The figures include the output of both placer and quartz mines, but only the amount purchased at the U. S. Assay Office at Helena has been taken into account. The figures are misleading, in that they do not indicate the value of ore shipped to smelters, or metals sold in other markets, and final totals for the year will be much larger. The exact figures given below may appear absurd, therefore, but it should be remembered that these represent an exact record of a part of the total production.

Beaverhead.—The county contains the famous old district of Bannock. Operations have been confined to the work of lessees and prospectors. Base ores and long hauls to the railroad are serious problems. Gold and silver production, $212.98.

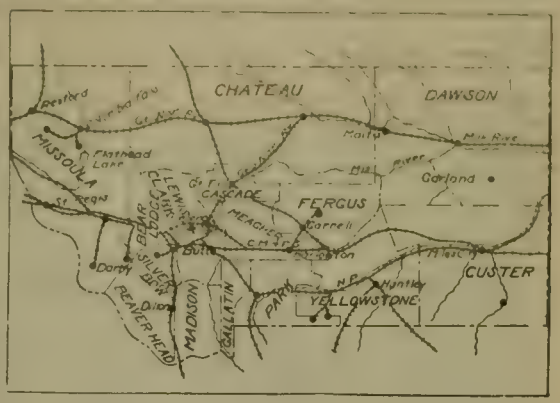
Broadwater.—Winston and Radersburg have shown the most activity, and probably the latter has seen more real money put into new companies and real development work than any district in the State—Butte always excepted. A depth of 700 ft. on the dip of the vein has been reached, and the character of the ore remains practically unchanged. It is a heavy iron sulphide, most suitable for smelting. The twelve-mile wagon haul to the Northern Pacific railroad would undoubtedly be done away with, were it not for a railroad bridge across the Missouri river, which would be necessary for a spur to the mines, and that may be built soon. A large amount of gold and silver comes from the Keating and other mines in the form of smelting ore. The gold and silver received at Helena, amounting to $7439.57 in 1911, represents the smaller mines.

Carbon.—Bordering the northwest corner of Wyoming, Carbon county has extensive coalfields, which, although they have produced for years, are now undergoing especially rapid development. The metal miner in Montana is apt to overlook the commercial and economical importance of the coal deposits. The county's production of coal for the year will approximate 1,200,000 short tons, requiring the labor of 2000 men, and having a value of $2,400,000 at the mines.

Cascade.—A large area is most excellent agricultural land, in the midst of which is Great Falls. Neihart, the famous silver district of the county, is still a shipper of lead-silver ore, and the operators are continuing work and hoping for better prices. The old Queen of the Hills shaft was unwatered last summer by one of the largest and strongest operating companies in the country, and there was a considerable holding of breath for a while—until the shaft was allowed to fill again. Cascade county is rich in coal, and the mines employ modern equipment, including coal cutting machinery. The 1911 estimated output, from the 1000 men employed, is 1,000,000 tons, valued at $2,000,000.

Choteau.—The Little Rockies in the southeastern corner of the county have created to pour forth their gold, and exploration has been carried on by both old and new companies. The district suffers from being fifty miles from the railroad. Gold and silver production, $470,061.11.

Deer Lodge.—Cable, Georgetown, and neighboring districts, welcomed the news announced late in the fall, that the Anaconda Copper Mining Co. had acquired the Southern Cross mine and would at once commence the extension of the Butte, Anaconda & Pacific railroad to Georgetown. The iron oxide ores of the district, difficult to treat locally, will be welcome at the Washoe smelter, and their production will be greatly stimulated by cheap transportation. Gold and silver production, $16,229.71.



MONTANA.

Fergus.—The Kendall mine continued to operate profitably at Kendall, and lessees have operated successfully the Gold Reef mine at Gilt Edge and the Maginnis and Cumberland mines at Maiden, in the Judith mountains. A new company commenced operations on the New Year mine. Cone Butte and Ford Creek districts are developing slowly. The county has been an important coal producer, but the Roundup coal district, which will show approximate output for the year of 650,000 tons of sub-bituminous coal, is now in the newly created Musselshell county. The coming of the C. M. & St. P. railroad four years ago, led to the discovery of the Roundup mines, and they are developing by leaps and bounds. Gold and silver production, $262,964.44.

Granite.—Many years ago, the Hope mine at Philipsburg and the Granite-Bimetallic at Granite began the production of rich silver ores, and they are still at it. New work is under way, especially in the southern part of the county, which will be reached by the extension of the B. A. & P. railway. Gold and silver production, $11,439.18.

Jefferson.—After the old placer days, some of the first quartz mining and smelting done in the State was in the Corbin and Wickes districts. The county is a steady shipper of lead-silver ores, the principal output coming from the Elkhorn mine. Three well financed copper companies are developing properties, which are not yet heavy shippers. Gold and silver production, $10,180.83.

Lewis and Clark.—Many mining men expect to see the Marysville district at the front once more. Thomas Cruse has been operating steadily the Bald Mountain mine, and prospecting has been active over the entire district. The long-drawn-out differences between the Drum Lummon and St. Louis companies are practically ended, and the latter company started operations in both properties. On the Missouri river, east of Helena, at the mouth of Magpie gulch, a modern electric, deep-digging bucket-dredge, with a capacity of 120,000 cu. yd. of gravel per month, was started early in the summer, with every prospect of success. At Helena, the Northwestern Metals Co. has been quietly building a 100-ton plant for the electro-chemical extraction of metals from ores, by the Burwell process. The aim will be to treat ores carrying zinc, lead, iron,

silver, and gold, for which there is a poor market, and on which the smelting charge is often prohibitive. Gold and silver production, $170,455.74.

Lincoln.—The Snowshoe mine, 20 miles south of Libby, began shipment of lead ore and started a 5000-ft. adit for prospecting purposes. Placer ground of great promise was sampled, and development work was general over the county. Gold and silver production, $1745.79.

Madison.—Prospecting went on steadily, and a successful producer has been developed in the Winetka mine, 4 miles above Virginia City, on Alder gulch. The work of the Conrey and Poor Farm Placer Mining companies is discussed in a supplementary article. In the Pony district, the Clipper and Strawberry mines have been steady producers, both worked under lease. Tungsten ore was found in the same district. Gold and silver production, $547,983.80.

Meagher.—A number of copper properties are being developed in the county, and better railroad facilities would hasten work materially. Gold and silver production, $101.46.

Missoula.—The northeast slope of the Bitter Root mountains, running off to the northwest, to within sight of the Coeur d'Alene country, is included for many miles in Missoula county, and promising prospects are showing up well. Gold and silver production, $30,982.92.

Park.—Here is another large area of coal land, which will produce 100,000 tons of coal for 1911. Gold and silver production, $1505.22.

Powell.—Some of the old-time placers were in this county, and deeper gravels are yet to be mined. Development is slow but steady. Gold and silver production, $30,584.46.

Ravalli.—This county is credited with a gold and silver production for the year of $1210.44.

Sanders.—That portion of Montana immediately east of the famous Burke district of the Coeur d'Alene is included in Sanders county, and development there has been quite active, but production is still small.

Silverbow.—The greatest mining activity of the State is centred in Butte. During the year, the first of the huge steam hoists has been rebuilt to use compressed air, delivered from a central plant and reheated at the shaft where used. This central plant is electrically operated, and in connection an automatic hydraulic auxiliary storage supply is maintained, to tide over any short breakdowns of the electric power lines. Since the output of the several power plants situated along the Missouri river, the Big Hole, and the Madison, can be thrown together, the likelihood of a complete breakdown is remote. Within the year the Washoe sampler, for handling custom ores, as well as those from the Anaconda company's mines, was rebuilt with a greater capacity. The East Butte company, operating the old Pittsmont smelter, added a new dust-chamber and stack. At the Washoe smelter, new slime-treatment plants have been built. Everywhere the additions and improvements are of a substantial character. The coming year will witness the construction of two and possibly three concentrators. The Butte & Superior company has already commenced work on its mill, which will have a capacity of 500 tons per day and will be one of the most modern in the country. The Butte Central Copper Co., operating the Ophir mine, has made preliminary arrangements for the erection of a concentrator, and work is to be commenced in the early spring. The Butte & Superior mill is to be ready for operation by June 1, while that of the Butte Central will be completed early in the summer. W. A. Clark has announced his intention of building a concentrator for the treatment of his zinc ore from the Elm Orlu mine, but since that announcement was made a rumor has been in circulation that he may take possession of the Basin Reduction Works' mill, the lease on which to the Butte & Superior company expires on July 1.

Summary.—Montana metal production will be a large factor in the markets of the world for a long time. Important discoveries of phosphate rock have been made during the year in Beaverhead, Madison, and Silverbow counties, 30 miles south of Butte, and there is every indication of a growing non-metallic and metallic mineral industry.

Gold-Dredging at Ruby, Montana

By Hennen Jennings

*The operations of the Conrey Placer Mining Co. and those of the Poor Farm Placer Co., both under one management, are at Ruby, Madison county, Montana, about 80 miles southeast of Butte. The principal work is in Alder gulch, the mouth of which has an elevation of 5200 ft. above the sea. The locality is only 50 to 60 miles from the Yellowstone National Park and is reached by rail by the Northern Pacific branch line from Whitehall to Alder. When N. S. Shaler and his associates acquired the Conrey and Poor Farm properties, between 1896 and 1898, the art of dredging was in its infancy in this country, and the value of the gravel in these tracts of land was lower than that of any which had previously been worked successfully by any other process than hydraulicking. As physical conditions prohibited the hydraulic system, it was a bold project that Shaler initiated, since it required the designing and operating of machinery not hitherto used.

CONREY No. 2 IN WINTER, BEFORE THE 14-FT. OPEN-CONNECTED CHAIN WAS CHANGED TO 9-FT. CLOSE-CONNECTED.

UNDER-CURRENT AND SLUICES ON No. 3.

The first attempt at working the ground was in connection with that part of Alder gulch known as the German bar. Here a central tower was constructed, to which were attached cables, washing appliances, and sluice-boxes, and the gravel lifted and conveyed to the elevated washing appliances by scoop buckets operated by wire-rope traction. This system failed to show a profit and was abandoned in 1900.

*Prepared to accompany the general review of gold-dredging in 1911 by Mr. Janin.

The next effort was made at the mouth of the gulch, where the gravel was excavated and handled by a device known as the Heyward machine. This was discontinued in 1898. The first dredging was attempted with a boat that was built in 189[illegible], in the Grasshopper district, Montana, and was known as the Maggie Gibson. It was one of the earliest bucket elevator dredges in this country.

The Conrey company started with the best type of dredge known at the date of its erection. It was an elevator steam dredge with open connected continuous bucket line and the sluice system of gold-saving devices. The boats were progressively increased and the size of buckets used at the time of erection was in advance of the current practice of that period.

Altogether, the two companies have had 7 dredges at work on their ground; 3 steam sluice-dredges; 1 electrical sluice-dredge; 3 stacker table-dredges of the type used in California. The three steam dredges have been dismantled and discarded, and the companies now have a fleet of four boats at work. No. 3, an electrical sluice-dredge, is still in commission and doing good work. This dredge is the largest and most perfect type of this class of dredge in the world. It was designed in 1904 and started work in 1906. A detailed description of the steam dredge and of No. 3 has been given by J. P. Hutchins.* Three California type dredges have been constructed since the death of Shaler (1906), and under my advice as consulting engineer. They have been built on contract by the Marion Steam Shovel Co. after competitive bidding.

No. 1 is specially constructed for working up Alder gulch on material which has been previously worked by placer miners who left an irregular accumulation of débris. This dredge has a short string bucket-line of 7½-cu. ft. close-connected buckets, and an exceptionally long stacker in proportion to the length of the ladder. It has worked up the gulch for several miles and, under favorable conditions, has excavated a monthly yardage of 140,000, with an average of about 90,000 yd.; depending on the gravel and season. No. 2 has a 9-ft. close-connected bucket chain, with a capacity to dig to a depth of 35 ft., and has dug from 75,000 cu. yd. to as high as 140,000 cu. yd. per month. No. 3, as first constructed, has been described by Mr. Hutchins in the article mentioned; but of late has been modified considerably. It has been given greater flotation and a close-connected 9-ft. bucket chain substituted for the first open-connected bucket line. No. 4 started work in June of this year.† It has a rated capacity per month of 300,000 cu. yd., but this depends on the nature of the gravel. The highest yardage up to the present is 260,000. This dredge is, I believe, as large as any other dredge now at work in the world. The hull is 150 by 58 ft. wide by 13 ft. deep; the bow, stern, and well are all sheathed with light steel plates for winter work in ice, which also requires an exceptional depth of hull. The ladder is 160 ft. from centre to centre of tumblers, with eighty 16-cu. ft. buckets weighing 4468 lb. each; stacker, 130 ft. long; steel spuds, 44 tons each; washing screen, 50 ft. long by 9 ft. 9 in. diameter, perforated plates ⅝ in. thick, lower end with ¾-in. holes. The gold-saving tables have an area of 2956 sq. ft. The tables were designed in accordance with my suggestions following our experience with gold-saving devices. The sluices coming from the upper sections on each side of the 9-ft. washing screen are made longer for the upper sections and gradually reduced toward the end, and the system of undercurrents found effective on No. 3 [illegible] also employed at the lower end of the table sluices, but in a modified form. The photograph shows the heading of the sluices and also the device designed by Mr. Pryer for the clean-up tables.

CONREY NO. 3 SLUICE-BOX DREDGE AT WORK IN WINTER.

In many respects, conditions of dredging at Ruby, Montana, are similar to those existing in California. The bed rock is a volcanic ash similar to that at Oroville, but possibly of a more clayey and tenacious nature. The gravel is compact and tenacious, but not cemented or hard as the hardest in Oroville district. It, however, has occasional boulders larger than those found in California. The chief disadvantage of the Montana workings over those of California is the severity of the winter climate, where the thermometer is known to fall as low as 30 to 40°F. below zero. The two companies have, for the most part, kept their dredges at work through the year, but it is doubtful whether it would be wise to continue working through the year, were it not for keeping together an excellent, trustworthy, and efficient lot of men that have been together under the able management of Charles Kammerer.

The average wages of Montana are also in advance of those in California, and the working costs at Ruby have been somewhat in excess of those in California. During the winter season dredges have twice sunk and been badly damaged, and costs have thus been made exceptionally high. The system of keeping accounts also takes into consideration bucket-ladder renewals. In spite of all these factors, the average cost for the past two years has not been much over 7c., and some months has run below 6c. per yard. It is hoped to still further reduce these figures when No. 4 has had, with the other dredges, a completed full year's run.

The Conrey and Poor Farm companies, between them, have 2500 acres of ground, all of which, however, is by no means dredgable. In addition to the fleet of dredges, the companies have a very extensive machine-shop equipment, and they do all their repairs at their own shops, and, in fact, the assembling and machining of much of their bucket-lines. They also have a complete transformer station for reducing the line tension from 80,000 to 2200 volts. The companies issue no printed annual report, as there are but few shareholders, and these in no way speculate in the stock. The main shareholder, though indirectly, is Harvard University, which inherited the interests of Gordon Mackay and of N. S. Shaler, who at the time of his death was the largest stockholder. I am not in a position to tell accurately the amount of gold return for 1911; but it will probably run from $550,000 to $600,000.

Eng. & Min. Jour., June and July, 1907.

†For details see Floyd Bushnell, 'Dredging at Ruby, Montana,' *Mining and Scientific Press*, Nov. 25, 1911.

THE Bunker Hill & Sullivan Mining & Concentrating Co. paid dividend No. 172 of $65,400 on January 4, 1912. This makes the total amount of dividends paid $13,225,050.

Utah

By W. A. Scott

According to compilations made at Salt Lake City the ore production of Utah in 1911 was approximately 6,680,000 tons, of which Bingham district supplied 5,871,000 tons; Park City, 124,000, and Tintic 404,000 tons; 25,000 tons was shipped from Beaver county, 20,000 tons from other districts, while about 239,000 tons was mined and milled at Mercur.

Dividends.—The following is a list of the dividends paid during the year, the aggregate being $8,973,856, a substantial increase over the amount for 1910:

Bingham-New Haven	$ 261,558
Boston Sunshine	5,632
Cliff	30,000
Colorado	180,000
Daly-Judge	45,000
Daly West	162,000
Gemini	30,000
Grand Central	25,000
Iron Blossom	320,000
Moscow	15,952
Opohongo	10,000
Sioux	89,400
Uintah Treasure Hill	106,292
Utah Copper Co.	4,703,022
Uncle Sam	75,000
Utah Consolidated	150,000
United States S. R. & M. Co.	2,770,500
West Mountain Placer	5,500

Smelter Products.—The four smelting plants which were operated during 1911 were the two belonging to the A. S. & R. Co., at Murray and Garfield, the lead smelter of the United States company at Midvale, and that of the International at Tooele. These plants were not operated exclusively on Utah ores, a considerable tonnage having been received from Idaho, Nevada, and Colorado. The following figures show the quantity and value of the metals produced at the four smelters for the year:

Gold—240,039 oz. @ $20.67	$ 4,961,606.13
Silver—12,573,931 oz. @ 53.27c.	6,698,233.04
Lead—117,593,855 lb. @ $4.42	5,197,648.39
Copper—131,782,916 lb. @ 12.27c.	16,169,763.79
Zinc—10,541,198 lb. @ $5.71	601,902.41
Total value	$33,629,153.76

The United States Smelting, Refining & Mining Co. has operated the lead furnaces of its Midvale plant during the year, having treated about 800 tons of ore per day; but no effort was made to operate its copper furnaces, although its success in controlling smelter fume has resulted in all injunctions having been dissolved by the courts. Before starting the copper furnaces, a bag-house probably will be erected. The International Smelting & Refining Co. operated two or three of its reverberatory-furnaces during the year. During the last two months of the year an average of 800 tons per day of copper ore has been smelted. In the meantime two blast-furnaces for lead smelting have been constructed. It is understood that these will be blown in soon after the first of the year. A bag-house for handling the lead fumes from the furnaces has been built.

Bingham District.—The Utah Copper Co., for the first quarter of 1911, produced 21,296,709 lb. of copper; 24,469,812 lb. for the second quarter, and 25,851,456 lb. for the third quarter, making a total of 71,617,977 lb. for the nine months ended September 30. This was an average monthly production of 7,957,553 lb. The average cost of producing copper for July, August, and September, after making allowance for smelter deductions, was 7.56c. per lb., as compared with the cost of 8.02c. for the preceding quarter. The cost of production for September was 7.18c. The company's two concentrating plants at Garfield treated 1,273,373 tons of ore during July, August, and September, the average grade of which was 1.4829% copper. The larger of the two concentrating plants, known as the Magna, has the capacity of 12,000 tons per day, and it has been operating at full capacity since August 1. The smaller mill, called the Arthur, was planned for 13 sections, and to have a total capacity of 8000 tons per day; five sections were built and have been in operation since September 1, treating 3000 tons per day, and the sixth section has since been completed and put in operation. When the Arthur plant shall have been completed as to the 13 sections contemplated, the company will have facilities for concentrating 20,000 tons of ore every 24 hours. The extraction during the year was close to 70%. Of the tonnage of ore treated during the quarter ended September 30, about 24% resulted from underground mining, and 76% was the output of steam-shovel operations. While official figures for the last quarter of the year are not available, it is learned from a reliable source that this company's copper production for October was 8,666,729 lb., and for November, 9,117,961 lb., making a total for 11 months of 89,402,667 lb., and that the product of December operations, not yet given out, will bring the year's output up to approximately 98,000,000 lb. of copper.

The Utah Consolidated company is mining daily 600 tons of ore from its Highland Boy mine, and this is transported to the International smelter by aerial tramway. A large amount of development has been accomplished within the year, including the sinking of a 3-compartment shaft from adit No. 7 to a depth of 400 ft. This shaft was equipped with an electric hoist. The Ohio Copper Co. has operated its mine and mill steadily during the year. Close to 2000 tons per day of ore averaging 1.3% copper has been concentrated. The capacity and efficiency of the mill has been enhanced, it is claimed, by the use of Wall rolls and slimers. Fifteen rolls of this pattern have been put in, and others are to be added to the present equipment. It is reported that milling costs have been reduced to 31c. per ton, mining costs are said to be 25c. per ton, and haulage, through the Mascot tunnel, to cost 15c., making a total of 71c. per ton. The saving is about 63%. The Bingham Mines Co. has been shipping about 3000 tons per month of copper ore and 60 tons per day of lead ore, and has performed a large amount of development. Much exploration and development has been done during the year on the three known veins of the Dalton & Lark group. The Bingham & Garfield railroad, 20 miles in length, was completed September 16, 1911. This line was built by a company controlled by the Utah Copper Co.; it extends from the latter company's workings at Bingham to the mills and smelter at Garfield, and was built at a cost of $3,000,000.

Tintic District.—The year's operations in Tintic district resulted in the extraction and shipment of over 8000 railroad cars of ore to the smelters, which was about 700 cars in excess of 1910 shipments. The Centennial-Eureka was the largest of the producers, its output having been over 2000 carloads; the Iron Blossom has second place with nearly 1700 cars. Following these two, the main shippers were as follows, the figures in each case being for 11 months ended November 30: Dragon, iron ore, 692 cars; Grand Central, 502; Colorado, 387; Gold Chain, 249; Uncle Sam, 212; Chief Con., 165; Gemini, 169; Sioux, 167; Bullion Beck, 144; Black Jack, 156; Scranton, 153; May Day, 151; Mammoth, 121; Yankee, 114; Opohongo, 92; Eagle & Blue Bell, 83; Beck Tunnel, 56; Victoria, 53; Ridge & Valley, 32; Lower Mammoth, 31; Eureka Hill, 22; Iron King, 18; Swansea, 10 cars. There were other smaller producers, shipments from which aggregated about 60 cars. The list of dividend-paying mines given herewith contains the names of eight Tintic properties, including the United States company, which owns the Centennial-Eureka and Bullion Beck in this district. The Opohongo and Gold Chain, near Mammoth, and the Victoria and Chief Con. at Eureka, are the newer properties of the district, on which development has resulted in exposing bodies of shipping ore. Within the year some new bodies of ore have also been found in the Mammoth; and important discoveries were made on the

2200 ft. level of the Grand Central. Good progress was made in developing the Victoria, Eagle & Blue Bell, and Chief Con. The upper workings of the Genoa are being operated by lessees, this work being in oxidized ore; the shaft has been sunk to a depth of 1960 ft., 200 ft. of which is in sulphide ore, which is not being shipped. The usual progress has been made in the Uncle Sam and May Day. The Yankee company has been shipping ore contained in a dump of 19,000 tons. The ores in the north end of the district, including those produced by the Uncle Sam, Yankee, Colorado, and Iron Blossom, consist mainly of silver and lead; while those of the Centennial Eureka, and contiguous properties, contain gold, copper, and silver.

Park City District.—Ore shipments from the mines of Park City district for 1911 aggregate close to 124,000 tons. The following are the names of the principal producers, with the tonnage of each for 11 months ended November 30: Beggs concentrator, 171; Daly-Judge, 28,347; Daly West, 38,000; Grasselli Chemical Co., 6572; Hanson Bros., 261; Little Bell Con., 3499; New York Bonanza, 331; Ontario lessees, 4913; Silver King Coalition, 29,812; Silver King Con., 177; Virginia lease, 284 tons. Those found in the dividend list are the Daly-Judge and Daly West. The Silver King Coalition, usually standing at the head among dividend payers, was prevented from paying dividends the past year by the litigation in which it was involved with the Silver King Consolidated. The outcome of this was a judgment against the Silver King Coalition Co. in favor of the Consolidated for about $725,000. The case is to be finally decided this year by the United States Court of Appeals. During the year the Silver King Coalition performed important development, and completed the work providing for electric power for all purposes at the mine, shops, and mill. The Silver King Con. opened a new body of ore on the 1550-ft. level of its Andes claim. This orebody has been followed 600 ft., and is about 12 ft. wide.

The Daly-Judge company has reduced its mining and milling costs, and within the year a connection has been made between Daly-Judge workings and the 1550-ft. level of the Daly West, whereby the Daly-Judge is drained to the 1900-ft. level. Within the next three months a similar extension of the 2500-ft. level of the Daly West is to be made into Daly-Judge ground. The Snake Creek drainage adit, largely controlled by Daly-Judge stockholders, which is being driven into this territory from the opposite side of the Wasatch range, has been advanced over 4000 ft., one section of swelling ground in which is supported by reinforced concrete. The Daly West, besides keeping up shipments of ore and operating its mill, has carried on about 2000 ft. of development per month. It produced 8100 tons of crude ore and 23,000 tons of concentrate. The Daly West, Daly-Judge, and Silver King Coalition companies have united in a plan of impounding the tailing discharged from their three mills, and for this purpose a tract of 700 acres has been purchased. The Ontario was a heavy producer under the Crowther lease, the ore mined consisting mostly of fillings in old stopes, which were found profitable. The year's development on the American Flag mine has been mostly in bodies of sulphide ore from the 800 down to the 1100-ft. level. The assays of samples taken show this ore to contain 15 to 30 oz. silver, $3 to $4 gold per ton, and 5 to 10% lead. The higher levels yielded oxidized ore carrying silver and gold in the ratio of $2 in silver to $1 in gold.

Considerable development has been done and much interest aroused in operations in the mineralized country between Big Cottonwood and Little Cottonwood canyons, with Alta as the centre for the latter. Among the properties are the City Rocks, including adjoining properties acquired, the Flagstaff, Emma, Vallejo & North Star, Grizzly, South Star, Columbus, Prince of Wales, and Albion. The probability is that eventually these properties will find an outlet for their ores through transportation adits into Big Cottonwood canyon, where there is an excellent road to the valley.

Minor Districts.—Beaver county mines have been more productive than in 1910, as have those of Ophir and Stockton.

New Mexico

By far the most important event connected with the mining industry of New Mexico in 1911, was the completion of the Chino mill and the entrance of the Chino Copper Co. into the ranks of producers. While not the largest of the new producers of 'porphyry copper,' the Chino is in some particulars the most interesting. The company owns the Santa Rita, the oldest copper mine in New Mexico if not in the United States, a property which has produced at intervals since 1804. Yet when the new mill began work in the fall, the ore reserve was estimated at 15,000,000 tons of 2.5% copper, of which 70% can be won by steam-shovel mining. This result of the application of new methods to an old property speaks well for the manager, John M. Sully, and his able associates. The mill is at Hurley, 9 miles from the mine, and the concentrate is shipped to El Paso, where the A. S. & R. Co. smelter has been reconstructed to handle the output.

In the Pinos Altos district, Corrigan, McKinney & Hutchinson made a valiant effort to resurrect the Western Belle without tangible results. Zinc shipments from the district to Colorado, however, began within the year, and development was quietly carried on in a number of properties. In the Burro mountains the Savanna Copper Co. continued drilling, and in Socorro county the Tri-Bullion, Deadwood, Treasure, Gold Dust, Maud, Socorro, Ernestine, and other companies did good work. The American Z. & L. Co. took a bond on the Lynchburg, the Treasure introduced Oliver filters, and the Mistletoe M. Co. built and started a dry-concentrating plant. In technical lines the most interesting event was the success scored by the De La Vergne oil-engines at the Deadwood mine. Despite the long haul of fuel, the cost was reduced to 11c. per horsepower-day. This is so much below the cost of steam-power with wood for fuel that similar engines have been ordered by the Ernestine and Socorro companies. One significant event of the year, not to be overlooked, was the distribution of the excellent monograph on the 'Ore Deposits of New Mexico,' written by Waldemar Lindgren, L. C. Graton, and C. H. Gordon of the U. S. Geological Survey. It is much the best general treatise of the sort available.

Washington

Mining operations in the State of Washington for 1911, as compared with those of 1910, resulted in an increase of about 10% in gold, 14% in silver, and a small decrease in the production of lead, which was slightly above 1,000,000 lb. The copper production for 1911 was approximately 261,000 lb., as compared with 86,000 lb. in 1910. The gold production came principally from Republic, though there was considerable produced at Orient and the Okanogan country, and also in the Cascade range. The silver output came from Stevens and Okanogan counties, and the Cascades. Lead ore was mined at Metaline, Cut Bank, and Bossburg. The Napoleon mine, situated between Orient and Marcus, produces iron ore with which there is considerable gold. The oxidized ore is milled and the gold recovered by amalgamation. The iron ore is shipped to the British Columbia Copper Co.'s smelter at Greenwood.

The bulk of the copper ore mined in eastern Washington was supplied by the United Copper Co., operating at Chewelah. In the western part of the State there has been some copper production in the Cascade mountains, also in the Olympic range.

The Republic Mines Corporation, Knob Hill, San Poil, North San Poil, Quilp, and others have been active the past year, near Republic, and there has been a good deal of ore shipped, though the low-grade ore is being held till the mill of the North Washington Power & Reduction Co. is ready to treat ore, which will be January 1912. The tungsten mines, 30 miles north of Spokane, have been developed to some extent during the year, and some of the ore has been concentrated. The First Thought mine, a gold property at Orient, has been idle for some time.

Idaho

By W. A. Scott

The Coeur d'Alene.—The 1911 operations in the Coeur d'Alene mining districts were characterized by a general increase in ore extraction from the mines and some advances in metallurgical work. There has been, as compared with 1910, a considerable increase in the shipment of first-grade ore and a still greater increase of the tonnage of concentrate. Within the year, the Bunker Hill & Sullivan, the Hercules, the Stewart, the Gold Hunter, and the Monarch have each increased their milling facilities. In the Morning mill of the Federal company improvements have been made in the coarse concentration department, and an auxiliary plant has been built and put in operation for treating, by tube concentrators, the middling and tailing, containing zinc sulphide and iron oxide. The plant of 119 tubes probably will be doubled in capacity; this method of recovering zincblende formerly lost in the tailing is attracting much interest, and is considered successful. The Bunker Hill & Sullivan company, besides operating its two principal concentrating mills on

SUCCESS MINE, NEAR WALLACE, IDAHO.

ore direct from the mine, is re-treating tailing that accumulated several years ago, in a plant built for that purpose. This company is now mining ore from levels and stopes below the great haulage adit. The Hecla M. Co., operating the well known Hecla mine at Burke, has had a successful year, as measured by tonnage of ore mined and concentrated and by dividends paid. The mine contains ample ore reserves, and the mine and mill equipment is adequate. The Hercules company, which lost its first mill by fire in 1910, built a new mill at Wallace last winter and began operating it in April. This plant was described in the *Mining and Scientific Press* last May. Hercules ore is noted for being of good grade, a considerable tonnage is accordingly shipped without concentrating. A feature of the mining operations is the driving of a two-mile cross-cut adit from near the bed of Canyon creek at Burke to tap the Hercules orebody several hundred feet deeper than the lowest workings. This driving is in progress and will not be finished until next year.

The Success mine and mill, situated on Nine Mile creek, north of Wallace, produce a zinc-lead concentrate. Production has been kept up during the year, and the company paid dividends aggregating $75,000. The Gold Hunter company, operating at Mullan, has increased the capacity of its mill whereby about 200 tons of ore per day is being concentrated. Great depth in the mine has been attained by driving the lowest cross-cut from the mill level, and sinking a 200-ft. winze on one of the veins below that level. Gold Hunter as a name is not now applicable to the property, which is a lead mine. The Snowstorm mine, three miles east of Mullan, the only copper mine in the Coeur d'Alene, has kept up shipments of silicious ore to various smelting plants to be used as converter lining. To describe what was found by driving the lowest adit to the Snowstorm orebody would require a special article. The higher workings yielded copper carbonate, to treat which a leaching plant was built a few years ago, but that was later abandoned. It is understood that sulphide ore has been opened on the lowest level. The Caledonia, situated near Kellogg, and facing Deadwood gulch, is one of the newer mines. It has a well defined vein, dipping about 50°, within which is both oxidized and sulphide ores, containing lead, silver, and copper, some of it being unusually high grade. Shipments have been kept up steadily during the year, and the lower cross-cut from Deadwood gulch, by which about 800 ft. greater depth below the old workings is obtained, is nearly finished. The Stewart, lying west from the Hercules, has become a heavy producer. It is an old mine resuscitated.

The North Fork country, or Murray district, has at least five producing lead-silver mines. The Coeur d'Alene North, or Monarch, has now a larger mill than in 1910, and has produced 70 to 80 cars of concentrate during the year. The most interesting accomplishment in the mine recently has been the sinking in ore below the 1400-ft. mill level. The Paragon, Black Horse, Bear Top, and Jack Waite comprise the other mines of this region which have produced some ore and are being further developed. The Bear Top and Black Horse each has a mill. The Jack Waite has an exposed vein of high-grade galena, and a lower level is being driven to open it at greater depth.

Several properties, formerly worked, situated in Sunset Peak district, have been acquired by outside investors who are beginning to reopen and equip them. Some orebodies have been developed and made productive in the Pine Creek district, lying south of Wardner. Much has been accomplished there during the year in the way of initial operating.

Salmon River Country.—The Pittsburg-Idaho mine, situated at Gilmore, Lemhi county, has been operated during the year with a force of 75 men, and has produced approximately 20,000 tons of silver-lead ore of a grade that was high enough to stand the expense of shipping to Salt Lake smelters without concentrating. The veins are in limestone, and the ore has been opened to a depth of 400 ft. vertically. The Latest Out mine, in the same locality, is similarly developed, and has ore of about the same character and grade as that of the Pittsburg-Idaho. Its shipments for 1911 amounted to about 10,000 tons of ore. The Allie mine, which has been developed, yields an iron ore carrying gold, some shipments of which were made during the year. The Junction mine, near Leadore, has produced 20 carloads of ore that sampled over 40% lead and close to 40 oz. silver. Much of the ore is carbonate. This district and other parts of Lemhi county have become more active since the Pittsburg & Gilmore railroad was built into the Salmon river region from Armstead. The Wilbert mines, situated 50 miles south of Gilmore, in Blaine county, have been developed by several adits, which, with drifts, raises, and cross-cuts, have resulted in exposing over 20,000 tons of ore running about 23% lead. A concentrating mill is being erected to treat this ore. The property is in the Dome district, 25 miles northeast of Arco. A gold-dredge was built on Kirtley creek last summer and put in operation September 1. The locality is near Salmon City.

Boise Basin.—The Boston-Idaho company, which has operated a dredge of 2000 yd. daily capacity during the past three seasons at Idaho City, constructed a second dredge and put it in operation last season. The new dredge has 13¼-cu. ft. buckets, close-connected, and has a rated

capacity of over 8000 yd. per day. Both dredges are electrically operated.

The following estimate of the amount of metal produced from Idaho mines in 1911 is made by Robert N. Bell, State Mine Inspector: Gold, 60,000 oz.; lead, 270,000,000 lb.; silver, 8,400,000 oz.; zinc, 8,760,000 lb.; copper, 3,300,000 lb.; estimated total value, $18,420,000.

Mining in Alaska in 1911

By A. H. Brooks

*The value of the total mineral output of Alaska in 1911 is estimated at $20,370,000, compared with $16,883,678 in 1910. The gold output in 1911 is estimated to have a value of $17,150,000; that of 1910 was $16,126,749. It is estimated that the Alaska mines produced 22,900,000 lb. of copper in 1911, valued at about $2,830,000; in 1910 their output was 4,241,689 lb., valued at $538,695. The silver production in 1911 is estimated to have a value of $220,000, compared with $85,236 for 1910. The value of all other mineral products in 1911, including tin, marble, gypsum, and coal, was about $170,000, an increase over that of 1910. By using the above estimate for the output of 1911, the total value of Alaska's mineral production since 1880, when mining first began, is found to be, in round numbers, $206,600,000, of which $195,950,000 is represented by the value of the gold output. The total production of copper in Alaska since 1901, when the systematic mining of this metal began, is about 56,700,000 lb., valued at about $8,170,000.

The favorable showing made by the Alaska mining industry during the year is due, first, to the very large output of copper and, second, to the greater production, compared with 1910, of the gold placer mines in the Innoko-Iditarod region. Aside from the increased production, the most important event of the year was the opening of the Copper River region by the completion of the railway into it. The industries already stimulated by this line strikingly illustrate the importance of railway communication to Alaska. As no progress was made in the opening of the coalfields, the needs for cheap fuel in Alaska are being met by the substitution of oil-burning for coal-burning engines. The importation of California crude oil is rapidly increasing, with a corresponding decrease in the use of coal. Some new drilling was carried on in the Katalla oilfield during 1911, one or two old wells being reopened and a small production made. The oil was refined and the gasoline sold in the local market.

Although most of the gold still comes from the placers, much progress was made during 1911 in paving the way for an increased output from auriferous lodes. The work was carried on in most of the gold-bearing areas of Alaska, but the most notable advances were in the Juneau, Valdez, Kenai Peninsula, Willow Creek, and Fairbanks districts. Aside from the increase in copper mining, the advances made in developing gold lode mines is the most encouraging feature of the year's operations. Dredging also made great progress, notably in the Nome region. It is estimated that, in the entire territory, 22 dredges were operated for the whole or part of the open season of 1911. In addition to those operated, at least half a dozen were in process of construction.

As improvement in transportation is the most important element in the advancement of the mining industry, the progress for the year in this respect will be briefly summarized. The Copper River & Northwestern railway was completed to Kennicott in April 1911. There was no other railway construction in Alaska during the year, though some railway surveys were made. At the close of 1911 there are 465 miles of railway in the Territory, compared with 371 miles in 1910. This mileage is distributed among nine different railways from 5 to 196 miles in length.

It is estimated that there were 15 gold lode mines in Alaska which made some production in 1911. Custom mills at Valdez, Cheena, Fairbanks, Nome, and Skagway were operated and milled ore from many prospects which cannot yet be classed as productive mines. Some development work was done during 1911 on several hundred prospects widely distributed over the Territory. The output from auriferous lodes in 1911 is believed to have been somewhat larger than that of 1910, which was valued at $4,105,459.

Auriferous lode mining was first attempted in the Ketchikan district some twelve years ago. Several conspicuous failures made at that time so discouraged operators that relatively little attention has since been paid to gold mining in this district. However, some development work has been continued, and in 1911 work was pushed on several properties near Dolomi and on Georges inlet. The advances made in the Portland Canal region of British Columbia stimulated prospecting on the Alaska side of the boundary and within the Ketchikan district. Some encouraging results are reported in this field.

OPENING DAY AT CUSTOM QUARTZ MILL, NOME, ALASKA, OCTOBER 7, 1911.

*The annual report on the mineral resources and production of Alaska for 1911 is now in preparation under the direction of Alfred H. Brooks, of the United States Geological Survey. The more important features of this report relating to the mining development during the year are abstracted as above. Complete and accurate statistics of the mineral production of Alaska cannot be collected within less than four or five months after the close of the year, but meanwhile it seems desirable to give prompt publication to preliminary estimates, which, although not based on accurate statistics, are believed to be not over 10% in error.

Philippine Coal Trade

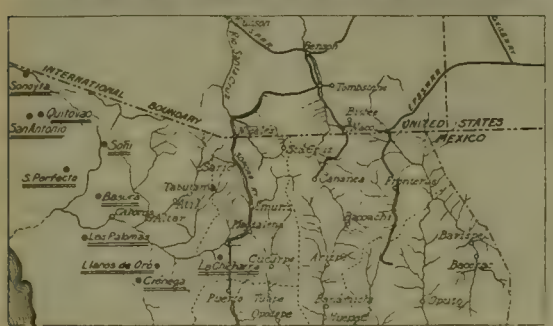
According to George E. Anderson, United States Consul General at Hongkong, the mine at East Batan in the Philippine Islands, is now turning out 100 tons of coal per day and is expected soon to be able to turn out and handle economically 300 tons. This mining enterprise, which was undertaken several years ago, at first proved a financial failure, and some time ago it was placed in charge of William E. Nolting under an agreement between the company and its creditors. This receiver or manager, in connection with E. R. Hix, a coal expert from the United States, has reorganized the business, and it is now said to be upon a paying basis. The Government of the Philippines has aided the enterprise by advancing funds against contracts for coal. These contracts are now gradually being carried out. The imports of coal into the Islands in the year ended June 30, 1911, amounted to 403,146 metric tons, valued at $1,267,312, as compared with imports of 303,117 ordinary tons, valued at $972,341, in 1910, 171,088 tons, valued at $461,465, in 1909, and 213,959 tons, valued at $567,220, in 1908. Up to 1909 Australia supplied most of these imports, furnishing 169,151 tons out of the total of 171,088 tons imported that fiscal year. In 1910, however, Japan commenced to enter the trade in earnest, apparently largely because of labor troubles in Australia. For the past two years it has furnished about half of the total imports into the Islands, through British North Borneo has commenced to enter the trade.

Mexico

By Our Special Correspondent

In the first half of the last fiscal year Mexico's exports of gold showed a big increase, totalling ₱29,510,679, as against ₱23,178,336 in the corresponding period of the preceding fiscal year. Silver exports amounted to ₱38,805,842, as against ₱37,754,931. Gold exports for 1911 were over ₱50,000,000, and silver exports about ₱75,000,000. The production of copper was well maintained in 1911. In eleven months Greene-Cananea produced approximately 42,000,000 lb., exclusive of that from the Miami concentrate. In the same period the production of the Moctezuma Copper Co. (Phelps-Dodge) was 22,648,094 lb., an increase over the production in the corresponding period of 1910. In the ten months ended October 31 the Boleo Copper Co. (French Rothschilds) had a production of 22,167,221 lb. The Mazapil Copper Co., in the State of Zacatecas, and the Teziutlan Copper Co., in the State of Puebla, contributed materially to the year's output. Mexico's lead is principally the product of the important silver-lead mines of the northern part of the Republic, and disturbed conditions and lack of transportation facilities curtailed the output during the first half of 1911. Zinc production was also affected.

The year saw the completion of the extensive campaign of betterment inaugurated by the present management of the Greene-Cananea in Sonora, and involving an expenditure of fully ₱7,500,000. For several months Greene-Cananea has been producing copper at an average cost of 9c., and at the present rate of production and the present price of copper the company is in position to earn approxi-



NORTHERN SONORA.

mately $1,675,000 per year. There is talk of dividends in 1912. Since the first of the year monthly gold content in the Greene-Cananea ores has increased from 468 to 763 oz., and the silver from 90,135 to 127,568 oz. During the greater part of the year Greene-Cananea has been smelting concentrate from the Miami Copper Co., under a contract made in 1910. The Calumet & Sonora Co. has put in a Huff electrostatic plant at its Cananea properties, and is getting good returns from regular shipments of concentrate. The Moctezuma Copper Co. has provided against water shortage by the construction of a dam for the impounding of storm-water. For several months the Lucky Tiger Gold Mining Co. has been operating its new 250-ton cyanide plant, and during the year it has been shipping high-grade ore. During the year small smelters have been blown in at the Mina Mexico, in the Sahuaripa district; at the mines of the Triunfo Consolidated Mining Co., near Arizpe; and at the Cerro Gordo properties near Cumpas; and 100-ton plants have been completed by the Sonora Copper Co. and the Cobriza Mining Co., both operating near Noria. Disturbed conditions have interfered with the plans of the Pacific S. & M. Co., owning, through subsidiary concerns, the Fundición and Guaymas smelters, and neither plant has been blown in. The Pedrazzini Gold & Silver Co. completed a cyanide plant this year, but recently suspended operations, pending the adjustment of labor and other difficulties. The Transvaal Copper Co., owning extensively developed copper properties near Cumpas, is credited with plans for a concentrator, and for a railroad to Cumpas; also with negotiations for the transfer of its properties to the Phelps-Dodge interests. In ten months of this year the net earnings of the Mines Company of America, controlling the Dolores and El Rayo mines in Chihuahua and the Creston Colorada and La Dura in Sonora, amounted to $673,109. The company has plans for reducing operating costs at Dolores by building a power plant at Madera and transmitting power to the mines. Early in 1911 the properties of the Hidalgo Mining Co., in the Parral district of Chihuahua, were taken over by the Alvarado M. & M. Co. at a price of $500,000. Recently the Alvarado purchased the power plant of the Parral Power & Reduction Co. Milling at the new plants of the Alvarado and the Veta Colorada M. & S. Co., in the Parral district, was not interrupted by the revolution, and the bullion output has been steady during the year. The Chihuahua smelter of the A. S. & R. Co., and the Terrazas smelter of the Rio Tinto Copper Co., shut down several months ago as a result of labor troubles following the revolution, have been recently blown in. Negotiations that may result in the transfer of the Santa Eulalia mines of the Chihuahua Mining Co. and the Potosi Mining Co. to English interests are in progress. The deals involve millions of pesos. French interests are reported to be negotiating for the big lead-silver mines of the Compañia Minera de Naica. The Rio Plata and La Republica companies have been operating profitably during the year. Work is in progress on a 300-ton plant for the Palmarejo & Mexican Goldfields, Ltd. The San Toy Mining Co. has had a successful year, and has paid several dividends. The net earnings for the first half of the year were $182,647. Development of the Buena Tierra mine at Santa Eulalia, purchased in 1910 by the Exploration Company of London and Mexico, has been attended by satisfactory results. Considerable high-grade ore has been shipped from the Dos Cabezas mine of the F. S. Pearson interests, and machinery for a stamp-mill and cyanide plant has been purchased at a cost of $65,000.

The labor trouble at El Oro in August, which appeared serious at the start, was not prolonged, and operations were not seriously affected. During the year the Dos Estrellas company has been producing from ₱800,000 to ₱900,000 per month, with a monthly profit of close to a half million pesos. Big dividend payments have been continued. In the ten months from January 1 to October 31 the El Oro Mining & Railway Co. had a production of $2,014,080, milling 302,860 tons of ore, and securing a profit of $861,060. The 1911 production of the Mexico Mines of El Oro has averaged about $127,000 per month. A report for seven months shows a total production of $894,192 from 80,649 tons of ore, the profits reaching $543,112. During the present year the net earnings of the Esperanza Mining Co. have been kept down by heavy charges, due to betterments of various kinds. Figures for seven months show profits of only $247,604 from a production of $970,029. The ore milled in that period amounted to 147,520 tons. The Real del Monte & Pachuca Co., controlled by the U. S. S. R. & M. Co., of Boston, has continued its improvement campaign during the present year, with the result that it is now handling about 32,000 tons of ore per month. The present rate of production represents an annual output of approximately 10,000,000 oz. of silver, and it is possible to further increase the tonnage handled. In June last the Santa Gertrudis company, a subsidiary of Camp Bird, Ltd., placed in commission its new 600-ton plant in the Pachuca district of Hidalgo. The company reports that the ore reserves, estimated at 462,000 tons at the time the Santa Gertrudis mines were purchased, have been increased to 1,150,000 tons, with a probable value of ₱16,500,000. In the first six months of this year the San Rafael y Anexas Co. had a gross production of ₱1,649,556, and earned profits of ₱546,114. A total of 71,587 tons was mined, the mining cost reaching ₱6.56, and the milling cost ₱3.94. The average yield was 643 grams silver and 3.43 grams gold. Dividends of ₱434,400 were paid in the six months. In the past fiscal year the La Blanca y Anexas Co., another big company of the Pachuca district, produced 67,354 tons

of ore averaging 880 grams silver and 4.06 grams gold. La Blanca recently entered into a deal to buy the Cinco Señores properties in the Pachuca district for ₱600,000.

It is estimated that the 1911 production of the Guanajuato district will at least reach that of 1910, which was approximately ₱14,000,000. The 40-stamp cyanide plant of the Providencia M. & M. Co., at the Tajo de Dolores, was completed early in the year, and has been in successful operation for several months. A 10-stamp cyanide plant started by the Tula Mining Co. in the first half of the year has been shut down pending the development of higher grade ore. The Peregrina M. & M. Co. has had a good year, handling 6000 tons per month from the Villapando mine of the Cubo M. & M. Co. in addition to 7000 tons of its own ore. The Guanajuato Reduction & Mines Co. has averaged 20,000 tons per month, about one-third of the ore milled resulting from new development in the old Rayas and Tepeyac mines. Up to this year the company has been operating on ore from dumps and fills. The mill of the Guanajuato Con. has been operating at half capacity during the greater part of the year, but higher-grade ore has been milled. The Pinguico has been milling from 5000 to 7000 tons per month, and the Carmen-Guanajuato has been operating at a good profit. The year's production of the rich El Monte de San Nicolas mine will be over ₱1,000,000. The Nueva Luz work, at a standstill during much of the year, was recently resumed. It is expected to cut the mother lode in February or March 1912.

The old Mololoa mines in the Hostipaquillo district of Jalisco were purchased early in the year by the Makeever interests, operating the El Favor and El Tajo properties. Since the purchase, development has been extensive and much high-grade ore has been shipped. Power interruptions during the rainy season interfered with mill operations of the Amparo company, in the Etzatlan district, and the El Favor company, in the Hostotipaquillo district, both taking current from the transmission line of the Chapala Hydro-Electric Co. The Amparo has continued dividend payments of 3% on $2,000,000. The addition of two tube-mills has recently enabled Amparo to increase the tonnage by more than 1000 tons per month. High-grade ore from El Favor stopes is being shipped to the smelter, and the development of the sulphide ores below the 600-ft. level has been commenced. The Consolidated Mining Co. has given an option on its Casados mine in the Hostotipaquillo district. During the first half of the year much high-grade ore was shipped from this property. The year's development has been extensive. The Espada Mines Co. has built an aerial tramway to deliver Espada ores to the Virginia & Mexico plant in the Hostotipaquillo district, leased early in the year, and milling will be commenced shortly. The Cinco Minas Co. (Marcus Daly interests) has been developing during only a part of the year. Plans for a 200-ton reduction plant are being drawn. The Regina Mining Co. has had an important year of development and is ready to build a concentrating plant at its copper mines in the Ameca district. Operations of the Magistral-Ameca Copper Co. were suspended during a part of the year. Sinking of the main shaft was recently resumed. The old Cerrito copper mine in the Ameca district has been taken over by the Almoloya Mining Co. at a price of ₱50,000. The ₱100,000 bond on the Zapote group of mines in the Ameca district, held by E. A. Montgomery, of Los Angeles, Cal., has been extended for a year, and extensive development has been continued. The San Miguel Gold Mining Co., has imported machinery for a reduction plant at gold mines near Ejutla. Work at the Keystone properties in the Tapalpa district has been resumed by the Mexicana Mining Co., a holding concern. The Tajo Mining Co., of the San Sebastian district, has increased its mill capacity to 100 tons.

During the year engineers of the Esperanza Mining Co., of El Oro, examined the old Escuadra mine in the Taviche district of Oaxaca with a view to its purchase by Esperanza. It is now reported that the deal has been abandoned. Much ore has been shipped during the year from the San Juan mine in the Taviche district, shipments reaching a value of ₱100,000 per month. The San Juan company has installed a hoist for deep sinking, and is planning the erection of a 200 ton mill to handle the lower grade ores. Oaxaca operations were not affected to any extent by the political upheaval. The most important transfer of the year was that of the Tiro General in the State of San Luis Potosi, the mines and 10 kilometres of railroad passing to the A. S. & R. Co. for ₱1,600,000. For a number of years the Tiro General has been an important shipper to the Aguascalientes plant of the A. S. & R. Co. The railroad gives the mines connection with the National Railways at Las Charcas. The Santa Rosa Mining Co., controlled by the Exploration Company of England and Mexico, has been at work on important reduction facilities at the Santa Rosa mines in the Concepcion del Oro district of Zacatecas. Operations in the principal Zacatecas districts have been well maintained. Important shipments of lead-silver ore have been made from the Lead Queen mine in Aguascalientes to the San Luis Potosi smelter, the smelter company having the property under lease. From the Taxco district of Guerrero ore has been shipped during the year by the Atlixtac, San Miguel, Mora y Milagro, Espiritu Santo, and San Miguel concerns. Atlixtac also has shipped concentrate and precipitate, and concentrate has been shipped from the Purisima and Chorrillo mills. There has been much development by the Taxco Mines of Mexico at the old Rosario properties, and plans for a 200-ton cyanide plant have been taken up. The Reforma M. & M. Co., owning the big Campo Morado properties, has been operating steadily.

MINES OF JALISCO.

The Mexico Con. M. & M. Co., owning extensive properties and a reduction plant in the Guanacevi district of Durango, was reorganized during the year, and since has been operating with satisfactory results. It is reported that English interests have made a deal for the Restauradora properties in the Guanacevi district, at a price of about ₱1,000,000. The Candelaria Con. Co., of San Francisco, California, has built a 100-ton cyanide plant at its mines in the San Dimas district of Durango, and is abandoning the old system of pan-amalgamation. The capacity of the plant will be increased after the completion of a hydro-electric plant. The San Luis Mining Co., another San Dimas concern, is replacing an old 30-ton plant with a cyanide plant of 100 tons capacity. The Compañia Exploradora y Explotadora de Guanacevi is pushing development work, and has entered into a contract to supply 50 tons of ore per day to the Rosario M. & M. Co. The Reyes M. & S. Co. has blown in a 50-ton lead smelter, and is operating with success. A contract for a new power plant at the Guadalupe de los Reyes mines in the State of Sinaloa has been signed, and the new plant will be ready for service by May 1912. Charcoal gas-producers will be used, and a big saving in operating expenses is expected to result.

Lake Superior Copper Mines

By Robert H. Maurer

As nearly as can be calculated at this time, actual figures in most instances not being available, the output of the Lake Superior mines for the year 1911 approximates 222,874,350 lb. fine copper, representing a gross value of $27,859,375. This output was made at a cost of about $22,000,000 or an average of 10c. per lb. for all companies, and all but about 15,000,000 lb. was produced at a profit. Omitting a production largely incidental to development in the various properties, and considering only the output of the profitable producers, the average cost was about 9.5c. per lb. Twenty-two companies contributed to this output, as against 20 in the preceding year, and there are now 18 yielding a regular production with a combined annual output not far from 220,000,000 lb. fine copper. There is little likelihood that the present rate of production will materially increase in the next year or two, though a 5% increase is easily possible. New sources of production are seemingly limited to the Lake Copper Co. and will show no marked effect on the annual rate for a year at least. Any material increase must come from one or several of the present producers and may be looked for only in the event of further and great improvement in the metal market. There is no undue restriction on output except in case of the Osceola and Calumet & Hecla, both of which are capable of far greater production. The other companies for the most part are producing well up to capacity. A table showing the estimated production in pounds fine copper of the several Lake Superior companies for 1911, as also actual figures of production for the preceding year, is appended herewith. Estimates are based upon the most reliable data obtainable. Official figures will not be available in some instances for several months to come.

Company.	1911. (Estimated.)	1910. (Actual.)
Calumet & Hecla	75,434,000	72,672,469
Copper Range Con.:		
Champion mine	17,845,000	19,224,174
Baltic mine	16,329,000	17,549,762
Trimountain mine	7,200,000	5,694,868
Quincy	21,398,000	22,517,014
Osceola	18,261,000	19,346,566
Ahmeek	14,926,000	11,844,954
Mohawk	11,937,000	11,412,066
Wolverine	9,642,000	9,665,534
Tamarack	7,514,000	11,063,606
Isle Royale	7,292,000	7,567,399
Allouez	4,725,000	4,655,702
Superior	3,213,000	3,181,041
Centennial	1,499,000	1,572,566
Mass	1,429,000	1,321,885
Victoria	1,415,000	1,164,564
Franklin	1,000,000	966,353
Winona	800,000	.....
Hancock	754,749	.....
La Salle	245,000	472,100
Gratiot	15,605	265,869
Miscellaneous	.....	262,031
Totals	222,874,354	222,420,523

The average price received for all copper sold during the year was 12.65c., which, with one exception, is the lowest annual average price recorded in ten years. The average for the decade was 15.12c., and in 1907 was 20c. Since that year it has ruled steadily under 13.5c. The end of the year brought material improvement in the metal market, and at the close the better grades of copper were selling freely at above 14 cents.

In consequence of the low price realized for the product, dividends were generally smaller and not always earned. The total disbursed by all companies during the year closely approximates $6,000,000.

New York Share Market in 1911

By Our Regular Correspondent

Falstaff said: "* * * My whole charge consists of ancients, corporals, lieutenants, gentlemen of companies, * * * slaves as ragged as Lazarus in the painted cloth, the cankers of a calm world and a long peace." In an attempt to review the mining share markets of the year in the East, there seems to be almost as little to be proud of as Sir John found in his motley band of riff-raff. The year 1911 will always be recalled as a period which broke all previous records for depression. Trading in mining shares in New York is carried on mostly on the Curb, an outside market without any organization, but whose members follow closely the rules of the New York Stock Exchange. This market, which really occupies a legitimate field among the various market-places of the Eastern financial centre, has been used by so-called brokerage houses making the bucketing of orders a regular practice, until the Curb has lost its public and can no longer fulfil its primary office—that of making a market for the distribution of new issues. The atmosphere of the New York Stock Exchange is distinctly hostile to all mining enterprises; in fact, it is one of the traditions of the Exchange to treat with unbounded contempt anything connected with the mining industry, at least so far as public trading is concerned. There are those who dare to say that this is short-sighted, and who point to the building up of business which does not go to the floor of the Exchange and in which mining plays a very large part, but so far there has been no sign of any change of attitude by the board of governors.

The beginning of 1911 found market operators turning from the copper shares, which were evidently facing a period of stagnation, due to the burden of accumulated stocks. The conditions prevailing at the beginning of the year clung to the copper market throughout nearly the whole of 1911, and only in the latter half of December was there any strong upturn. Throughout the year, the copper situation was an exceedingly interesting one—one which was followed by the general public with close attention as well as by producers, sellers, and consumers. The whole of 1911 must be counted a period of stress for the copper producers, a period devoted largely to close study of cost sheets in an anxious effort to meet conditions. The year just begun will undoubtedly demonstrate that the depression of 1911 was by no means an unmixed evil. Forced rehabilitation of many properties has been completed, development work has been accomplished, and economies enforced that will all add to profit in the future. The Canadian silver issues—all Cobalt properties—with only one or two exceptions, demonstrated one of the queer turns of public sentiment as regards mining shares. The close of 1910 showed that the mines in Cobalt had broken all previous records, dividends were satisfactory, in some cases very large in proportion to the market prices for the shares, but the public trading had then dwindled to insignificant proportions, and in spite of increased production throughout the year, market followers refused to have anything to do with Cobalt issues.

Trading in Nevada issues had sunk to very small volume during 1910, and when Goldfield Consolidated was 'taken inside', as the phrase goes, meaning its removal to the floor of the Stock Exchange, Goldfield shares were left without a leader and almost without any public following. It appeared, therefore, that there was no obstacle in the way of the development of a new mining field. Especially if a gold-mining district, with the lodestone of high-grade gold ore, could be brought before the public, then another real boom could be made in a market way, and many thousand shares distributed. So it was that Porcupine dawned, with every mining broker, promoter, and advertising solicitor watching its rise with anxious eyes. Early in the year, the prospectors, claim-owners, and option-holders moved upon New York in solid phalanx, with tongues trained to speak of no sums less than hundreds of thousands. Hun-

deeds of pounds of rusty rich quartz, heavy with free gold, came to New York in one sack and grips. One or two deals were made on greatly inflated figures, and Porcupine owners began counting their millions. The stock market was prepared for wild periods when a perceptible chill began to be felt. The Englishmen who came to Canada, came and went, their going accompanied by rather lame explanations, for the most part, and the fire in midsummer swept away practically all the anticipated booms. The public never took any interest in Porcupine, so far as New York is concerned.

Boston, which is the market for the Lake copper shares, was in a turmoil during the greater part of the year on account of the consolidation attempted by the Calumet & Hecla; a move which was fought so bitterly as to be finally abandoned by its promoters. The situation was made more interesting by the work of J. R. Finlay, formerly manager of the Goldfield Consolidated, who made an independent appraisal of the principal Lake properties for the Michigan State Board of Taxation and Equalization. Mr. Finlay has some advanced ideas about mines and mining investments that ought to be read by every would-be buyer of mining shares, before he makes his purchases - not after. For Boston, like New York, the year was one of low prices and a very small volume of business. One of the principal deterrent factors to normal activity in mining enterprises was the Mexican insurrection, which resulted in the exile or flight of General Diaz. New York has many mining men, promoters, and engineers, to whom, for many years, Diaz was Mexico, and it is not strange that confidence, uprooted by the downfall of Diaz, should have been slow to be recovered. New York has many interests in Mexico and is hoping for an immediate restoration of tranquillity. One of the brighter features in the mining-share market was the revival of Tonopah. The making of a big mine of the Belmont, and coming back of Montana-Tonopah, gave one group of operators a cheerful air of prosperous business.

Any study of the mining market in New York City begins and ends with an analysis of the peculiar conditions surrounding the Curb market. In reality, the Curb market is simply an outgrowth of custom. It is granted the privilege of trading in the street by a stretch of the police power, and holds its sessions in the open air during the whole year. The bulk of its business is in mining stocks, in new issues not yet granted the privilege of trading on the New York Stock Exchange, and the greater part of the business comes through members of the Stock Exchange. It is one of the iron-clad rules of the Exchange that members are not allowed to trade with the rival exchanges. It has, therefore, been impossible for the Curb to organize itself without losing the overflow business from the big exchange. In fact, its members with Stock Exchange connections have been strong enough to prevent any real organization being effected. This peculiar situation has left the Curb without power to redress any wrongs committed by the traders who abuse the privileges of the open market. The Curb has been, and is still, unable to enforce any sort of discipline or punishment upon traders transgressing these unwritten rules. Could this anomalous condition be overcome, the New York mining market would immediately achieve an enthusiastic public following that would grow to immense proportions.

If the mining engineers of the United States could, through some official organization, impose conditions which would prevent any reputable engineer from lending his name to 'get-rich-quick' paper promotions, foisted upon the public by promoters, that bear no real relation to the mining industry, it would mean a tremendous double step forward. The public realizes mining to be a field in which it should be able to embark profitably. The same public has just recently begun to realize the need of common sense and business judgment in making such embarkations. New York will never have one-half the mining market it should have until some preventive measures are adopted which will be more effective than the mere example of the punishmnt of those who use the United States mails for fraudulent purposes.

California Petroleum Production

The production of the various California oil districts in 1911, less the fuel used in the field, is given below:

	Bbl.
Moreno	20,[illegible]1,669
Coalinga	1,[illegible]93,221
Kern River	12,2[illegible],273
Santa Maria	6,29[illegible],766
Fullerton	5,88[illegible],069
McKittrick	5,139,364
Maricopa	4,108,087
Salt Lake	2,815,097
Whittier-Coyote	1,106,966
Ventura	153,764
Los Angeles	136,200
Newhall	139,508
Summerland	64,875
Lost Hills	63,500
Total	77,874,359
Less loss	650,000
Net for year	77,224,359
Shipments 1911	66,665,000
Increase in surplus	10,559,359

London Share Quotations of the Year

(In pounds sterling, unless otherwise stated.)

	Dec. 5, 1910.	Dec. 5, 1911.
Transvaal.		
Crown Mines	8	7
Rand Mines	8 1/16	6 3/4
East Rand	5 1/8	3 3/16
Modderfontein	11 3/4	11 5/8
Randfontein Central	2 5/8	1 3/4
Randfontein Estates	2 1/4	1 7/8
City Deep	4 1/8	2 5/8
Robinson	9 1/2	6 3/4
Meyer & Charlton	4 1/8	4 1/8
Rhodesia.		
Chartered	1 1/2	31s.
Cam & Motor	1	35 1/2s.
Giant	3 3/8	2 5/8
Globe & Phoenix	2 3/4	2 1/16
Lonely Reef	2 3/4	3 3/8
Eldorado	3 1/8	3 1/16
Shamva	4 5/8	4 3/8
Tanganyika	6 1/2	2 1/16
West Africa.		
Ashanti Goldfields	2	1 9/16
Prestea	1 5/8	1
Abosso	2	1 1/4
Taquah Exploration	2	1 1/4
West African Trust	1	7/8
America.		
Alaska Treadwell	8 3/4	8 3/4
Camp Bird	31s.	31s.
Tomboy	1	1 1/4
Oroville Dredging	6s.	5-1/2s.
El Oro	26s.	23s.
Mexico of El Oro	7 1/2	7 3/4
Esperanza	2	1 1/2
West Australia.		
Bullfinch Proprietary	2 7/8	9s.
Great Boulder	21s.	15s.
Boulder Perseverance	5s.	4 1/2s.
Associated	9s.	7s.
Golden Horse-Shoe	4	2 7/8
Great Fingall	15s.	15s.
Sons of Gwalia	1 7/8	1 7/16
Broken Hill.		
British Broken Hill	16s.	62s.
Broken Hill Proprietary	36s.	50s.
Broken Hill North	4 1/4	5 1/2
Broken Hill South	5 1/4	6 5/8
Zinc Corporation	13s.	9s.
Amalgamated Zinc	34s.	38s.
Sulphide Corporation	23s.	23s.
Copper.		
Anaconda	8 1/8	7 3/8
Arizona	1 3/4	1 5/8
Atbasar	1 1/4	1 3/8
Spassky	3 3/4	3 3/4
Kyshtim	1 3/8	1 3/8
Great Cobar	5 1/4	2 1/4
Great Fitzroy	13s.	4s.
Mount Lyell	32s.	27s.
Mount Morgan	3 3/4	2 3/4
Poderosa	3 1/8	1 5/8
Rio Tinto	69	70 5/8
Oil.		
Anglo Maikop	25s.	12s.6d.
Cal. Oilfields	5	4 1/4
Kern River	12s.6d.	5s.6d.
Lobitos	28s.	17s.
Maikop Pipe-Line	19s.	10s.
Mexican Eagle ($10 pref.)	20s.	29s.
Trinidad	15s.	15s.
Tin.		
Dolcoath	16s.	20s.
Gopeng	3 1/4	3 1/2
Pahang	4s.6d.	5s.6d.
Tekka	2 1/4	2 3/4
Tronoh	1 3/4	2 3/4
Champion Reefs	1 5/8	1 7/16
Tin Fields of Nigeria	1 1/2	1 1/8
Lucky Chance	1 1/8	3/4
Naraguta	1	1 5/8
Miscellaneous.		
Waihi	6	3
Waihi Grand Junction	30s.	30s.
St. John del Rey	15s.	18s.
Lena	3 1/2	5
Mysore	5 1/4	5 1/8
Nundydroog	31s.	35s.
Ooregum	15s.	17s.
Champion Reef	8s.6d.	10s.

Market Reports

LOCAL METAL PRICES.

San Francisco January 3.

Antimony	11—11½c	Quicksilver (flask)	44.50
Electrolytic Copper	15—16½c	Tin	47—48½c
Pig Lead	4.70—5.65c	Spelter	7½—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES.

Silver reached the highest point for the week ended January 3 on last Wednesday, when New York quotations placed it at 51⅝. The week opened strong at 51⅜, but on Saturday the price dropped to 51⅛. Since then it climbed steadily to the figure named. The latest New York quotations place electrolytic copper at 13.90, lead at 4.45, and spelter at 6.30.

COPPER SHARES—BOSTON.

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, Jan. 3.		Closing Prices Jan. 3.
Adventure	6½	Mohawk	$ 56½
Allouez	43	North Butte	28⅜
Calumet & Arizona	61	Old Dominion	47½
Calumet & Hecla	440	Osceola	107
Centennial	18	Parrot	14½
Copper Range	55½	Shannon	10
Daly West	6	Superior & Boston	3¾
Franklin	12	Tamarack	31
Granby	39	Trinity	5½
Greene Cananea, ctf.	8⅛	Utah Con	17¾
Isle-Royale	22	Victoria	4½
La Salle	5⅛	Winona	6
Mass Copper	8½	Wolverine	100

NEVADA STOCKS.

(By courtesy of San Francisco Stock Exchange.)

San Francisco, January 3.

Atlanta	$ .17	Mayflower	$ .02
Belcher	.48	Mexican	4.32
Belmont	7.90	Midway	.20
B. & B.	.20	Montana-Tonopah	1.05
Booth	.06	Nevada Hills	2.52
Chollar	.15	Ophir	1.60
Combination Fraction	.14	Pittsburg Silver Peak	1.20
Con. Virgina	1.05	Round Mountain	.54
Florence	.61	Savage	.22
Goldfield Con.	4.25	Tonopah Extension	1.12
Gould & Curry	.06	Tonopah of Nevada	7.30
Jim Butler	.29	Union	1.20
Jumbo Extension	.22	Vernal	.16
MacNamara	.26	West End	.78

OIL SHARES.

(By courtesy of San Francisco Stock Exchange.)

San Francisco, January 3.

Associated Oil	$44.62	Peerless	$ 4.75
Brookshire	.50	Pinal	2.90
Caribou (New Stock)	1.12	Premier	.40
Claremont	.85	P. S. Petroleum	.19
Coalinga National	.14	Republic	.27
Con. Midway	.02	Silver Tip	.85
Cresceus		Sterling	1.35
Enos	.15	S. W. & B.	.16
Maricopa National	.21	Turner	1.00
Midway Premier	.29	Union	99.00
Monte Cristo	1.40	United Oil	.30
Palmer	.75	W. K. Oil	2.55

Current Prices For Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ₱ 100 lb	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ₱ 100 lb	1.00	1.50
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ₱ lb	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ₱ lb	0.09½	0.12
Acid, muriatic, com'l, carboy, ₱ 100 lb	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ₱ lb	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ₱ lb	0.10½	0.15
Acid, nitric, com'l, carboy, ₱ 100 lb	5.25	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ₱ lb	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ₱ lb	0.12½	0.15
Argols, ground, bbl., ₱ lb	0.20	0.25
Borax, cryst. and conc., bags, ₱ 100 lb	2.75	3.85
Borax, powdered, bbl., ₱ 100 lb	3.00	4.00
Borax glass, gd., 30 mesh, cases, tin lined, ₱ 100 lb	10.00	11.00
Bone ash, 60 to 80 mesh, bbl., ₱ 100 lb	4.50	5.50
Bromine, 1-lb. bottle, ₱ lb	0.55	1.00
Candles, adamantine, 12 oz., 40 sets, ₱ case	3.50	4.15
Candles, adamantine, 14 oz., 40 sets, ₱ case	4.00	4.55
Candles, Stearic, 12 oz., 40 sets, ₱ case	4.95	5.50
Candles, Stearic, 14 oz., 40 sets, ₱ case	4.65	5.20
Clay, domestic fire, sack, ₱ 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, ₱ lb	0.20½	0.24½
Cyanide, 98 to 100%, 200-lb. case, ₱ lb	0.20	0.24
Cyanide, 129%, 100-lb. case, ₱ lb	0.27½	0.28½
Cyanide, 129%, 200-lb. case, ₱ lb	0.26½	0.27½
Lead acetate, brown, broken casks, ₱ 100 lb	8.75	9.65
Lead acetate, white, broken casks, ₱ 100 lb	10.00	10.25
Lead acetate, white, crystals, ₱ 100 lb	11.75	12.25
Lead, C. P., test., gran., ₱ 100 lb	13.00	15.00
Lead, C. P., sheet, ₱ 100 lb	15.00	18.00
Litharge, C. P., silver free, ₱ 100 lb	10.50	13.00
Litharge, com'l, ₱ 100 lb	7.50	9.00
Manganese ox., blk., dom. in bags, ₱ ton	20.00	30.00
Manganese ox., blk., Caucasian, in casks, ₱ ton (95% MnO_2—4% Fe)	42.50	50.00
Nitre, double ref'd, small cryst., bbl., ₱ 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., ₱ 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., ₱ 100 lb	7.25	8.00
Potassium bicarbonate, cryst., ₱ 100 lb	12.00	15.00
Potassium carbonate, calcined, ₱ 100 lb	15.00	18.00
Potassium permanganate, drum, ₱ lb	0.11	0.12½
Silica, powdered, bags, ₱ lb	0.03	0.05
Soda, carbonate (ash), bbl., ₱ 100 lb	1.50	1.75
Soda, bicarbonate, bbl., ₱ 100 lb	2.00	2.50
Soda, caustic, ground, 98%, bbl., ₱ 100 lb	3.15	3.40
Soda, caustic, solid, 98%, drums, ₱ 100 lb	2.65	2.85
Zinc shavings, 850 fine, bbl., ₱ 100 lb	11.25	12.00
Zinc sheet, No. 9—18 by 84, drum, ₱ 100 lb	9.75	11.00

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, ₱ ton	*$20.00	$25.00
Arsenic, white, refined, ₱ lb	0.02	0.02½
Arsenic, red, refined, ₱ lb	0.07½	0.08½
Asbestos, according to length and quality of fibre, ₱ ton	100.00	350.00
Asbestos, lower grades, ₱ ton	10.00	100.00
Asphaltum, refined, ₱ ton	15.00	20.00
Barium carbonate, precipitated, ₱ ton	42.50	45.00
Barium chloride, commercial, ₱ ton	42.50	45.00
Barium sulphate (barytes), prepared, ₱ ton	20.00	30.00
Bismuth ore, 10% upward, ₱ ton	*75.00	upward
Chrome ore, according to quality, ₱ ton	10.00	12.50
China clay, levigated, ₱ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ₱ lb	2.50	
Coke, foundry, ₱ 2240 lb	13.50	15.00
Diamonds:		
Borts, according to size and quality, ₱ carat	2.00	15.00
Carbons, according to size and quality, ₱ carat	75.00	100.00
Feldspar, ₱ ton	5.00	25.00
Firebrick:		
Bauxite, ₱ M	175.00	
Magnesite, ₱ M	150.00	275.00
Silica, ₱ M	42.50	47.50
Flint pebbles for tube-mills, ₱ 2240 lb	15.00	25.00
Fluorspar, ₱ ton	10.00	15.00
Fullers earth, according to quality, ₱ ton	20.00	30.00
Gilsonite, ₱ ton	35.00	40.00
Graphite:		
Amorphous, ₱ lb	0.01½	0.02½
Crystalline, ₱ lb	0.04	0.13
Gypsum, ₱ ton	7.50	10.00
Infusorial earth, ₱ ton	10.00	15.00
Magnesite, crude, ₱ ton	7.50	10.00
Magnesite, dead calcined, ₱ ton	22.50	27.50
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ₱ ton	10.00	25.00
Manganese, prepared, according to quality, ₱ ton	30.00	70.00
Mica, according to size and quality, ₱ lb	0.05	0.30
Molybdenite, 95% MoS_2, ₱ ton	400.00	500.00
Monazite sand (5% thoria), ₱ ton	150.00	200.00
Nickel metal, refined, ₱ lb	0.45	0.60
Ochre, extra strength, levigated, ₱ 100 lb	2.25	3.25
Platinum, native, crude, ₱ oz	30.00	40.00
Sulphur, crude, ₱ ton	15.00	25.00
Sulphur, powdered, ₱ ton	40.00	45.00
Talc, prepared, according to quality, ₱ ton	20.00	50.00
Tin ore, 60%, ₱ ton	450.00	475.00
Tungsten ore, 65%	455.00	520.00
Vanadium ore, 15%, ₱ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, ₱ ton	*15.00	20.00

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EDITORIAL

LOS ANGELES mining engineers have formed a committee, under the chairmanship of Mr. F. J. H. Merrill, to organize a local technical society. Whether it will be affiliated with one of the national societies has not yet been determined.

SHIPPING interests are 'after the scalp' of the Court of Commerce, and will make an effort to secure its abolition, on the ground that appeals from the decisions of the Interstate Commerce Commission should go directly to the Supreme Court.

NEW MEXICO is at last a State of the Union, and will duly celebrate the event next Monday. New Mexico has had a long and interesting career as a Territory, it is a region of large, undeveloped resources, and we are glad to wish that as a State it may realize to a full its best ambitions.

EXTENSION of the operations of the United States Smelting, Refining & Mining Company into States other than Hidalgo, forecasted by an item in our news pages, will be welcomed in Mexico, where the company, as at home, is well liked and has a record of clean dealing and achievement.

WHAT'S in a name—"The largest open-cut mine in the Federated Malay States, situated at Kamunting, Perak, belongs to Towkay Ng Boo Bee, who has had a very tempting offer from a London syndicate. The conservative old gentleman, however, is not disposed to sell." He is evidently neither booby nor n. g., after all.

TROUBLE with the farmers over smelter fume has again come to a head in California. This time the Farmers' Protective Association is asking action against the Penn Chemical Works at Campo Seco, in Calaveras county. Such matters should be settled by a joint technical commission rather than a board of county supervisors. Unfortunately, as yet this seems impossible.

TEPIC, the ancient capital of the Territory of the same name in Mexico, will be in railroad communication with the rest of the world after February, and construction of the Southern Pacific line on to Guadalajara is to be pushed, according to Mr. Epes Randolph. The influence of better transportation facilities is already felt, the railroad having cast its shadow before, as noted in the cheerful account of mining development in the Territory printed on another page.

LEASING the coal and grazing lands is advocated by Mr. Walter Fisher in his annual report as Secretary of Interior. While by some this is considered the essence of radical doctrine, the idea is rapidly becoming familiar and popular. On the whole Mr. Fisher's recommendations are much less revolutionary than conservatives had anticipated and, being evidently based upon thorough and fair study of actual conditions, they have produced an excellent impression.

DREDGING costs are not based everywhere upon the same method of computation. Too commonly the theoretical capacity of the bucket, multiplied by the number dumped per minute, is taken as the basis of yardage. In California practically all companies compute their returns on the basis of the ground in place that has been dug, and, to determine the amount each month, careful surveys and soundings are made. The capacity of dredges in California is therefore larger and operating costs lower than those elsewhere, with few but important exceptions, when equality of conditions is considered. The figures used by Mr. Charles Janin in his review of dredging are in each case those computed according to the local standard, data for recasting them not being available.

A SURPLUS in the United States Treasury once brought Grover Cleveland into the presidency, though, sad to relate, the surplus, having accomplished so much, promptly vanished. Another surplus, in the treasury this time of the Tonopah Mining Company, is popularly reported to have brought Mr. J. E. Spurr to the vice-presidency of that company, that he may expend it for another mine 'equally good.' We are unable to say whether there is foundation for the report, but it is evident from reading the news columns that from now on every mysterious stranger seen hanging around a likely prospect will be regarded as an emissary of the potent Mr. Spurr. We hope the Tonopah Mining Company may have a long career of usefulness. Another good mine could hardly fall into better hands, but we doubt very much whether its campaign of optioning is as wide as current news items suggest. Somebody is going to be disappointed.

MOJAVE has been the centre recently of a new oil boom engineered by the Mojave Oil Company, of Los Angeles. Rigs have been erected, certificates engraved, and drilling and stock-selling are simultaneously active. The literature distributed by the company dilates enthusiastically on the "Kraemer anticline," "plainly traceable above ground for over a hundred miles," "without a fault." The supposed oil pool is linked convincingly with the field at Maricopa, the presence between of the Tehachapi mountains being gracefully ignored. It is stated that the "drill has just penetrated through an exceedingly hard capping, and entered a brown shale, impregnated with the usual oil odor." The fact is that the drill is in igneous rock underlying all sedimentaries, and that the anticline, of which so much is made, is a minor wrinkle of no great extent. There may be oil near Mojave, but the Mojave Oil Company has represented no convincing evidence thereof, and is evidently wrong in important particulars. However, there are those who maintain that at least some oil will be found—it is hard to sell stock on an odor, even when it is admittedly strong.

FOREST SERVICE officials are at some pains to dispel the impression, so widely current, that prospecting on lands in the National Forests is to be restricted. In a circular letter recently issued by the District Forester in San Francisco, it is pointed out that the Act of June 4, 1897, specifically says that prospectors shall not be prohibited from entering upon National Forest lands for the purpose of prospecting, locating, or developing the mineral resources therein. Prospecting and mining may go on within the National Forests just the same as on public lands outside. The prospector is absolutely free to travel about and explore just as much as he pleases and wherever he pleases, without asking anybody's permission. When he finds mineral he can stake out, locate, record, and work just as many claims as he thinks worth while, precisely as he would on the public domain. Any time he wants to get patent for his claims he can do so, providing the mining laws of the United States have been complied with. No one can patent claims which are taken up merely for the timber on them, or to get possession of land for purposes foreign to mining. The mineral as well as all other resources of the National Forests are for use. Within a National Forest the prospector and miner are assured of timber when they need it, and as long as they need it for the development of their claims. Outside, the timber supply is often doubtful. This is designed to be the chief difference between prospecting inside and outside National Forests.

ECONOMIC geology is recognized as perhaps the most difficult of all subjects, connected with mining, to teach, and in the current number of *Economic Geology* Mr. C. A. Stewart reopens the discussion as to teaching methods. It may be worth while to point out that the difficulties encountered, in part at least, arise from the necessity of covering three phases of inquiry in one course. The thorough study of the principles and criteria of ore deposition, for which Mr. Stewart pleads, must necessarily be based upon an adequate knowledge of the occurrence of deposits—what might be termed economic geography—and this, in turn, must be based upon a good working knowledge of ordinary geography. The average undergraduate mining engineer is too often devoid of the last of these, and the instructor's task is correspondingly magnified. Nevertheless, the criticism is justified, that in many technical schools too much time is devoted to the study of details, and too little to the correlation of details and the acquisition of general principles. Until by psychological analysis it is possible to determine beforehand exactly what the needs of a student will be, and to direct his education to that specific end, much as candidates for examination are coached on the questions asked during previous years, no better teaching method can be devised than a thorough inculcation of principles and methods of study. The capable man will be able to acquire detailed knowledge as it is needed, and will be the better off for not having his mental storeroom full of old lumber. Too often there is a disposition to overvalue facts and undervalue principles.

Alaska's Immediate Needs

Chambers of Commerce of the Pacific Coast cities have united in urging upon Congress prompt action covering the more imperative needs of Alaska along non-controversial lines. Attention has been so concentrated upon the railway and coal-land situation that other matters of equal importance are being overlooked. Alaska needs railways and better land laws, but, because there is dispute as to how these needs are to be met, is no reason why the present disgraceful condition of the Alaskan coast as regards lighthouses and other aids to navigation, should continue. This past summer one of the steamers had occasion to run out of its regular course for a short distance in the immediate vicinity of Sitka, which, it is well to remember, has been a centre of civilization since 1799, and discovered that the coast was still unsurveyed! Not only the coast, but the land is without surveys, and while a beginning has been made by authorizing the United States Geological Survey to take up the work, it remains true that settlement is practically prohibited in most of the Territory by the fact that the land is still unsurveyed. Cable tolls are high, wagon-roads are few, the salmon are being fished out without adequate provision for the future, and in many other ways Alaska is being neglected and exploited rather than rationally developed. The Alaskans deserve better things. They have natural difficulties enough with which to contend, and

the National legislative body should not allow its attention to be focused upon polemics to the exclusion of the humble but useful matters of everyday life.

Revision of the Mineral Land Laws

There have been few times when as much intelligent public interest was focussed upon National problems as now, and none probably when the laws relating to the mineral lands were under such general and active discussion. The need of thorough revision has long been recognized by those familiar with Western conditions, but inertia, seconded by self-interest, has prevented any considerable accomplishment. Both still stand in the way of adequate revision, but the demand for change is more widespread and is better organized than ever before. The withdrawals of public land from entry, first by executive act, and later with Congressional approval, have forced attention to the need of change. So long as it was possible by 'hook or crook' to continue to get possession of mineral land as needed for development it was done, and there were many who justified the particular means adopted as affording the only way open for meeting an acute situation. We are not among those who believe that good would come from a wide investigation of titles acquired under former conditions. If there were irregularities, responsibility therefor is not one sided, and a general unsettling of titles would be a National calamity for which neither necessity nor adequate justification exists. Bygones may well be let bygones; the present and future afford troubles enough.

The American Mining Congress has maintained for several years a committee on the revision of the mineral land law. This committee, under the chairmanship of Mr. E. B. Kirby, has undertaken a campaign to secure from Congress a commission or some other authorized body to hold public hearings and receive suggestions looking to a complete re-writing of the Federal statutes relating to mineral land. This plan has received wide support and there is excellent prospect of the suggestion being adopted. In the meantime an extensive discussion is going on among engineers as to just what changes should be made. The Mining and Metallurgical Society has appointed a strong committee, consisting of Messrs. H. V. Winchell, C. W. Goodale, and M. L. Requa, to study and report on the matter. The San Francisco and other sections of the Society have debated the situation, though as yet no reports have been published. The chairman of the committee, Mr. Winchell, will be glad to receive suggestions from those interested, whether members of the Society or not.

The admirable analysis of fundamental conditions by Mr. George Otis Smith, printed in this issue, affords at once a sound basis for discussion and a well formulated statement of the position taken by the proponents of change. The country is fortunate in having just at this time as Director of the Geological Survey, one who takes such keen and intelligent interest in the problem. The great mass of exact data available to an officer of the Geological Survey, with the detached position of the organization as a technical bureau, renders particularly valuable opinions from such a source. Mr. Smith is evidently favorable to deep-seated and extensive change, but he approaches the matter mainly from the point-of-view of one who must help meet actual problems as they arise. He favors the separation of surface from mineral rights, "whenever the two estates have values that can be separately utilized," because such separation permits the immediate utilization of the one in present demand without sacrifice of the other. Congress has recognized in recent legislation that it is foolish to give coal of large future value to the man who only wants and can only pay for desert land for agricultural purposes, and that it is equally absurd to prevent present development of the surface, by irrigation or otherwise, because the coal is not yet in demand. We believe the principle of separation of the two values, where there are two values, is sound, and many reasons for so believing are cited by Mr. Smith. The general subject of land law revision can not be discussed adequately in any one paper or editorial. We commend Mr. Smith's arguments to our readers and we desire at this time to emphasize one point only.

The law of the apex has proved troublesome from the first. It is founded on an erroneous conception of the mode of occurrence of ore deposits, and in practical operation it is necessary to buy and hold more land to protect a newly discovered orebody, than would be necessary with square locations. The reason lies in the complexity of the law and the necessity for protection against claims founded on the presence of 'lodes' of both steeper and less steep dip. The case of the Round Mountain Mining Company may be cited as one in point, and difficulties to be faced by anyone undertaking deep development along the Mother Lode in California, as another. The absurdity of regarding the porphyry copper deposits at Bingham, Utah, as 'lodes' such as originally contemplated by the law, is enough to condemn the latter. To all such arguments the common reply has been made that conflicting rights could be adjusted by the courts, and that introduction of the square location would interfere with existing rights. Adjustment by the courts of rights, themselves none too definite, is slow and expensive business, and if no other mineral claim was ever located in the United States, the courts would have enough and to spare of apex litigation for years to come. If, on the other hand, the square location had been adopted ten or twenty years ago, many important districts would have entirely escaped vexatious litigation arising from the extralateral right. The districts yet to be opened should not be denied protection because mistakes have been made in the past. Any change made now could not interfere with any existing right, and it cannot be said too plainly or too often that any revision of the mining law that may be undertaken should be in such terms as to prevent any possible question as to the protection of any accrued interests. This is demanded by the spirit of fairness, and any argument to the contrary is academic. That such a policy accords with the intention of Congress is shown by the fact that when the land withdrawal act was passed, provision was made for confirming any vested rights. For the first time a locator on oil land had protection so long as he continued work in good faith. It is true that a clause which would have operated to confirm all claims, good and bad, was defeated, as it should have been, but legitimate locators were left, as a result of the new law, in a stronger position than ever. It happens that the United States does not recognize a location as a vested interest acquired against itself, and that defence of the possessory right of a locator on public land, as against others seeking to dispossess him, falls to State courts as a part of their work of preserving the public peace. It would be possible, therefore, for the Government to refuse, in case a new law was enacted, to recognize rights acquired by location but not as yet confirmed by patent. We do not believe that this should be, or would be, done, though the point is worth emphasis in order to prevent any possible miscarriage of justice. Revision of the mining law is needed. Old conditions have passed, and to face the new, to continue the development of the West, to secure the highest possible utilization of the great natural resources, radical changes are imperatively demanded. Let the revision be prompt and thorough, but let it protect old rights and define new ones so as to free the industry from unnecessary litigation.

The Mineral Land Laws and Their Defects

By George Otis Smith

*The increasing share which the Geological Survey has been asked to take in the public-land administration by the Interior Department has brought many of the problems connected with the public-land laws more directly to the attention of those charged with the work of this bureau. For over 30 years, however, these problems have interested the Federal geologists, who have had exceptional opportunities for first-hand observation in nearly all the important mining districts of the country, and for almost as long a period the engineers of the Survey have been in touch with the irrigation and power developments in the public-land States. This intimate experience with both field conditions and administrative problems justifies an expression of opinion concerning the land laws, which, it is believed, will be appropriate to this administrative report. To a large extent the principles here presented and the specific provisions advocated have been expressed in memoranda submitted by the Geological Survey to the Secretary of the Interior during the past four years.

Proposed Amendment of Public-Land Laws

The objects to be sought by amendment of the public-land laws are, first, purposeful and economical development of resources for which there is present demand, with retention of such control as may insure against unnecessary waste or excessive charges to the consumer; and, second, the reservation of title in the people of all resources the utilization of which is conjectural or the need of which is not immediate. The means that are essential to the attainment of these objects are, first, the classification of the public lands; second, the separation of surface and mineral rights; and third, the disposition of the lands on terms that will secure the highest use, enforce development, and protect the public interest. Legislation based on these principles will not only secure the positive benefits of immediate utilization, but will also avoid the evils of speculative holdings of lands by fictitious use or by admitted nonuse for the future enjoyment of the unearned increment or of the profits of monopolization. With actual development made a condition of possession, and with land classification and separation of estates made preliminaries of disposition, the present-day utilization by individuals or corporations, and the reservation to the people for future use become at once possible without conflict of interests.

The classification of the public land is essential to the administration of not only such laws as express the principle of separation, but also of those whose purpose is to promote the highest use of the land. Land classification is, first of all, the determination of the best use to which each particular portion of the public domain can be put, and by the organic act of March 3, 1879, this duty was specifically imposed upon the Director of the Geological Survey. Progress now being made in this work is set forth in this report.

Separation of surface and mineral rights might be effected without classification of land by the automatic reservation of all mineral deposits to the United States in every patent issued as a result of non-mineral entry, selection, or purchase. Legislation of this type would possess the merit of simplicity and effectiveness, but the well-known objection to limited patents would with considerable reason be made the basis for the contention that the Government should assume the burden of classifying its land before disposition.

The classification of the public domain is itself an outgrowth of the principle of relative worth, which early found expression in the land laws of this country, in that they provided for the reservation of mineral lands from disposition for other purposes. The present coal-land law also expresses this principle of relative worth by giving deposits of gold, silver, and copper, priority over coal, and coal, in turn, preference over agricultural values. Such distinctions necessitate land classification based on adequate field examination, and with the classification data at hand the principle of relative worth can be further developed. Wherever the different values of the land conflict, the highest use should prevail, and under legislation that does not oppose the principles of economic law the highest use will prevail.

Under the withdrawal act of June 25, 1910 (Stat. L., Vol. 36, p. 847), classification is made possible in advance of disposition, and disposition can be postponed to await immediate legislation. Fully to accomplish this purpose, for which it was enacted, the withdrawal act itself needs amendment in several particulars. No withdrawal is effective against location or appropriation for minerals other than coal, oil, gas, and phosphate, the apparent intent of the law being to promote the exploration and discovery of metalliferous minerals. However, this exception to the application of the withdrawal law is far too broad, in that it would include such minerals as potash or nitrates, the disposition of which is a matter of no less vital concern to the agricultural interests of the nation than is the proper utilization of the phosphate deposits. So, too, it is true that attempts are being made to claim sand and gravel as minerals excepted by the law and under such contention to secure control of power-sites, even in the face of an executive withdrawal. Connected with this defect in the law is the lack of recognition therein of the principle of relative worth. There is a too-evident opportunity for a gypsum entryman, notwithstanding the fact that the gypsum, by reason of poor quality or lack of transportation facilities, may be worthless commercially, to set up a claim for title to a tract of great prospective value for oil—a tract which is protected from oil entry by an oil withdrawal. Similarly, under the mineral law it is possible to seek title to the walls of a narrow canyon, withdrawn as a power-site, in spite of the great discrepancy between the utterly negligible value of the building stone it contains and the strategic importance of the dam-site.

Separation of Surface and Mineral Rights

The first step, both in principle and practice, in any amendment of the land laws, appears to be that of making possible by legislation the separation of surface and mineral rights whenever the two estates have values which can be separately utilized. A notable advance in public-land legislation was the passage of the acts of March 3, 1909 (Stat. L., Vol. 35, p. 844), and June 22, 1910 (Stat. L., Vol. 36, p. 583), which provide that patents issued thereunder grant title to the surface of the land only, and thus permit its agricultural development, while at the same time the United States retains title to the underlying coal deposits. The results have been of undoubted value in permitting homestead and desert-land entries, Carey Act selections, and reclamation-act withdrawals on lands which are withdrawn or classified as coal lands or are known to be valuable for coal.

A similar separation of surface and mineral rights should be extended to all other non-mineral entries, selections, or locations, to include oil, gas, and phosphate lands as well as coal lands, the mineral rights to be reserved to the United States until they can be disposed of most beneficially to the people. For all these lands the need of legislation for the separation indicated is not academic, but actual, since under each class there are already requests for surface patents.

Similar legislation applying the principle of separation

*From annual report as the Director of the United States Geological Survey.

is demanded in order to reserve to the Government the exclusive right to grant easements for the future development of water resources, for either power or irrigation, and at the same time to make provision for grants of surface patents for the agricultural use of the land, or of mineral patents where mining may not interfere with water-power development. During the past year the principle involved in this proposed legislation was recognized by the enactment of an item in the Indian appropriation act which provides for the issuance of limited patents on the shores of Flathead lake, in Montana, where increased storage for power and irrigation may be at some future time found to be advantageous. A further recognition of this principle was given in the water-power bill introduced by Herbert Parsons at the third session of the Sixty-first Congress (H. R. 33000), wherein provision is made for a double use of land leased for water-power utilization and for the reservation in perpetuity to the United States of all rights to future occupancy and use for water-power development on all lands designated by the President. The need of statutory authority for limited patents is most evident in regions where, because of the possibility of future power-development, lands are now withdrawn which possess present value for agricultural use. Provision should be made whereby future power-development will be absolutely insured whenever the value of the lands for such use would exceed their actual agricultural value.

The chief advantage of land withdrawal and classification lies in its essential relation to the principle of proper disposition of the public domain, the real purpose of public-land administration being to insure such reservation or disposal of the people's land as will result in its highest use. The question of amendment of the present laws relating to the disposition of coal, oil, gas, and phosphate deposits on the public domain is recognized as fairly before the public by the specific mention of these minerals in the withdrawal act.

Law Applicable to Coal Lands

The coal-land law is unquestionably the most satisfactory of the present mineral-land laws in that it admits of the placing of an adequate valuation upon the deposits, and in the administration of this law the purpose is not only to base the appraisal price upon the quantity and quality of the coal present and to give consideration to every known physical and commercial factor affecting the value of the deposits, but also to make the selling price approach as nearly as possible the present purchase price of a royalty under a leasehold. Thereby it is intended to permit purchase for immediate development and at the same time to prevent, or at least discourage, purchase for long-time investment or for monopolization. So many factors, however, require consideration that an ideal adjustment of the values is well-nigh unattainable for many, if not for most, coal lands, and on this account a strong argument may be made for support of the lease over the sale system. Under leasehold it would be comparatively easy so to adjust the relationship between ground rental and royalty as to prevent the acquisition of coal deposits until such time as their development should be profitable. On the other hand, it is possible, under the present law, and it is the policy in its administration, to readjust the prices from time to time, either by reduction to encourage development in special cases, or, more commonly, by raising the price on account of increased value due to new discoveries or to changed commercial conditions. The greatest advantage of the lease system to the operator directly, and to the public indirectly, is relief from the large capital outlay now required in the acquisition of the large acreage absolutely necessary for a modern mine. This argument, advanced against the present policy of valuing the public coal-lands at even conservative prices, thus becomes an argument for a leasehold law. Thus contrasting the lease with sale outright to the coal operator, the reduction in capital necessary for original investment must result in reducing the cost of operation to the mine-owner and thus make possible a correspondingly lower price of coal to the consumer. Hardly less important, moreover, is the better control possible under a lease system, although against the advantage of such control must be weighed the cost of Federal management and the possibilities of inefficient administration or even maladministration.

The present coal-land law, however, has one serious defect, which should be remedied if a leasing law is not enacted. The restriction of area that may legally be acquired to a maximum of 160 acres for an individual and 640 acres for an association is not in accord with good mining practice. The fixed charges on the cost of a modern coal mine, provided with the up-to-date equipment necessary to conserve life and property and to assure maximum recovery, are too high to be assessed against the output of so small a tract, especially if the coal seam is of only moderate thickness. A law designed to promote the practical utilization of coal deposits, where the system contemplates sale or lease, must provide for the holding of a large enough unit to permit the opening and equipment of a modern mine and to warrant its economical operation. Without such provision for commercial operation, too great an advantage is given to the land-grant railroads and large coal companies already in possession of considerable areas of high-grade coal.

Laws Applied to Phosphate Lands

The present uncertainty whether the phosphate rock of the public land should be entered under the lode law or under the placer law is conclusive evidence of the need of legislation. As a matter of fact, neither of these laws is more applicable to the acquisition of beds of phosphate-bearing limestone than it would be to that of coal beds. The realization that the phosphate deposits are more extensive than was known or suspected when the Survey geologists began land classification work in Idaho and Wyoming does not lessen but rather increases the urgency for a leasing law which will provide for the utilization of this large supply of mineral fertilizer, so as to meet both present and future needs.

Law Needed for Oil and Gas Lands

The most urgent need of legislation for the disposition of mineral deposits is in the case of oil and gas. It is most apparent that the placer law, which is none too well adapted to meet modern conditions in mining placer gold, is wholly inadequate if applied to public oil lands, inasmuch as oil is discovered at a late stage in the exploration and development of the land claimed under the law. Thus, large expenditures, extending over several months, if not years, are necessary before any right is acquired against the Government, and during all this time there is no legal protection of the oil prospector against unscrupulous claimants or competitors better backed by capital. The need for remedial oil legislation is somewhat less pressing than it was a year ago, by reason of the passage of the act approved March 2, 1911 (Stat. L., Vol. 36, p. 1015), the effect of which is to validate a class of claims that, although clouded by the construction which the Department was forced to place upon the misfit placer law under which title to oil lands must now be gained, were *bona fide* in that the inception of their development antedated the oil-land withdrawals. This legislation was in accord with the spirit of the withdrawal act, which provides for the protection of equities already established. The need for a better law is, however, imperative, and the legislative action demanded by the situation should not be limited to an attempt to revamp the general placer law, but should consist of the enactment of an altogether new measure especially adapted to provide for the sane and equitable development of this industry in the future. First, the new law should authorize the issue of exploratory permits, granting to individuals or associations the exclusive privilege of occupation, the sole condition of such a grant being diligent and adequate prosecution of development work, measured by the expenditure of fixed sums within certain periods, with possibly the payment of a

small fee to the Government in lieu of such expenditure during the first six months. The issue of this permit should preferably be limited to one to each citizen or association of citizens, although after the lapse or surrender of such a permit the former holder should be allowed to apply for another exploratory permit. In the second place, the law should provide that upon discovery the holder of the permit be given a leasehold title with a royalty varied to meet local and actual conditions. The 'wild-catter' or prospector in unproved country, whether such unproved territory is classified on geologic evidence as oil land or not, should be given special privilege to offset his greater risk. This privilege might take the form of an increased acreage, held both under permit and under lease, or a practical exemption from the payment of royalty, merely a nominal rental being charged under the lease.

The chief advantage that may be urged for the leasehold for oil over a fee-simple title lies in the prevention of monopolization through large holdings. Such large holdings without production would be guarded against by a ground rental sufficiently high to discourage the acquisition of lands except for immediate and continued development, although provision should also be made in the lease for surrender under terms which would protect the Government. This indirect control of development would be preferable to the direct enforcement, by forfeiture, of continuous production, which should be avoided because of the danger of disturbing the delicate equilibrium between supply and demand. Transfers of interest, under either permit or lease, should be permitted because of the absolute necessity in most instances of procuring capital for both drilling and operating an oil well. The law, however, should set forth the purpose of the control of such transfer, which would be to provide protection for the original locators, most of them men of small means, and more especially to insure the prohibition of too large holdings of Government leases by big companies.

Laws Relating to Metalliferous Minerals

Proposed amendments of the well established laws relating to metalliferous minerals always raise the warmest discussion. With the opinion of mining men in general favoring revision of mining laws of the United States, and with commission after commission appointed by various bodies to suggest improvements, the statutes have remained practically unchanged for nearly forty years, while the geology of ore deposits and the technology of metal mining have made marvelous progress.

The law of the apex has proved more productive of expensive litigation than of economical mining. In many of the more recently established and more progressive mining districts this statute has been made inoperative either by common agreement or by compromise between adjoining owners. Its repeal could not affect established equities under patents already granted, but would render possible more certain property rights in large mining districts, not as yet discovered, where new and valuable claims will be located a hundred years from now. The unit of disposition should be the claim, preferably square, limited on its four sides by vertical planes, and of a size sufficient to allow the miner occupying two contiguous claims to follow the vein or lode to considerable depth, even if its dip is only 45°. Such definition of a mining claim is found practicable in both Mexico and British Columbia, and in the latter country the change from the apex law was effected without trouble or confusion.

The same knowledge of natural conditions that leads to the suggestion of a repeal of the law of the apex forces the further suggestion that discovery of ore in place cannot be made universally a prerequisite to the location of a mining claim. Geologic study of ore deposits has furnished examples in a number of regions where the present law cannot be complied with, although rich deposits exist underground and their extent can be more definitely surmised than in most places where ore is discovered at the surface. To meet such actual conditions, the law should provide for the acquisition of metalliferous mineral land classified as such upon the basis of adequate geologic evidence, whether actual outcrops are present or not.

Most important, perhaps, in any amended mining law would be provision for enforced development, a principle expressed, it is true, in the present law, but not made effective in its workings. A requirement of actual use as a condition of occupancy of mineral land cannot be regarded as either novel or radical. As regards the large acreage of undeveloped land in many mining camps to which patent has already been issued, it is perhaps true that the situation is without relief, unless the Western Australian plan is adopted, whereby the Government steps in and permits mining under a lease, the proceeds of which are assessed, collected, and paid over to the owner. The principle invoked seems to be that no property-owner can rightfully oppose the development of the resources of the State.

In the case of unpatented claims, a remedy should be sought for what has been termed "the paralysis of mining districts," and the rigid requirement of annual assessment work should be made actual and effective by inspection and supervision, in order to put an end to the present procedure of allowing a claim to lie idle for practically two years after its location, not to mention the many localities where claims are held year after year with only perfunctory compliance, or even without any performance of assessment work—a type of local disregard for law that is in striking contrast to the observance accorded to the district customs and regulations of earlier days, whereby the right of possession was made absolutely dependent upon continuous operation.

The remedy, then, for the existing evil of idle mining property must be sought either in the adoption of leasehold, under which the Government can enforce operation, a system which fully attains the desired end of promoting mining development in Australia and New Zealand, according to the report made in 1907 by A. C. Veatch, of this Survey, to the President, or in the thorough revision of the existing system. Radical amendment to the present law would be necessary in order to secure something more nearly approaching equality of opportunity. Some limitation should be put on the number of claims which an individual can locate in each mining district, and the prevention of monopolization would be furthered by the rigid enforcement of assessment development. The record of claims kept by a local official elected by the miners should be reported to the nearest land office in order to furnish the Federal Government with a notice of the intention of the claimant, and thus to initiate the operation of effective inspection, the purpose of which would be to enforce the use and development of mineral land as contemplated in the law.

Legislation Required for Water-Power

On the subject of water-power legislation the position of the Geological Survey is essentially that set forth in January of 1911 in a report addressed to the Secretaries of the Interior and of Agriculture by a joint committee representing the two departments. The legislation there outlined would provide for leases of public and reserved lands of the United States valuable for water-power development for a fixed term, not to exceed 50 years, with moderate charges for use and occupancy of the land, revocable only upon breach of conditions or on account of the charge of excessive rates to consumers. These leases should be identical in terms, under whatever department they are granted, with joint and uniform regulations governing all matters relating to water-power development of land belonging to the United States. Provision should also be made for periodic and equitable readjustment of charges, transfer of leases, preferential rights to renewal, and compensation for improvements at the termination of the leasehold. The law should specifically recognize water-power use as dominant, should insure to the lessee undisturbed occupancy of the land needed for such use, and should reserve for future utilization all land believed to possess value for water-power development, these lands to be designated by the President but to be open to other entry, subject to this reserved right wherever separation of the water-power use and other use is possible.

Review of Gold Dredging in 1911

By Charles Janin

ARIZONA

*The Eleanor P. M. Co. is reported as having a gold-dredge in operation in French gulch, but no details are available.

COLORADO

The only place at which gold dredging is being conducted in Colorado is at Breckenridge, Summit county, where three companies are now operating one dredge each. The first dredges in Breckenridge were of the New Zealand type and were started in 1898; these, and a number of other boats following, proved too light for the ground and were soon shut down. It was not until 1898, when the Reliance dredge was constructed, that any success was met with in gold-dredging in the State. This boat was originally designed as a double-lift dredge, but was afterward entirely reconstructed. The Colorado Gold Dredging Co. is operating a Bucyrus dredge, which is the largest in Summit county. It was built in 1908, and handles from 160,000 to 170,000 cu. yd. per month. During 1910 the dredge handled 1,400,554 cu. yd. at an operating cost of 4.7c. per cu. yd. The dredging season was from March 23 to December 4. This dredge has 42 close-connected buckets of 9½-cu. ft. capacity and is designed to dig 38 ft. below water-level. The profitable gravel is confined to a narrow channel 150 to 200 ft. wide. This company has a dredge now idle in the Blue river. When last in operation, the buckets ran into a hard porphyry dike, and the bucket-line was badly damaged. In French gulch there are boats belonging to two dredging companies, the Reliance and the French Gulch, each operating a 5-ft. dredge. The cost of operating the French Gulch dredge, a Bucyrus boat, which was built in 1908, is stated to be 5½c. per cu. yd., and the monthly capacity 75,000 yd. Operations last through nine months of the year. The Reliance Dredging Co. handles 70,000 cu. yd. per month, and operations are continued throughout the year. The Reliance dredge is an old boat which has been repeatedly overhauled and remodeled. It was originally designed for steam-power, but was changed in 1909 to electric power. Some years ago dredges were operated near Golden, but were unsuccessful, and the machinery was afterward moved to other fields. In Routt county several attempts have been made to dredge different areas, but no dredges are at present operated. A small dredge, with 1½-ft. open-connected buckets, operated for a few months near Hahn's Peak in 1907. The deepest ground was 12 ft., and the best day's work, according to the man in charge, was 1174 yd. in 24 hours, and the coal consumption 4 tons. As coal cost only $3 per ton, delivered, it is seen that the fuel cost in this instance was not high. The dredge did not pay, however, and was shut down.

The gold won from dredging operations in Colorado has been approximated as follows: 1907, $36,000; 1908, $145,000; 1909, $413,000; 1910, $344,210; 1911, estimated, $350,000.

IDAHO

Gold-dredging in Idaho first started in 1894 with the installation of a suction dredge on the Snake river near Minedoka. It was claimed that this boat was successfully operated and that the working cost of handling gravel was 1½c. per cu. yd. However, when the company built a second boat, it was of the bucket-elevator type. This second boat had 5-cu. ft. buckets and an average capacity of 2000 yd. per day over a period of twenty months at a reported cost of 5½c. per cu. yd. It did not prove a profitable enterprise, and it was dismantled, and the machinery moved to Boise Basin. In Boise county a 3½-ft. Risdon dredge was built in 1898 and operated for a number of years until worn out, and since that time a number of successful boats have been built. The Boston & Idaho Gold Dredging Co. put in operation in 1911 a 15-ft. boat built by the Yuba Construction Co. Power is furnished from the company's plant on the Payette river and delivered to the dredge motors, which call for a total of 810 hp. at 2200 volts. This company also operates a 5-ft. Risdon boat with a capacity of 57,000 cu. yd. per month. This latter boat was built in 1909. One of the most profitable enterprises is said to be that of the Moline Mining Co. at Placerville, operating a 5-ft. Risdon boat. This company formerly operated a steam-shovel plant on the same property. Other dredges have been placed in different parts of Idaho, two near Elk City, and one this last year by the Kirtle Creek Dredging Co., five miles from Solomon, Lemhi county. This is a 9-ft. dredge using electric power. The production for 1911 is expected to show a decided increase over that for 1910, which was, according to the U. S. Geological Survey, $91,247. Dredging operations in Idaho were described in the *Mining and Scientific Press* for January 1 and July 16, 1910.

TYPE OF LIGHT DREDGE TRIED IN OREGON. NOW IDLE.

Detailed figures of the number of dredges working and the production in recent years are given below:

Year.	Dredges working.	Amount.
1905	3	$ 34,332
1906	3	39,200
1907	6	74,434
1908	5	77,189
1909	8	101,705
1910	6	91,247
1911 (estimated)		200,000

*For notes of gold-dredging in California, Montana, Alaska, Russia, and the Philippines, see the *Mining and Scientific Press*, January 6.

MONTANA

The operations of the Conrey Placer and Poor Farm companies in Madison county were discussed by Mr. Jennings last week. In Missoula county there are two dredges working, one a Marion dredge at the La Casse placers, and the other, which was started this year on Kennedy creek, a 5-ft. Risdon boat, with steam-power using wood for fuel. During 1909 a dredge was operated for a few weeks near Butte, but has been stopped. The Magpie Development company put a dredge in operation in May 1911 on Magpie gulch, in Lewis and Clark county, about twenty miles from Helena. This dredge is operated by electricity and is said to have cost $150,000. It was built by the Union Iron Works.

NEVADA

The only dredging operation in Nevada is that of the Federal Mines Co., about 14 miles from Oreana, Humboldt county. This has been discussed by H. G. Walker in the *Engineering and Mining Journal* of June 11, 1911. It is a Risdon boat, equipped with 28 buckets of 5-cu. ft. capacity. The power is furnished by four Doak gas-engines with a total of 196 hp., using distillate as fuel. The depth of the ground ranges from 20 to 30 ft., and contains a considerable number of boulders. The dredge has been shut down after operating but a short time, and it is reported that the boat will be moved to a new location.

OREGON

Gold-dredging in Oregon has never met with any pronounced success. The total production of gold won from dredging operations in the State, does not, so far as can be learned from U. S. Geological Survey records, exceed $250,000. A number of years ago dredges, both bucket and suction type, were built on the Snake river, and for a while some of them, perhaps, paid operating expenses. One of these, a 5-ft. bucket dredge, was reported as being successful after working over some bars of the river and was moved to Boise Basin, Idaho, where it was shortly afterward shut down. An article written a number of years ago for the *Mining and Scientific Press* by W. M. H. Washburn, gives an interesting account of the gold occurrence on the bars of the Snake river and describes some dredging operations at that time. A pony dredge was operated for a while near Sumpter, but was not a success. It was claimed that the machinery was too light for the character of the ground. A company has started to prepare for a dredge this season on ground near Sumpter. After considerable prospecting the dredge pit was dug 150 ft. square by 12 ft. deep, and it is expected the dredge will be built next year. It is to have 9-ft. buckets and use electric power furnished by the Olive Lake power-plant, and will be the first modern dredge following California methods to be operated in Oregon. In 1905 the Western Mining & Development Co. put in commission a dredge on the south fork of the John Day river. The dredge operated during 1905 and a part of the second season, and was then dismantled. The White-Shelby Hunt dredge, which operated a short time in southern Oregon, was originally built for reclamation work at Grays Harbor, Washington. It was afterward moved to Pleasant Valley, Josephine county, and mounted on wheels. Water interfered with its operation and it was again put on a hull. It was run a short time only; large boulders and difficult digging proved a serious handicap, and the ladder was broken. The dredge was equipped with buckets of 2-cu. ft. capacity and a gasoline engine; it is now idle. The Josephine dredge, near Waldo, Josephine county, was a 4-ft. bucket dredge, using steam and wood fuel, and was owned by an English company. It operated only one season, when, it is claimed, the company got into litigation. Repairs were not kept up, and while in charge of a watchman the dredge sank and has never been recommissioned. Recently there has been a report of another dredge to be built near Waldo, but no definite information is at hand regarding it. The only dredge operated in Oregon that seems to have made anything over operating profit, and that could be classed as even partly successful, is that of the Champlin Gold Dredging Co. on Foote creek, Jackson county. This is a 5-ft. dredge, operated by electric power. It was operated successfully for several years and during part of the present season, but the bucket-ladder line broke a few weeks ago and the weight of the buckets, about 70 tons, sprang the hull planks and the dredge sank in about 18 ft. of water. It is said that repairs will be made at once; the loss being estimated at $35,000. While this is the only company whose dredging operations have returned a profit in Oregon, there seems to be no reason why some of the other dredges should not have proved a financial success if they had been properly designed for the ground on which they were placed. It is probable that investigations will be made of Oregon placers in the near future, and if the proposed dredge near Sumpter returns a profit, a number of other dredges of the type that has proved such a success in California will be erected. Gold-dredging in Oregon produced $34,010 in 1910, according to the U. S. Geological Survey.

SOUTH DAKOTA

During June 1911 the Castle Creek Gold Mining Co. began operating a dredge at Mystic, Pennington county. The dredge was built by the Stearns-Roger Manufacturing Co. of Denver and cost approximately $95,000. The dredge follows California ideas closely, being built under charge of J. R. Henderson, who was formerly superintendent for the Yuba Construction Co. It is equipped with buckets of 5-cu. ft. capacity and is designed to dig 35 ft. below water-level. In connection with the dredge a power-plant using coal as fuel was built close to the railroad. Electricity is generated at 2000 volts and supplied in motors direct. On account of the power-plant being built to supply one dredge only, the operating costs are expected to be somewhat higher than if several dredges were working. The costs for the first month are given at 5c. per cu. yd. Obviously this figure, while of some interest, has but little real value, and costs over a longer period will be watched with interest.

BRITISH COLUMBIA

Dredging has not so far been a success in British Columbia, and there are no dredges at present working in the Province. Attempts have been made to dredge various areas, and the following account may be of interest. According to the report of the Minister of Mines for 1910: "The various dredging leases on the Fraser river have been amalgamated in one company, the Canada Dredging Co., Ltd., but there has not been any work done by the company up to the end of the year." In 1900 a dredge was erected on the Fraser river, near Lytton. This was built for the Cobbledick Mining Co. by Roby & Co., England. The bucket ladder and tumblers were furnished by Simons Bros., Renfrew, Scotland, and the dredge was constructed under the direction of George Hurst, now manager of the dredging department of the Union Iron Works. The dredge was of the open-connected type, equipped with 5-cu. ft. buckets and designed to dig 35 ft. below the water-level. The dredge was operated several years with varying success, but was finally shut down. It is stated that one of the causes of failure was due to the fact that no tailing stacker had been provided, as it was thought, when the dredge was constructed, that as it was to operate in a running stream, none would be necessary. It was found, however, that at times the tailing piled up and prevented the dredge from even digging its own flotation. No difficulty was encountered from the spring freshets, which some nights, it is said, raised the water-level 15 ft., but experience proved the advisability of keeping the head-lines out of the water. Some years ago two dredges, one having buckets of 3-cu. ft., the other of 7½-cu. ft. capacity, were installed near Atlin, but operated a short time only. Large boulders and an insufficient gold content prevented the operations being a financial success. It is reported that

examinations of several areas on the Fraser river, and elsewhere, have been made this year with a view to building dredges if conditions were favorable, but as yet no definite account has been made public.

VICTORIA, AUSTRALIA

The output from gold dredges for 1910 was 87,156 oz. In all, 107 dredging plants were in operation, and they treated a total of 19,838,552 cu. yd., with an average recovery of 9c. per cu. yd. The following details of dredges of different classes is taken from the Government report on Victoria: Bucket dredges, 53; pump hydraulic sluice, 46; jet elevator, 8. The best results during the year were obtained by the Tewkesbury Amalgamated Co., operating 5 bucket-dredges ranging in size from 4½ to 5-cu. ft. buckets and dredging a total of 1,553,350 yd., at a yield of approximately 5.6c. per cu. yd. and a cost of 3.8c. per yd. This company paid dividends of £3325 for the year. Considerable attention has been paid of late, in Victoria, to resoiling dredged ground. The latest arrangements in this line have been described in the *Mining and Scientific Press* of April 15, 1911, and a description of hydraulic pump dredge, which has proved so successful in Victoria, was given November 11. The Austral Otis Engineering Co. of South Melbourne reports that during 1911

FIVE-FOOT DREDGE, FRASER RIVER, BRITISH COLUMBIA.

dredge construction was almost entirely comprised of the removal of dredging plants from old sites to others nearby, and that there is little opportunity for new plants in Victoria and the Commonwealth generally, as dredging has of recent years been greatly restricted, and also as there are in existence so many plants, which were built during the dredging boom, and put on unprofitable areas.

The following table, giving the results of dredge mining in Victoria, has been adapted from the report for 1910:

Year	No. of companies working	Total cubic yards hauled	Yield in ounces	Av. yield, cents per cubic yard	Total acres worked	Yield per acre, oz.
1905	82	13,450,945	72,926	11.1	479.5	152.1
1906	125	17,307,277	85,271	10.1	628.5	135.6
1907	133	20,199,892	97,821	10.1	739.0	132.3
1908	123	20,546,346	104,167	10.3	777.2	134.0
1909	111	19,979,131	88,339	9.0	737.7	120.0
1910	107	19,838,552	87,156	9.0	698.0	124.8
1910-1911*		149,209,093	726,431	10.1	5187.0	140.0
Prior to 1910*		†14,000,000	90,525	...	432.0	210.5
		†163,209,093	816,959		5617.0	145.4

*Estimated. †Total dredge and hydraulic sluice mining.

Kuk San Dong Cyanide Plant

By A. E. Drucker

*The method of treatment consists of washing, classifying, and re-concentrating the material as it comes from the dump. The tailing from the concentrator plant is rejected, while the concentrate obtained, containing the bulk of value, is classified, re-ground (all slimed), and the gold extracted by cyanide agitation and filter-pressing. The plant consists of a concentrator and cyanide annex. The concentrator contains one water supply tank (12 by 12 by 10 ft.), one storage dump bin (22 by 20 by 12 ft.), one 9-in. screw conveyor, one 5 by 3-ft. revolving screen washer and distributor, one 36-in. hydraulic cone classifier, four Callow 6-ft. cone thickeners, and eight No. 5 Wilfley tables. The cyanide annex contains one steel (15 by 12 ft.) stock cyanide solution tank, one concentrate storage bin (22 by 10 by 12 ft.), two 6-in. bucket elevators, one 6-in. screw conveyor, one 4 by 16-ft. tube-mill, two 3-in. Morris centrifugal sand-pumps, two hydraulic 36-in. cone classifiers, two 6-ft. Callow cone thickeners, four Pachuca steel agitators (8 by 30 ft.), two steel sand-clarifying tanks (10 by 6 ft.), four zinc-precipitation boxes (36 by 30 in. by 12 ft.), two steel cyanide-solution sumps (15 by 12 ft.), two Morris 2-in. centrifugal solution-pumps, one Monteju pressure tank, one Dehne (24-frame) filter-press, one vacuum-pump, and gold precipitate filter-box. The power-plant consists of one 90-hp. steam-engine, one air-compressor (300 cu. ft. per min.), and one Fraser & Chalmers (60 in.) steam boiler. The foregoing is a full description of the plant. It occupies a space 30 by 140 ft., with an engine and boiler room annex. The tube-mill, pump, engine, and Wilfleys are set on concrete foundations. It was necessary to put in four stone retaining walls.

Up to August 1, 1911, the plant had a very irregular run, due chiefly to trouble with the sand-pumps, Pachuca agitators, steam-engine, and inexperienced native help. The Pachuca agitators were connected in series and fitted with baffle cylinders so as to use the continuous agitation and decantation method which has proved an advantage in the modern plants of Mexico. This arrangement has proved a failure in our case, neither were we able to obtain a satisfactory circulation of the pulp, nor clear solutions to the clarifier tanks and zinc-boxes. This has been the most serious trouble and has prevented the getting through of a satisfactory amount of concentrate, also interfering largely with precipitation in the zinc-boxes. We have, however, at the present time overcome these defects by a different arrangement.

It must be remembered that in no other place has the attempt been made to re-treat an old oxidized concentrate cyanide tailing dump by the cyanide process, and in no case have we been able to profit by the experience of others on a similar proposition. Therefore we have had to work out a special treatment of our own. The plant is now treating 60 tons per day and will be brought up to 80 tons capacity per day, that which it was originally intended to treat. During the past we have been running through dump that only assays $2.56 per ton, so as to prevent losses until things were made right. Our new plant at Taracol will reap the benefit of our experience at Kuk San Dong. The assays and bullion returns so far show that we are able to obtain the following results:

Dump heads, $2.56 per ton (average heads for total dump, about $7).

Gold extraction by concentration, 79% (value contained in concentrate).

Gold extraction by cyanidation, 73% (value extracted from concentrate).

Total bullion extracted from $2.56 heads, 58 per cent.

*From report of the Oriental Con. M. Company.

New Zealand and Nevada Mining Methods Compared

By F. C. Brown

Having recently spent a short time at the comparatively new mining districts of Tonopah and Goldfield, Nevada, I have been thinking it might be of interest to some of your readers to have a few comparisons between methods and conditions existing there and those in New Zealand, where I have been engaged in mining during the past fifteen years. The actual mining methods at Tonopah and Goldfield are somewhat difficult to compare with those in use in New Zealand, as the conditions in the two places are different. In the former district there is very little water with which to contend, so the mines are not equipped with the huge pumps which are a feature of the Waihi, Karangahake, and Thames districts in New Zealand. All pumps and other machinery in the mines and mills at Tonopah and Goldfield are operated by electric power obtained from about 100 miles away, while in New Zealand, although water power is available for generating electricity within a reasonable distance of the mines, power is chiefly produced by means of steam-engines, steam-turbines, and producer-gas engines. The Waihi mine is now preparing to produce some 6000 hp. from water power sixty miles from the mines, with the object of driving most of its machinery by electricity.

At Tonopah and Goldfield the development work in the mines is done almost entirely by the wages system, and there is practically no hand-drilling of holes, the heavy work in drifts being done by piston machines, and the lighter work in the stopes and raises by the hammer machines. In most districts in New Zealand the bulk of underground work is done on the contract system, driving, raising, and sinking at so much per foot, and stoping, usually by the ton of ore broken. The contract specifications provide for the contractors doing the whole work to the satisfaction of the underground manager, and all necessary material, such as explosives, candles, and the like, are provided by the company, but charged up to the contractor at about cost price; the company also supplies the drilling machines and power to operate them. As a rule, a contract is taken by a party of men, and this party, unless large enough to fill the terms of the contract as regards the number of men employed, engages wage-workers to make up the required number. Such wage-workers are invariably paid higher wages than the ruling rate paid by the companies. The wages for miners are $2.15 per day of 8 hours, a week's work being 45 hours, provision being made for a short half holiday on Saturday. A week of 45 hours is classed as 6 full working days on the pay-sheets. The day shift commences at 8 a.m. and the men stop work at 4 p.m., being allowed half an hour at noon for lunch. Men working in the mills are on duty for the full 8 hours and have no half holiday on Saturday. Contractors, on an average, make about $3 per day, and they pay their wage-men at least $2.50 per day. Extra good parties of contractors make up to $5 per day for each man.

I understand the wages for miners at Tonopah and Goldfield are $4 per day and $3.75 for shovelers, and I should judge that the miner in New Zealand who can make $3 is the better off, as living there is cheaper and the general conditions better. A peculiar feature in New Zealand is the closing of the mines for about a two weeks' holiday at Christmas. It must be borne in mind that Christmas comes in mid-summer there and is a great holiday season throughout the whole country.

In New Zealand there is now no Sunday work at the mines or mills, except such work as pumping in the mines and the running of agitators in the mills, and necessary repair work. This work is provided for by special permits issued by the Government Mining Inspector. When this law was under discussion some years ago, all the mining companies were against it, and all the old arguments, such as decreased output from the mills and consequently less employment for the miners, were brought to bear upon the case, but after the law had been in operation for some years there were few, if any, who wanted to return to old conditions. Outside of the religious and physical aspects which indicate that a rest-day in seven is necessary for the well-being of man, the closing of mills on Sunday brings other advantages, as repairs and alterations can be effected while the machinery is at a standstill, instead of having the men working amidst swiftly moving belts and rapidly revolving pulleys, shafts, and fly-wheels—all with such a terrific noise everywhere that it is even difficult for a foreman to give correct instructions. My experience is that, after the passing of the Sunday-rest law, the machinery in mills was better looked after than it was before.

At the mines and also the mills in Tonopah and Goldfield there is more effort in the direction of doing away with hand labor than in New Zealand. In the former places all the mining steel is sharpened by drill-sharpening machines, while in New Zealand this work is still done by hand, even at the large mines. The handling of the ore, especially the crushing of it preparatory to putting it in the ore-bins behind the stamps, is done in a far more practical manner than in New Zealand, and I notice the Goldfield Consolidated uses 50-ton cars for a comparatively short haul from the mines to the mill, while in New Zealand the usual practice in hauling ore even over distances of five miles, is to use a large number of small cars, holding 3 to 4 tons each.

With regard to milling methods, it is difficult to make comparisons, as each class of ore requires its own special process or combination of processes, and even in the case of two adjoining mines a variation of processes is sometimes necessary. In New Zealand the tendency is to go in for all-sliming, and stamps followed by tube-mills are the favorite combination for reducing the ore. Crushing in cyanide solution is being introduced there and is giving satisfactory results. When concentration is necessary, the concentrate is treated in a separate plant, the process being grinding to a very fine slime and cyanidation of this slime. The slime is treated by air-agitation, usually in Pachuca tanks, and filtered in vacuum-filters, the solutions being precipitated on zinc shavings. The zinc-dust process has not gained a footing there, although it has been tried by some of the large companies. Tube-mill practice in New Zealand seems to me more advanced than at Tonopah and Goldfield, and this is no doubt due to the fact that tube-mills have been used in New Zealand since 1903, while at Tonopah and Goldfield they are a more recent innovation.

Most vacuum-filter plants in New Zealand are of the type which requires the filter leaves or frames to be lifted from the sludge and wash tanks, while at Tonopah and Goldfield the stationary filter-frame type seems to be the favorite. Both types do good work if properly erected and attended.

In New Zealand all workers in or about mines or mills work under an industrial agreement as regards wages, hours, and some other conditions, this being one of the provisions of the Arbitration Act, the object of which is to prevent strikes by bringing the employer and worker together to discuss any matters causing friction which may arise. These agreements are entered into by the mining companies of the district as one party, and the workers, represented by their unions, as the other party, and are usually for a period of three years. The Arbitration Act has now worked well for a number of years, but it has still to go through the test of a general labor upheaval, when labor pits itself against capital for a reason or reasons often difficult to define. Even if the act should fail in a period of great stress, it has already, in my opinion, proved of great benefit to both the employer and worker by bringing them together to discuss the general

conditions of labor, both sides being called upon to present its views of the questions at issue.

In Tonopah and Goldfield a deduction is made from the men's wages for the medical fund, a worker being entitled to free hospital treatment in case of accident or sickness. In New Zealand compensation for accident is provided for by the Workers' Compensation Act, under which a schedule sets forth the claims that can be made for the various kinds of injuries, temporary or permanent disablement, loss of health, or death. During disablement the worker receives half pay. Loss of life is assessed at about $2000, the money going to those who were dependent upon the deceased for their support. One of the great benefits of this act is that the worker, instead of having to fight his claim through the courts and risk the fees of unscrupulous lawyers, receives full compensation according to the schedule. If a company does not like to carry its own risk under this act, it can take out an insurance policy, either in the Government Insurance Department or in a private insurance company, the procedure being to pay a premium rate depending upon the degree of hazard in the occupation. The premium is paid for a year in advance and is based on the estimated wages for the year, adjustment being made at the end of the year.

I was familiar with mining conditions in this country when I left for New Zealand fifteen years ago, and I now notice a great improvement in the way men are cared for and treated by their employers, and it is to be sincerely hoped that mining companies will see the wisdom of continuing to use every effort in this direction.

German Mining in 1911

German mining is for the most part concerned with coal, iron, and potash. Coal production was unusually large all through the year 1911, and every month up to and including October, with relatively slight exceptions, the production has been greater, month by month, than in any year since 1907. As this increase has been steady, it may be assumed that most of the coal has gone into industry, largely, of course, by way of the coking ovens. The improvement includes brown coal, and the returns for coke show that larger quantities than usual have been used for metallurgy. The total quantity of coal produced in the German Zollverein during the first 10 months of the year was 133,470,434 metric tons. This compares with 126,030,092 tons in the corresponding 10 months of 1910. The figures for lignite were 60,292,946 tons, against 56,284,894 tons. The coke produced in the corresponding periods named was 20,818,326 tons and 19,393,499 tons.

Returns for iron ore production are not available. Since pig iron production keeps mounting up with a record output every month, the assumption is safe that the production of iron ore has been likewise growing. Import returns covering iron ore from foreign countries, such as Scandinavia and Spain, may, however, show that foreign countries have supplied the excess ore. The production of pig iron for the first 11 months of 1911 was 14,156,586 tons. This is almost as large as the total for 1910, and is larger than the total for any other preceding year back to the year 1905. It may be observed that besides Spain and Scandinavia, Germany proposes to draw largely on French iron-ore fields. One of the largest German houses has erected works in Normandy, where it will even engage in smelting. Brittany, too, will be the scene of German enterprise. There are in Normandy already 22 iron ore works, of which 5 at least are of considerable importance, and in Brittany there are 7 in process of development. As these fields are not conveniently situated for smelting purposes, it may be taken for granted that it is intended to export the ore. It is even stated that the house of Fried. Krupp has made a contract with a number of Normandy iron-ore producers for as much as 12,000,000 tons of ore to be shipped to Rheinhausen by way of Caen.

But the factor in German mining which has stood out most boldly this year, as last, has been the development of the potash deposits in the Western districts. This has been thrown into sharp relief by reason of the contract disputes with American buyers, and the international embroglio which resulted. The Germans are in no way perturbed at the reports of the discovery of potash in America, but this must be read strictly in the present tense. When the report was first sent round, they were very nervous indeed; so much so, that a learned professor at Heidelburg felt constrained to confess to his fellow countrymen that Germany need not look for a permanent monopoly of the potash business, since geologists were well aware of the existence of large reserves in other countries which had only to be exposed to bring enterprising contractors to the field to develop them. Meantime it is known that the exploitation of the potash fields of Germany has been carried on very actively, and the value of the products exported, particularly, has reached an extremely satisfactory level. But it is rather with the proximate future than with the present that the chief interest lies. An effect of the new potash law, particularly the features guaranteeing a market for the product of almost any potash field fairly exploited, has been to bring a large number of companies to the fore that have undertaken to develop and exploit fields hitherto left untouched. The effect of that on the potash mining industry has been somewhat remarkable. Germany is not unacquainted with the principle of concentration in her industries; but when the company promoter swooped down on potash and floated company after company in order to take advantage of the new law, the existing old fashioned potash concerns felt compelled to take steps in self-protection and adopted a policy of amalgamation or concentration which has profoundly affected the whole potash situation. Companies that were large before have by absorption become larger still, and insignificant or poorly paying companies, have acquired importance by reason of alliance with great concerns that have found it worth while to absorb them. The near future therefore will see a tremendous extension of potash production in Germany. The old works are equipping themselves to compete in this respect with the new houses; and unless, as is urged by some, the Government intervenes with fresh laws to limit the production, the country is within easy reach of a feverish activity in the potash fields that may well result in a glut. Naturally as the world calls for more fertilizers the demand will at all events to some extent, if not entirely, keep abreast of the growing supplies. But the time is approaching when the new companies will be starting exploitation in batallions and the great quantity of potash which they will bring into the market must almost inevitably produce a potash crisis. But that time is not yet. Perhaps the Government will be able to take measures to regulate the business in proportion to the world's needs. This is a step that has been taken with great success—for example, in the neighboring country of Russia with its sugar business—and as Germany is following in the same direction in the matter of nationalizing industries, as shown by the interest her Government is taking in the coal and potash mining industries, it is fair to assume that no serious calamity will be allowed to take place for want of regulation.

The petroleum production, which was 110,996 metrical tons in 1910, undoubtedly amounted to somewhat more in 1911, as fresh wells have been opened. Other mining industries exploited are copper, zinc, pyrite, lead, manganese, and salt, but the returns are not available on which to estimate the work done this year. As the German industry in 1911 has been remarkably successful, there can be little doubt that in all these items progress will be reported as compared with 1910.

THE estimated December production of the Goldfield Consolidated Mines Co. was 29,127 tons of ore from which the gross recovery was $700,000. The operating expenses were $240,000 (including $42,000 for construction work), corresponding to a net operating profit for the month of $460,000.

Review of Lake Superior Copper Mining in 1911

By Robert H. Maurer

Dividend disbursements by Michigan copper-mining companies during the past year and total payments of all companies for all years of which there is any record is presented herewith:

Companies.	1911.	1910.	Total to date.
Ahmeek	$ 100,000		$ 100,000
Atlantic			990,000
Calumet & Hecla	2,400,000	2,900,000	114,900,000
Central			2,130,000
Cliff			2,518,620
Copper Falls			100,000
Copper Range Con.	1,157,837	1,536,740	11,914,363
Franklin			1,242,000
Kearsarge			160,000
Minnesota			1,820,000
Mohawk	150,000	200,000	2,300,000
National			320,000
Osceola	721,125	961,500	10,064,375
Pewabic			1,000,000
Phoenix			20,000
Quincy	440,000	550,000	19,742,500
Ridge			100,000
Tamarack			9,420,000
St. Mary's Land	480,000	160,000	5,080,000
Wolverine	540,000	600,000	6,840,000
Totals	$5,988,962	$6,908,240	$190,761,858

The non-dividend payers are many, and among them are few that give promise of early dividends. The Isle Royale and the Allouez would seem to be exceptions. Both are operating with some profit to themselves, and each is rounding into shape for heavier production, and dividends eventually. The status of Franklin has changed wonderfully during the year under efficient management, and this company will make good. The same may be said for the Lake and Hancock. The others are coming along more slowly, with varying degrees of promise.

Considerable attention was directed in 1911 to the exploitation of new territory, though not to the extent observed in 1910. This work has on the North Range added materially to the known mineral resources of the district and opens a wide strip of possibilities along the eastern edge of this range. The disclosures in the St. Louis and New Baltic acreages are most important. The South Range was quite thoroughly explored in the preceding year and continues to receive its full share of attention. More than 30 companies were actively engaged on both ranges seeking workable copper deposits or developing deposits already opened, and nearly $2,000,000 was required, in amounts varying from $100,000 to $300,000, to meet the cost of this work during the past year. Eight companies active in the preceding year suspended operations indefinitely for various reasons.

The number of workers employed in the various branches of the industry was smaller than in the preceding year and is now around 18,000, compared with 19,000 a year ago and 21,000 employed in the three counties in 1907. Fully 15,000 find employment in Houghton county. The surplus of labor is quite evident, despite the great numbers that have gone to other fields. Attempts to unionize local labor are not very successful, and though the Western Federation of Labor has established a foothold and maintains local headquarters, its efforts are not well received.

The fear in the minds of many that the Lake Superior district has seen its palmy days with the passing of the Calumet conglomerate lode, now less than 20 years removed, is a mistaken one. Less than one-fourth of the known mineral-bearing area has been touched, and though there may never be another deposit such as was the Calumet conglomerate, there is in the area under development at different points a demonstrated tonnage far greater in the aggregate than was contained in this famous deposit. The porphyry bugaboo also has created a most unpleasant fear that the Lake Superior vein mines would soon be a thing of the past. This fear is brother to the fear that in the late '90s possessed so many of our good people when the Butte mines were expected to put the local producers on the shelf. There is not a sign of the grass growing on the streets that the mind's eye of that period pictured deserted, and the Lake mines will be doing business years after the present porphyry deposits have become exhausted. A brief resumé of what the Lake Superior companies accomplished during the past year and what can be expected in the future, follows.

The Calumet & Hecla Mining Co., with probably less than 20 years of life remaining in the conglomerate lode, is concerned chiefly with the development of the Osceola lode mine and with the development of a number of other mines on this and other formations in which it has large shareholdings. The conglomerate bed has been a most profitable source of production and will continue to be to the end of its life, though declining values have materially affected profits. Openings have been kept well ahead of immediate requirements, and much good ground is being developed in places long thought to be without value. Particularly is this true of the Black Hills portion of the mine. The conglomerate is supplying around 80% of the Calumet production, about 2,000,000 tons of ore, averaging 30 lb. of fine copper, annually. There remain approximately 30,000,000 tons unmined. In the Osceola lode the company has a low-grade property easily capable of supplying 1,000,000 tons annually, of an average copper content of about 15 lb. of fine copper. A tonnage standing close to 16,000,000 tons has been placed in sight, out of a total possible tonnage estimated roughly at 40,000,000 tons. A limited amount of work is also in progress in the Kearsarge lode with results not altogether satisfactory. Many economies were introduced during the year in the effort to achieve 'dollar rock', and though such a figure may never be reached, material reductions in the cost of breaking ground have resulted. Early in the year the company became involved in litigation growing out of its proposal to merge the several so-called Calumet subsidiaries, and is to some extent yet involved, but has abandoned its merger plans and will continue to operate the various companies independently. The great savings that would undoubtedly have resulted in their operation under the plans proposed, have by the opposition of protesting shareholders, thus become only savings that might have been made. In addition to the output secured from the Osceola and Calumet conglomerate lodes, the company, through its ownership in the subsidiary companies, controls upward of 57,000,000 lb. fine copper, giving a total output of well over 130,000,000 lb. fine copper annually, or approximately 60% of the entire output of the Lake Superior district.

The Copper Range Consolidated is not directly engaged in mining, but is a securities-holding company controlling and directing the operation of the Baltic, Champion, Trimountain, and Atlantic mines and the Copper Range railroad. It is none the less a considerable factor in the Lake Superior output contributing approximately 20% of the total production of the district. The mines operated by the company yielded approximately 41,000,000 lb. fine copper, a decrease of but 2% from the output of the preceding year. In this production the St. Mary's company has an equity equal to about 9,000,000 lb., being one-half of the output of the Champion mine, owned jointly by these companies, leaving the Consolidated a

net production of about 32,000,000 lb. The company's position was further strengthened during the year by the acquisition of the Atlantic property, which development has shown to be not wholly without promise despite rather negative results obtained in the past under the former management. No work has been done in this property by the new owners. The Baltic and Champion mines are the mainstay of the combination and show no appreciable changes from year to year. Both are opened well ahead of immediate requirements, and both are yet in their infancy. The Trimountain mine has improved wonderfully during the year, is earning a small profit, and promises soon to take equal footing with its big neighbors, the Champion and the Baltic. Production increased more than 25% over the previous year.

The Osceola Consolidated Mining Co., fourth in point of production, ranks third in the list of dividend payers of the district with a disbursement of $721,125. Production was smaller by about 1,000,000 lb. compared with that of the preceding year and is about 20% under normal, due principally to the loss of production from the Osceola Branch, which was shut down nearly two years ago and remains idle. The output was approximately 18,300,000 lb. fine copper. The Kearsarge North and South branches were operated without interruption, and in the North Branch resulted in the development of considerable productive ground in the older workings. The South Branch has become a stoping mine and fully developed with about 2,000,000 tons of ore remaining unmined, and will probably become exhausted within another ten years. The North Branch is good for 40 years to come. The Osceola, too, is striving for 'dollar rock', and its efforts have come closer to realization than has any other mine in the district. The cost of mining, transportation, and milling a ton of rock during the past year will probably average less than $1.20 and may even reach $1.10. The ability to show such remarkably low operating costs is in part due to the favorable physical condition of the South Kearsarge Branch, but is withal an achievement that fairly radiates good management.

The Quincy Mining Co., when final figures are in, will report a production probably 5% below that of the preceding year. The dividends, too, were reduced, and for the year totaled $440,000, compared with $550,000 in the preceding year. The mine is old and deep in the south end, in which operations were begun, but is being reinforced by the north territory, in which three shafts are being steadily sunk. The Quincy is no longer the rich mine it once was, and ore values here, as in all other Lake Superior mines, have declined materially with depth. The present yield will range 14 and 16 lb. fine copper per ton of ore mined, and will probably average slightly better than 15 pounds.

The Ahmeek is all progress and coming along faster every year. Production, increased fully 50%, costs were further reduced to a figure close to 12c., and there is no other producer with a brighter future before it. Late in the year the company paid its initial dividend of $100,000 and just before the close declared a second dividend of $150,000, payable early in the new year, with promise of dividends quarterly thereafter. Development in the new north shafts disclosed a continuation of the same excellent copper ore opened in the older and deeper south shafts, and another year will put the mine in position to produce upward of 20,000,000 lb. fine copper.

The Wolverine Copper Mining Co. reports an average production and dividends slightly reduced, the year's disbursements amounting to $540,000, as against $600,000 last year. Production is secured entirely from the mine on the Kearsarge lode and promises to hold for another ten years, after which the company will have to look elsewhere for its copper. A number of promising copper-bearing lodes traverse the property, and these are being explored. The Osceola lode has been opened by shafts and drifts to a depth of 300 ft., and is generally without

Each rectangle is a township, six miles square.
Key to Mines.

1. Aetna	19. Tamarack
2. Empire	20. Osceola
3. Delaware	21. Tecumseh
4. Amygdaloid	22. Rhode Island
5. Copper Falls	23. Franklin, Jr.
6. Central	24. Franklin
7. Phoenix	25. Arcadian
8. Cliff	26. Quincy
9. Mohawk	27. Isle Royale
10. Ahmeek	28. Atlantic
11. Allouez	29. Baltic
12. N. Kearsarge	30. Trimountain
13. Wolverine	31. Champion
14. Mayflower	32. Belt
15. Centennial	33. Adventure
16. Tamarack Jr.	34. Mass
17. S. Kearsarge	35. Michigan
18. Calumet & Hecla	36. Victoria

THE COPPER MINES OF THE LAKE SUPERIOR REGION.

promise. The exploratory work to the eastward of this and the Kearsarge lodes is showing more encouragement. A promising copper-bearing amygdaloid was cut in the horizon of one of the Old Colony lodes and will probably be followed by other beds with the further extension of the cross-cut now driving in that territory, and is expected to give the company a mine in that section.

The Mohawk Mining Co. is the champion low-grade producer of the district, and its ability to wring profits from the treatment of copper-bearing rock yielding less than 15 lb. fine copper per ton of rock reflects great credit on the management. Earnings were at the rate of $150,000, compared with $200,000 in the previous year. The north and poorer end of the property has shown some improvement under development, but it is in the south end that the future of the company lies. This end shows marked betterment at depth and, already a considerable factor in the output of the mine, is yielding a grade of rock probably 25% richer than is that yielded by the older workings on the north. Five shafts are sinking steadily and one has been permanently bottomed. The No. 6 shaft, sunk on the extreme south end of the property, is down around 700 ft. in depth, with lateral extensions on several levels breasted in copper ground of exceptional richness and which appears to improve with depth.

The Tamarack is seemingly hopeless. It is a deep mine and the cost of production is high. Little encouragement is had from the year's operations, which were conducted for the most part in ground of known worth and with little regard for the creation of reserves. Work in the Osceola lode has ceased entirely. The working force was

greatly reduced in an effort to produce copper at a profit. Production declined more than 50% until late in the year, and near the close was again normal, the year's output reaching 7,500,000, as against 11,060,000 lb. in the preceding year.

The Isle Royale, Allouez, and Superior companies may be grouped in one class. All report average productions made at a small profit to themselves and, excepting possibly Superior, have become mines of demonstrated worth. Isle Royale is the largest producer of the trio. Production holds steadily around 7,000,000 lb. fine copper annually, and promises to increase materially as a result of development now in progress. Activity is centred in the development of the Isle Royale lode, in which the company now has four producing shafts, with prospects of two more to follow. The property is one of great potential worth, and, though a limited amount of exploratory work in the Baltic lode failed to reveal copper in commercial quantities, the more recent developments in the Houghton acreage adjoining makes ultimate success reasonably certain. Allouez is giving full attention to the development of the Kearsarge lode with good results generally, and today is nearer dividends than is any other of a number of likely prospects among the non-dividend payers of this district. The mine is easily capable of producing 10,000,000 lb. fine copper annually at a cost of not to exceed 10c. per lb. following completion of improvements now under way at the north shaft, and an output close to this figure is predicted for the new year. Superior is capable of greatly increased production. While development in the north shaft is adding to the reserve at a satisfactory rate, similar work in the south shaft is discouraging. The company is just about breaking even on present price of the metal.

In quite another class are the Lake, Franklin, Hancock, Mass, Centennial, and Winona. The Lake is an unknown quantity, with possibilities on the Lake lode rather limited. Its unexplored territory measures acres in extent. Commendable progress was made in the development of the Lake lode and in fitting the property for regular production, and a small though rich mine has resulted. Production is expected to begin in early summer. The Franklin has turned the corner after years of discouraging work and is going to make one of the biggest mines in this district. Development is confined to the Pewabic lode, in which two shafts have been sunk and provision made for three more. Both mill and mine were overhauled in a most thorough manner with the one idea of economy. The new year will see the rate of production trebled. The Hancock centred attention in shaft work and has attained a depth of 3100 ft., with prospects of reaching the Quincy-Pewabic lode within another 400 ft. Several promising veins were opened in the course of sinking in this shaft and will add materially to the mineral resources in this acreage. Considerable work was also done in the Hancock lode, and a mill-test of short duration gave returns of slightly more than 18 lb. fine copper from the material treated. It is quite unlikely that Hancock will figure as a producer in any considerable quantity for several years to come. Mass is in the making. The shafts are being equipped for heavy duty, and the reserve is growing at a satisfactory rate. The mine promises soon to do better than merely get a new dollar for an old one. Development is in progress in the Evergreen and Butler lodes, and is generally encouraging. The mine is in better physical condition than it has been in many years. Centennial confined activity to the development of the South Kearsarge underlay and appears to have turned the corner. The north laterals at depth are continuously in excellent copper ground. Winona is making haste slowly. A consolidation was effected with the King Phillip adjoining, and the two properties are being developed as one. Production was begun upon the completion of the stamp-mill about the middle of the year. A large tonnage of low-grade material has been developed, and the mine is easily capable of doubling the present rate of production.

Of the greater number of companies engaged in exploratory work among which Victoria, though yielding a regular production may be included, lack of space forbids more than mention. Victoria is obtaining just enough encouragement to induce further work. The best in this division are Laurium, Indiana, Algomah, Houghton, St. Louis, Adventure, Ojibway, Oneco, and New Baltic. All seem to have found copper deposits of promise and are now engaged in exploratory work. Wyandot has nothing in sight, but has hopes. Others have passed this stage and found their several discoveries wanting. Among them are the Keweenaw, Gratiot, La Salle, and Seneca. A few others are seeking more encouragement before making the more thorough investigation that only underground openings can give, in which category are Mayflower, Old Colony, Bohemia, North Lake, and New Arcadian. South Lake has found a promising deposit, but lacks funds with which to carry on development. Section Twelve is in the same class. Somewhere new mines are undoubtedly in the making.

Work in the Snake Creek Tunnel

The Snake Creek drainage and transportation tunnel in Utah, projected and controlled by stockholders in the Daly-Judge M. Co., has been driven about 4100 ft., and is to be 15,000 ft. in length when completed. Its portal is in Snake Creek canyon, on the Heber City side of the Wasatch range, being eight miles from that town. It will cut the crest of the range at a depth of over 3000 ft., but the depth to be attained in Daly-Judge ground, on the Park City side, will be close to 2100 ft. The dimensions are 9 by 6½ ft. in the clear, with a concave water channel, having a top width of 4 ft. and a depth of 3½ ft.; this channel is on the right-hand side of the tunnel, the left-hand side having a solid roadbed for trackage designed for loaded cars. A track is to be laid over the waterway for empty cars. The present flow of water from the tunnel is about 2250 gal. per minute. The range of costs thus far incurred in driving is $25 to $30 per foot.

About 300 ft. of swelling and caving ground was passed through a distance of about 2000 ft. from the portal, and this proved to be so troublesome that this part of the tunnel was first timbered, then built up with reinforced concrete. The concrete work is supported by an arch formed by 50-lb. steel rails set in pairs. The rails are heated and so bent that when two are joined together by fishplates they form an oval, and sets of these are placed 4 ft. apart inside the timbers in the tunnel, the lower or small end of the oval-shaped frame being placed downward and buried in concrete below the track level. This steel frame is reinforced at the top of the arch by a second rail. The spaces next to the timbers are filled with concrete, and extending from one set of rails to the next is a triangular-mesh wire screen, weight 109 lb. to 100 sq. ft., held in cement. The arch has a height of 7 ft. 1½ in. above the tracks, and has a width at track level of 9 ft. 6 in. The track is laid on 8 by 8-in. timbers, 4 ft. apart. This special work is now in progress. It is being performed at the expense of the Snake Creek Tunnel & Transportation Co., under general direction of G. W. Lambourne, manager for the Daly-Judge company, though the tunnel proper is being driven by Free & Taylor, under contract. O. N. Friendley, engineer for the Daly-Judge company, has direct supervision of the tunnel work as a whole.

Coal in Montana

According to the annual report of State coal mine inspector, J. B. McDermott, one man was killed during the past year for every 224,107 tons of coal produced in Montana, and one man was injured for every 58,268 tons produced. There was one fatal accident for every 290 men employed, and one serious accident for every 76 men employed. The coal production for the past year amounted to 2,913,397 tons, as against 2,970,246 tons in 1910. A total of 3776 men are engaged in coal mining, and the mine value of this year's product is given at $4,903,621.

Wyoming Mineral Industry in 1911

By Arthur C. Boyle, Jr.

During the year 1911 mining operations in Wyoming as a whole were quiet. Certain districts have been characterized by continuous development, most of which has resulted in opening bodies of good ore. Considerable attention has been paid to the development of new territory which has added much to the known mineral resources of the State. In gold mining, the greatest amount of work has been done in the South Pass district, where the Buck Mining Co. has erected a small mill. Prospecting and development have been carried on also in the Medicine Bow and Bear Lodge mountains. Here gold is found in quartz veins and in ideal condition for cyanide treatment, and several steam dredges are operating. Copper ores are found in every county of the State, and consist almost wholly of altered sulphides. In some localities the oxidized and carbonated ores have accumulated in great masses. Systematic sampling shows some of these masses to contain 14% copper. At the present time the deposits are situated far from transportation facilities, and are therefore of no importance commercially, but are of interest as possible sources of copper. One great drawback to the State is that a large portion is arid, and prospectors, unless specially well equipped, cannot penetrate safely into the greater portion. Consequently a large part is absolutely unexplored.

Within recent years Wyoming has advanced to the front as an asbestos-producing State. Great activity has been in the Casper district, where asbestos of excellent quality occurs in great quantity. Throughout the State this valuable mineral is found, but at present this is the only known locality where chrysotile is in such associations as warrant commercial extraction. The Consolidated Asbestos Co. has erected a completely equipped fiberizing mill and is now placing on the market excellent products. The long fibres are especially well suited for spinning and weaving, while the shorter stock is manufactured into board, plaster, and paper. There is good reason for believing that Wyoming will become an important factor in the supply of this product. The management reports a very successful year from the point of view of asbestos production.

In iron-ore mining the chief operations have centred around the Sunrise district, where ores of excellent quality exist. The mines are near a main railroad line, and at present the products are shipped mainly to Colorado. The actual tonnage is not known at the time of this writing, but it is safe to say that 1911 has been the banner year in the iron mining industry. Many other localities are known within the State where iron ore deposits of high grade exist. These will be of greater importance as transportation facilities are made better.

The past year has witnessed marked progress in the oil fields. Pipe-lines, storage tanks, and refineries are now available in many of them. New fields have been drilled, and while little is definitely known regarding many of the smaller fields, it is generally understood that the productive oil area has been greatly increased. The smaller wells are capable of producing from 100 to 200 bbl. per day, and it is stated on good authority that some wells are now producing 5000 bbl. per day. The oil found is of excellent quality, and, with few exceptions, has a paraffine base. The greater part of the oil produced is shipped out of the State, but there is considerable local consumption also. The Leroy, Spring Valley, and Byron fields find ready market for their products in Utah and the West. The reported production for 1911 far exceeds that of 1910.

The coal production of the past year is slightly in excess of that reported for 1910. The total known acreage has been increased, as a result of recent studies made by the U. S. Geological Survey. It is estimated that there are in Wyoming 14,500,000 acres of coal land, valued at about $670,000,000.

Joplin Lead and Zinc Production

The aggregate valuation of zinc and lead ores shipped from the Joplin district for 1911 was $13,055,511, more than $1,000,000 less than the total production for the previous year, and more than $2,000,000 less than the record production of 1907. Taken by themselves, however, the shipments of lead were the heaviest in the history of the district, due largely to the enormous production from the Webb City, Joplin, and Galena camps.

The new year dawns much more auspiciously in the mining district than did 1911. Prices for all ores are considerably better. Spelter is quoted $1 higher than at the opening of 1911, and the demand for both metals and ores is extraordinarily heavy for this time of the year.

The accompanying table shows the yearly output, in districts, with their valuations of zinc and lead ores:

Camp.	Blende.		Calamine.		Lead.		Total
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	value.
Webb City-Carterville, Mo.	189,376,352	$3,828,906	.....	.....	49,239,545	$1,428,076	$5,256,982
Joplin, Mo.	116,869,886	2,331,600	3 797,190	$46,296	17,620,492	507,940	2,885,836
Galena, Kan.	34,947,656	747,362	167,242	2,786	7,707,460	221,264	971,412
Duenweg, Mo.	30,363,950	611,765	4,512,255	56,075	3,822,970	110,061	777,901
Alba, Mo.	32,123,750	672,619	.....	.....	639,240	18,753	691,372
Oronogo, Mo.	20,330,390	399,135	.....	.....	2,735,790	75,129	474,264
Granby, Mo.	8,225,510	143,616	18,731,540	238,600	1,315,830	34,369	416,585
Miami, Okla.	16,373,679	243,977	.....	.....	5,354,105	149,882	393,859
Spring City, Mo.	4,871,505	104,131	5,594,040	66,601	1,925,890	50,114	220,846
Carl Junction, Mo.	8,986,316	187,667	.....	.....	127,920	3,522	191,189
Aurora, Mo.	6,824,935	131,836	3,556,755	42,618	162,700	4,571	179,025
Cave Springs, Mo.	8,022,546	173,693	.....	.....	499,190	15,548	189,241
Quapaw, Okla.	4,295,120	82,960	18,010	216	560,585	15,754	98,930
Carthage, Mo.	3,052,350	61,417	456,760	5,345	82,370	2,244	69,008
Sarcoxie, Mo.	2,235,210	43,800	622,310	7,210	12,150	330	51,340
Springfield, Mo.	1,639,620	36,309	.....	.....	489,720	13,836	50,145
Badger-Peacock, Kan.	2,401,580	47,675	.....	.....	82,100	2,054	49,729
Lawton, Kan.	1,767,926	36,633	.....	.....	49,230	1,477	38,110
Stotts City, Mo.	1,236,570	24,309	.....	.....	.....	.....	24,309
Wentworth, Mo.	504,150	10,085	.....	.....	.....	.....	10,085
Reeds, Mo.	286,470	5,650	.....	.....	.....	.....	5,650
Seneca, Mo.	.....	.....	256,900	3,320	60,490	1,644	4,964
Peoria, Okla.	.....	.....	222,750	2,724	.....	.....	2,724
Greenfield, Mo.	.....	.....	197,670	2,005	.....	.....	2,005
Total shipments	494,631,471	$9,925,145	38,133,422	$473,798	92,487,777	$2,656,568	$13,055,511

Russian Mining in 1911

The two fine harvests of the years 1909 and 1910 had the inevitable result of making a fine business year of 1911, which has been characterized by remarkable activity in the mining and manufacturing industries of the country, and the total foreign trade of which bids fair to eclipse easily that of any preceding year. It is hard to say in which of the departments of mining the country has made most manifest progress in the year 1911; since in iron, coal, and copper the production has been a long way ahead of that of preceding years. That much is known already, but returns must be waited for from the goldfields before as much can be said of the industry of mining the precious metals.

In the South Russian coalfields, the Donetz basin, the output of coal has been remarkably large. And that this is not accounted for entirely by the high prices of liquid fuel driving the consumers back to coal, is shown by the fact that the production of coke has also been largely in excess of that of 1910, and the evidence that this has been called for by the iron works is to be seen in the fact that the production of cast, half-finished, and finished iron shows the best figures that these fields have been able to present. The real production of iron ore seems difficult to establish in more countries than Russia. The statistics, if gathered at all, do not appear to be considered worth publishing, and one is compelled to estimate the quantity of ore extracted by the quantity of iron smelted therefrom. Taking that as a basis, and even allowing for the fact that considerable reserves remaining over from 1910 were used by the furnaces, there appears to be no room for doubt that the iron mines have been exceptionally busy in 1911. It may be worth noting that the pig-iron famine was not entirely due to the short production consequent on the workmen fleeing the works because of the cholera, but also to the extraordinary demand that the various Russian manufacturing industries have made on the national metallurgical works for machinery. Among these—not least—was the great national sugar industry. But while the heavy metallurgical industry of the South has flourished, that of the classical Urals has sadly wasted, and even the coalfields of that area, by a reduced production, bear testimony to the fact that the better organized South leaves the local producers no chance in the competition; although the distance over which the southern products have to be carried is anything from 500 miles to 1000 or 1500, according to the district to be served.

Copper mining has been carried on vigorously through 1911 and the statistics show a distinct advance on the production of 1910, with an additional note that is more metallurgical than mining in point of interest. The production of electrolytic copper is becoming of greater importance in the country year by year. As is well known, the leading copper-producing centres are the Urals, the Caucasus, and Siberia, and in each of these substantial progress was made, and the hope continues to be expressed that the day is not far distant when Russia will smelt all the copper needed locally. That is an annually expressed pious wish, which up till now has not found fulfilment, not so much because her production has not kept up to her previous requirements, but because her requirements grow along with her production. With a rapidly reproducing population such as Russia's, now exceeding 150,000,000, and the increased energy displayed in her manufacturing industries, the demand for metals naturally grows, and the development in their production must increase at a greater ratio than at present if she is going to be a self-supporting copper country. It may be that one day the Caucasus will export copper, but it will probably be to the northwest provinces of Russia. This is a subject that has been dwelt on at considerable length in previous articles on Russian copper. Nothing particularly new is to be stated with respect to the equipment of the mines. Most of the increases are due to the initiative, enterprise, and vigor of foreign proprietors, and it can be comfortably assumed without fear of error that these proprietors have introduced into the mines the most up-to-date machinery and plant. The cases where this is so could easily be specified; but there is no room to do other than make the statement.

Statistics must be awaited before passing an opinion on the gold industry. Naturally, in some districts where the foreigner is prominent, progress is to be reported. In others there certainly have been set-backs, due, as is always complained, to 'want of capital, want of technical knowledge, and want of energy all through,' defects which are repeatedly attributed by Russian critics to her countrymen when they are reviewing the national metallurgical industries. One of the features of the year has been the encouragement afforded by the building of the Amur railway. It continues to develop or reveal new gold veins; but the exploitation there, as elsewhere in the East, continues to suffer from the lack of labor, which is really an artificial want, for there is abundance of Chinese and Korean labor available if the Russian Government will let these people work. This it will not permit. Perhaps the most interesting feature in the gold industry is the continued increase in the use of machinery, particularly dredges, which for working placers in Siberia (and from these practically all the gold of the country comes) are coming more and more into favor. But here again the Government steps in and largely strangles the industry by allowing the Russian makers to make poor dredges at high prices by means of a high protective tariff, rather than allow efficient dredges to be imported from abroad, say from America or England. The gold producers complain continually, they telegraph to the Government, they petition the Government, but hitherto they have met with no satisfactory reply.

The allied industry is platinum. This has been a very active year for platinum; but high prices obtained have stimulated both large and small producers to do their best to make hay while the sun shines. Further, the cold weather has been late in coming, and consequently the small operators especially have been able to work for a much longer period than usual. It will have been a splendid platinum year. As for the associated metals, iridium, osmium, etc., the production of these is so infinitesimal as only to have a curious significance. They are eagerly inquired for, but are slow in coming forward. It will be some time before the statistics show what quantities of these have been locally separated from the platinum; though probably, as before, most of them have gone to foreign countries with the 83% platinum ore on which standard the official quotations are made.

Zinc and lead are produced in the country, the former in Poland particularly; but away in the Far East, zinc mines have been opened at Tetyuch and exploitation is progressing at a great rate. Already there is a large export movement in zinc ore. Manganese has little to say for istelf. It has been considered a ruined industry for a long time, and it is not believed that it can recover until the operators are able to produce ferro-manganese on the spot. The last reports from the manganese fields (Scharopan) were very despondent in tone. Various reasons are assigned for the decline, but the most probable one is foreign competition, because all the other reasons existed previous to the appearance of India and Brazil as rivals in manganese production.

Although the number of metals exploited in Russia is small, this is no index to the natural riches of the country. Many of the metals most prized in the world are plentiful enough here, and they will no doubt be exploited as occasion offers.

The most depressing feature of the Russian mining industry this year is in petroleum. The Baku wells, as their returns come in month by month, give every evidence that the forecasts of the previous few years have been correct. They are giving out, and there is little else in Russia that can afford any hope of taking their place. All the land called petroliferous in the Baku area

has not yet been let out, but there is not much to give away and when it is let competent authorities are of the opinion that, even if it has not been already seriously drained by the wells existing, it can never supply enough to bring back Baku to the grand producing days of 1904. Grozny continues to increase its production, but not at the same rate as formerly. Some enthusiasts think it will do as well as Baku one day, but there are not many of that opinion. Maikop, the petroleum field that was to dwarf Baku, and to become a serious menace to the Standard Oil Co. and the Dutch Royal in their struggle for the world's markets, has up to the present time proved to be a great disappointment. The wonderful wells of a year or two ago have become in some cases exhausted and in others are producing less than before. Boring, however, proceeds vigorously in the more hopeful parts of the field. The other oilfields of the country such as Uchta, which is in the prospecting stage still, and the Urals, a little north of Astrachan, which continues to produce a nominal quantity of oil, cannot be taken into account for the moment. It may be said of Uchta that the same authorities—and they are the giants of the Russian petroleum world—that spoke slightingly of Maikop will simply have nothing to do with Uchta at all. Maikop appears to justify their views. Perhaps Uchta will surprise them. But it is in the north, and even if it furnishes a lot of oil, it will only be of local significance. One result of the scarcity of petroleum in Russia has been the great advance in the price, which naturally has materially reduced, if it has not more than made up for, the loss due to smaller production. Thus it may be said that while the more solid mining industries are doing well, the capricious oil industry is at last obviously yielding to the process of exhaustion.

The East Rand Fiasco

The official report of the Government Commission appointed to inquire into the East Rand Proprietary Mines affair, confirms all the statements made in the October 21 issue of the *Mining and Scientific Press* and goes further into details, showing into what straits the general manager has been driven in the attempts made to maintain the output and profits, as likewise to make it appear that the working costs were being lowered. It shows plainly that all the troubles at the East Rand Proprietary Mines were due primarily to overestimating the tonnage sent to the mill, perhaps with the object of apparently lowering the working costs per ton, but such a policy only led to more gold being reckoned on than was actually put through the works. To recover this missing gold the monthly clean-ups were increased in intensity, and when that failed to procure the desired output, the date of clean-up was gradually postponed until it reached the thirteenth day of the following month, instead of the first. Once started, this maneuvering did not end here. Mere estimates of the monthly outputs were supplied to the Chamber of Mines due on the 10th, while accidents and mishaps were made occasions when large tonnages of ore were put through the mill and not accounted for, in the hope of supplying some of the gold based on former estimates which had failed to materialize. Other acts of subtlety are disclosed in the report, made with the apparent object of lowering the costs and keeping up the profits, and the wonder is, perhaps, that the artful contrivances used did not in the least seem to ameliorate the position. Eventually, the general manager made a clean breast of the fact that the gold already declared had caused 13,000 oz. to be apparently missing; that to estimate future profits was impossible, while working costs thereafter must advance, and the available tonnage for the mill must in the future diminish. To the credit of the directors be it stated, that as soon as the actual position was officially disclosed to them, drastic and immediate steps were taken to put the matter right, but the mischief had been already done, for which, rightly or wrongly, several of the directors have been blamed, with the result that, at the time of writing, a director who was not specially blamed felt it his duty to set an example by resigning from his position on the board. A further inquiry is to be made by the company into the whole administration of its affairs, and doubtless some radical changes will be necessary before the lost confidence is restored. One interesting query likely to result from the recent Government inquiry is whether the returns supplied to the Mines Department monthly did actually disclose the gold recovered each month, or were mere estimates when the monthly clean-ups were postponed to the 13th of the following month. The mining regulations provide that these monthly returns to the Mines Department shall disclose the actual output, and the forms are so elaborate and detailed that an estimate seems impossible and would probably be sure to fall short of the law's requirements. The Government has the power, moreover, to have these returns sworn to, should it be deemed necessary to do so. As in many respects the mining regulations in the Transvaal are more or less a dead letter, no surprise need be expressed even in this instance if a breach of the regulations is shown to have been committed, and the Mines Department may hesitate to institute a prosecution.

Copper Producers' Association Figures

The statement of the Copper Producers' Association for December shows a decrease in stocks on hand of 22,330,493 lb., as compared with the previous month. The production for December was 122,986,697 lb., as against 111,876,601 in November. Domestic consumption was 65,988,474 and exports 79,238,716 lb., compared with 68,039,776 and 67,049,279, respectively, in November. In the last month of the calendar year the stocks of metal on hand decreased 51,440,161 lb. This was more than an offset to the first five months, when increased stock ranged from 20,409,295 lb. in January to 44,000 in May.

Below are given the amounts, in pounds, of copper known to be available at the first of each of the last six months and for January of 1911:

	U. S.	Foreign.	World.
January	122,030,195	187,705,280	309,735,475
July	157,434,164	157,184,280	314,618,444
August	137,738,858	152,376,000	290,114,858
September	133,441,501	149,887,360	283,328,861
October	140,894,856	150,841,600	291,736,456
November	134,997,642	138,512,640	273,510,282
December	111,785,188	131,447,680	243,232,868

Nevada Dividends

During the year 1911 the mining companies of Nevada paid over $12,000,000 in dividends, distributed as follows:

Goldfield Consolidated	$ 7,118,296
Nevada Consolidated	1,800,000
Tonopah Mining Co.	1,650,000
Tonopah Belmont Co.	1,350,000
National Mines Co.	225,000
Florence Goldfield Co.	105,000
Jumbo Extension Co.	97,165
Montana Tonopah Co.	60,000
Manhattan Big Four Co.	32,496
Mexican Mining Co.	20,160
Ophir Mining Co.	20,160
Total dividends for 1911	$12,478,277

Dividends have been declared and will be paid in January, by the Goldfield Con. of $1,779,574; by the Tonopah Mining Co., $400,000; and by the Tonopah Belmont Co., $375,000, making a total for the month of $2,554,574. An estimate compiled by the correspondent of the *Mining and Scientific Press* of the gold production of Nevada in 1911 before the announcement of the preliminary estimate of the Director of the Mint, places the total at $19,010,799, or within one-fifth of 1% of the Mint figures.

Dark Scale of Hardness

By Alfred C. Lane

*The hardness of a mineral is its resistance to shearing stress. Like other properties of minerals, it may differ in different directions. When two similiar surfaces are rubbed together, the softer mineral leaves a powder 'streak' on the other. In order to be sure which mineral gives the streak, it is at times convenient to have besides the common Mohs scale of hardness, composed of light minerals, a 'dark scale of hardness' of minerals whose color and streak is dark, especially in teaching. For such minerals, the following properties are desirable: those of being quickly recognizable, easily obtainable, and uniform hardness. I have used the following minerals: (1) Graphite, with one good cleavage, at one extreme in the white scale, at the other extreme in the black. (2) Stibnite (Sb_2S_3), with two good cleavages, bladed. (3) Galenite (PbS), with three good cleavages. (4) Iron (use soft wire nail), magnetic, ductile. (5) Niccolite (NiAs), characteristic color, no cleavage. (6) Magnetite (Fe_3O_4), magnetic, brittle.

Cobalt and Its Market

Another interesting problem in connection with the cobalt-silver ores, is what to do with the cobalt. The situation is described in the report of the Bureau of Mines of Ontario for 1910, as follows: "The cobaltic oxide trade is at present demoralized, and is likely to remain in this condition until a greatly increased use of the article enables the demand to overtake the supply. The enforced production of cobalt ore from the mines at Cobalt has resulted in a much greater quantity of ore than can be converted into oxide and marketed as such. In fact, one year's operation of the Cobalt mines will produce ore enough to meet the present consumption of oxide for several years. The inevitable consequence has been a very decided fall in the price of cobaltic oxide. * * * Cobalt ore cannot at present be sold, and none is being hoisted from any of the silver-free veins of the Cobalt camp, the entire production being of ore associated with silver. * * * The only hope of absorbing the cobalt contents of the ores which will continue to be produced in Ontario is an enlarged demand, brought about either by the low levels to which the prices have fallen, or by new uses for the product. It is not unreasonable to expect that the former will lead to the latter."

Russian Gold Property Auctions

The annual auctions of gold-mining properties will be held in 1912, in the month of February, in the towns of Ekaterinburg and Tomsk, for the Urals and Tomsk mining Governments, respectively. The number of mines that will be put up for sale in the Urals district will be 525, and those in the Tomsk district will number 485. These auctions will include a number of mines already auctioned on which the deposits have been paid and forfeited. Many of them have already been worked; some of them not at all. The date of the auctions in Ekaterinburg is February 10 to 23, and in Tomsk, February 8 to 21, 1912. These auctions are supposed to indicate to some extent the condition of the gold industry in the regions where they are held. Some years ago after the Russo-Japanese war, it will be remembered, there was what was called the gold fever in respect to Siberian and Urals mines, respecting which the English particularly were affected, and gold-mining properties were bought up by Russians for a few shillings and offered to the greedy Englishmen at fabulous prices. This fever, however, has gone down, and the difficulty is to get those who have bid for the mines to hold on to their bargains. At the moment it can be said that there is no sign of a recurrence of the activity referred to; but one never knows what is going to happen.

*Presented at the Washington meeting, 1911, of the Geological Society of America.

Manganese Dioxide

Manganese dioxide has been known from very early times. In 1740 I. H. Pott showed that it did not contain iron, and that it yielded a definite series of salts, while in 1774 C. Scheele proved that it was the oxide of a distinctive material. The material was isolated by I. G. Gabu, in 1774, and in 1807 I. F. John obtained an impure material by reducing the carbonate at a high temperature with charcoal mixed with a small quantity of oil. R. Bunsen prepared the material by electrolyzing manganese chloride in a porous cell, surrounded by a carbon crucible containing hydrochloric acid. C. Brunner reduced the fluoride by metallic sodium, and E. Glabzel the chloride by magnesium. W. Moissan reduced the oxide with carbon in the electric furnace, and W. Goldschmidt has prepared the metal from the oxide by means of his Thermit process. W. H. Green and W. H. Wahl prepare a 97% manganese from pyrolusite by heating it with 30% sulphuric acid, the product being then converted into manganese oxide by heating in a current of reducing gas at a dull red heat, cooling in a reducing atmosphere, and finally reduced by heating with granulated aluminum in a magnesia crucible, with lime and fluorspar as a flux. A purer metal is obtained by reducing manganese amalgam by hydrogen. Prelinger's manganese has a specific gravity of 7.42, and the variety obtained by distilling pure manganese malgam in vacuo is pyrophoric, and burns when heated in a current of sulphur dioxide. The pure metal gradually evolves hydrogen when acted upon by sulphuric and hydrochloric acids, and is readily attacked by dilute nitric acid. It precipitates many metals from solutions of their salts.

Oilfields of Mexico

Oil development in what is referred to as the Tampico territory in Mexico, has been growing rapidly. Late in December 1910 the Pearson interests brought in at Potrero, in the State of Veracruz, the greatest oil gusher in the history of the oil industry, with the possible exception of the burned-out Dos Bocas, another Pearson well. Before it was brought under control the flow of the well reached 170,000 bbl. per day. Two pipe-lines have been built to give the gusher connection with the Tamiahua lagoon, and a third will carry oil to the port of Tuxpan. The Huasteca Petroleum Co. (Doheny) has had great success in the Juan Casiano field, and has established a second tank-farm that gives it a total storage capacity of about 10,000,000 bbl. of oil. The Huasteca will soon have a second pipeline from the Juan Casiano field to Tampico. The East Coast Oil Co., a Southern Pacific concern, has brought in two gushers in the Topila field. The Texas Oil Co. has bought land on the Panuco river for storage facilities, and will build pipe-lines to the Topila and other producing fields. The year 1911 saw the first shipments of Mexican oil to the United States. During the year several American and English companies have started exploration and development, and recently leases on several thousand acres have been taken for John Hays Hammond and Thomas J. Ryan. Rumors of pending transfers of the Pearson holdings to American interests have been current during the year, but so far as known no deal has been closed. A bill recently introduced in the Mexican Congress seeks to place oil lands on the same basis as mineral lands, and open them to denouncement. It is authoritatively stated that the projected National Railways line from Tampico to Veracruz, traversing the oil belt of the State of Veracruz, will be built.

L. Vogelstein & Co. give the following figures of German consumption of foreign copper for the months January to October, 1911: Imports of copper, 157,934 tons; exports of copper, 7507 tons; consumption of copper, 150,427 tons; as compared with consumption during the same period in 1910 of 141,472 tons. Of this quantity 138,991 tons was imported from the United States.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Mass Copper

The Editor:

Sir—In your issue of December 2, in a short article on mass copper, you state that when large masses are found in the Lake Superior mines, high explosives are of little use in reducing the masses to fragments of a movable size, and the work required in cutting up such masses with a chisel is so expensive as to consume the larger part of the profit from their extraction.

In the very old days of fifty to sixty years ago, when black powder was the only explosive, and masses of native copper of enormous size were found occasionally running up into the hundreds of tons, the work of extracting the masses by means of long-handled chisels was very slow and costly. Gradually this work was reduced to a better business basis; but any sort of an explosive is but poorly adapted to breaking mass copper, though it will break the mass out from the surrounding rock. For the past ten years or so, pneumatic chisels have been employed to excellent advantage, in cutting up heavy mass copper found underground. With the powerful hoists and large skips now in use, it is possible to hoist masses up to ten tons in weight, and these are, if necessary, hand-cobbed, or perhaps cobbed under a steam-hammer in the rock-house, and then transported to the smelters, where they are dropped into the reverberatories by taking off the tops. Pneumatic chisels give about four times the efficiency of the old plan of hand-chiseling, and masses are divided by simply cutting channels, from which are taken ribbons of metal five-eights of an inch in width, and averaging perhaps a quarter inch in thickness.

HORACE J. STEVENS.

Houghton, Michigan, December 27, 1911.

Stamp-Battery Cam-Shafts

The Editor:

Sir—In your issue of December 16, C. T. Hutchinson gives some interesting details of stamp-mill construction. During the last twenty years of experience with stamp-mills I have been in but one mill where a cam-shaft had broken, and, as it happened, that shaft was not on the side of the mill of which I had charge. Of course, I have seen cam-shafts that had broken, and many of them. The chief cause I believe to be due to the boxes getting out of alignment, and one would expect the more boxes the greater the chance of a broken shaft. Now, it has been my fortune to have never seen or heard of a five-stamp unit cam-shaft breaking. Then why not adopt the unit of five stamps instead of the ten, fifteen, and twenty-stamp unit? I know the fifteen and twenty-stamp units are obsolete, but the ten-stamp unit is the standard for all large mills. The unit of five stamps is objected to on account of the movements on the end opposite the bull-wheel. If the battery has been well put together with concrete foundations and the battery posts made of concrete, or the wooden battery posts well anchored to the concrete sole-plate, the vibrations are little more, and in many cases not as great as those in the ten-unit cam-shaft. It is not even necessary to cap the outer box.

Mr. Hutchinson says that the question of "keeping the cam-shaft bearings in line will never be satisfactorily settled until the concrete, reinforced, self-contained battery-frame construction is employed, and installed without being connected in any way with the ore-bin." Two years ago I suggested certain departures from the regular type of construction, though the matter was not then published. The principal departure was in placing the line-shaft immediately under the cam-shaft, so that the pull would be vertical, and therefore the tendency of the frame to move toward or away from the ore-bin would be negative. I had arrived at this notion as an improvement on the all-concrete battery post construction that I had proposed in the *Engineering and Mining Journal* some years ago, because I saw that the split contained concrete structure must have a vertical pull so as to reduce the tendency to tip backward or forward, which would be present if the pull was from the ore-bin side of the centre where the line-shaft is usually placed. That concrete structure should have guide girts, made of cast iron, attached to the concrete.

This idea has since been put to practical test in the City Deep mill, as Mr. Hutchinson states; but to lessen the vibrations of the cam-shaft, I proposed a bearing between each stamp. This, then, gave thirteen bearings for every ten stamps, but as these were all to be on a heavy casting the bearings could not get out of alignment, although the shaft might get out of the horizontal if the concrete work should settle or the timbers on which this casting rested should contract unevenly—two conditions that are not likely to occur. Another radical departure was that of a low mortar box, with the boss projecting through the top, a feature by no means original with me, as M. P. Boss had long before adopted it. The battery plates also were placed away from the mortar, and in its place a car provided running alongside to carry shoes, dies, etc., to the mortar, and battery sands away to the clean-up barrel, or worn-out pieces to the scrap heap. I have heard millmen object to this, because, as they contend, the pulp cannot be distributed as well away from the battery as when issuing from the screen. This, in my opinion, requires simply a little ingenuity in making a distributer. I would also have the back knee supports held in shoes that allow of the lengthening or shortening of the braces—an adjustment that would require in practice but a few moments time.

Mr. Hutchinson says that chrome-nickel steel is the best material for cam-shafts; yet, if I am not mistaken, this material was used in the Boston Con. mill and broke so frequently that a change was made to malleable iron, since which time no trouble has been experienced. The vibrations of a cam-shaft in a stamp-mill are not exactly those in the axle of an automobile, and so while chrome-nickel steel may be good for one purpose, it may be of little use in the other, where the vibrations are of a different character. As Mr. Hutchinson says, nothing but price is considered in placing orders for machinery. It may be that the mine-owner consults an engineer who obtains the price with specifications from many machinery houses, but how often does the engineer have the ultimate choice? Machinery houses should insist upon minimum sizes for certain parts of mills; the quality of the material must be left to a competitive price. A six-inch cam-shaft, while not strong enough for a ten-stamp unit, is plenty large enough for a five-stamp battery. Some houses offer a 5½-in. shaft for a five-stamp battery, but this is not strong enough. This size is well suited for a two-stamp unit.

I would suggest the 'mortar hold down bolts' two inches in diameter. This I consider the correct size for concrete foundations. Only six of these are needed, three on each side, and, as some millwright has suggested, four good bolts will answer the purpose as well as eight. The battery posts should be held down to the sole-plate with 1½-in. bolts and not the usual inch bolts. The sole-plate may be held down by removable bolts, as used for the mortar construction; but, as Mr. Hutchinson indicates, the all-concrete, reinforced-battery construction will no doubt come into vogue as soon as the mining man throws off some of his conservatism and looks upon his mine as a commercial business instead of a stock-jobbing enterprise.

ALGERNON DEL MAR.

South Pasadena, December 20, 1911.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

PATENTS can now be registered and kept alive in Japan as in any other country. The original fee is about $25, and renewal costs $10 per year. In case a patentee does not within a certain time register his patent, anyone else caring to do so may register it in his own name and collect royalties.

FILES clogged with tin or lead may be cleaned by immersion in strong nitric acid. For iron filings, use blue vitriol, rinse in water, and dip in nitric acid. For copper or brass, use nitric acid several times; for zinc, dilute sulphuric acid. After any of these treatments, rinse the files in water, brush vigorously, and dry in sawdust or by burning alcohol on the file.

TIN occurs in America chiefly in the Black Hills of South Dakota, at Spearfish, and at Harney Peak. Litigation has hampered the development of the properties, which are not of high grade, and the operations have not been successful. Tin is chiefly obtained from the Straits Settlements, though Bolivia, Cornwall, and China are important producers as well.

GARNET is used as an abrasive, the variety known as alamandite being preferred for this purpose. The present production is obtained from the Adirondack mountains, in New York, where the crushed rock is either hand-sorted or jigged. It is made into garnet paper, which is used in the shoe and wood-working industries, and brings $30 to $32 per ton.

THE following is a short accurate method for securing length for a belt. When it is not convenient or possible to measure with line the required amount of belt needed, add the diameter of the two pulleys together, divide the result by 2, and multiply the quotient by 3⅛. Add your product to twice the distance between the shafts carrying the pulleys and the result is the length for belt.

SISKIYOU, a county in California, and mountains in Oregon, by some authorities is said to be a corruption of the original name given the district in California by the French—*six cailloux*, meaning 'six boulders'; others state that it is an Indian word meaning 'bob-tailed horse,' the mountains between California and Oregon having been so named because a famous bob-tailed race-horse was lost on the trail.

MONAZITE SAND from the interior of Brazil contains only 4 to 5.7% of thorium oxide, while that from the sea coast contains 7%. The deposits have resulted from the erosion and concentration of felspathic rocks which contain .0.07 to 0.20% of thoria. The sand is mined and concentrated roughly and is finished on electromagnetic separators which make a 95% monazite that contains 3.7% thorium oxide on the average.

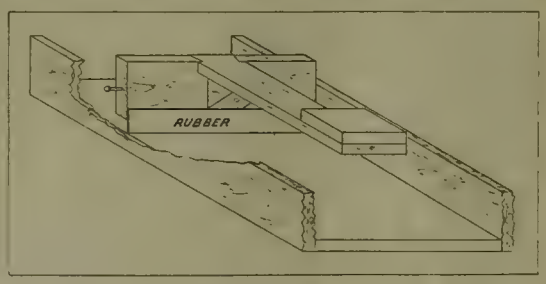
GROUND which is the subject of an adverse claim may be excluded from the patent application, that the latter may at once proceed to final entry and patent, without any rights to the ground in conflict being waived. An agreement made by a patent applicant to deed certain portions of the claims or rights, after patent has been obtained, to those threatening to adverse, in consideration of no adverse being made, is sound and valid.

LOSS OF GOLD in amalgamation may be due to a number of causes. If it be due to free gold included in or surrounded by gangue rock, a sizing test will reveal it through the higher value of the coarser sand. In some cases the coarser sand can be crushed in a mortar and panned to show a 'prospect' of gold. The remedy for the loss is to crush fine, not the ore in general, but the coarser grains. This may be accomplished by using a finer screen with the same or lower height of discharge.

ELECTROLYTIC refining of copper, as is true of all other processes, involves some waste and re-treatment of material. The large loss is due to a part of the anode, used for supporting the weight, becoming scrap. In Eastern refineries it is customary to use anodes where a lip projects from either end of the upper edge, and the material in these lips is necessarily left unrefined and must be remelted. Scrap in this process amounts to as much as 12%. At Great Falls the scrap has been reduced to 7% by means of an ingenious device perfected by the superintendent, Willis T. Burns. Briefly, the weight of the anode is supported by two loops of copper wire in place of the usual lips. The ends of these loops are placed in the molds when the anodes are cast, and thus the copper in the wire loop becomes firmly imbedded in the copper of the anode. At the end of the refining process the amount of copper left to be re-treated is much less than when the usual form of anode is used.

ISOPLANATION, as a term complimentary to peneplanation, was defined at the recent meeting of the Geological Society of America by D. D. Cairnes, on the basis of physiographic studies made by him in the Yukon region. "Where remnants of the original plateau surface remain," he said, "agencies, including nivation, frost, and chemical action, are at work on the upland tending to remove all inequalities of the surface by transporting material from the upper to the adjoining lower levels; for this process the term 'isoplanation' is proposed. This name has suggested itself, as its results tend to make the elevation of all points equal (iso) in the area affected. Isoplanation is the reverse of peneplanation, as by isoplanation there is but a slight, if any, loss of material within the planated areas, but in peneplanated tracts all crustal matter above sea-level tends to become transported to the ocean. Isoplanation thus includes all planating activities, even wind action, whereby a plain-like surface tends to be produced, and by which there is no perceptible loss of material to the planated tract: all ordinary stream action, which is the main factor in peneplanation, is thus excluded."

SCREENING fine material over fixed screens where feasible, is less expensive than where trommels are used, because of power and repair bills incident to the latter. Where feed is irregular, however, there is a marked tendency for material to slide over the screen in a mass, and so to be delivered imperfectly screened. At the Portland mill at Colorado Springs this difficulty has been met by means of the device shown below. Across the screen is



placed a tipping block swung on pins and weighted by means of an arm as shown. Along the lower edge of this block is fixed a strip of rubber belting, fitting down close to the screen. When a mass of material is dumped on the screen it slides down against the rubber strip and bounces the block up and out of the way. The counterweight throws the block back into position and the material is, as a result, spread evenly over the screen by a series of light blows. This greatly increases the efficiency of the screen.

Special Correspondence

SALT LAKE CITY, UTAH

NEWS FROM COTTONWOOD CANYON. MICHIGAN UTAH. ALTA T. & T. CO. ALTA CONSOLIDATED.

The Michigan Utah Mining Co. has been organized to take over a number of important mining properties lying on and between Big and Little Cottonwood canyons, in Salt Lake county, on a basis tentatively agreed upon in arranging for a big consolidation. The properties proposed to be merged consist of the Utah Mines Coalition, City Rocks, Grizzly, Copper Prince, International, Kearsarge, Gen. Monk, and Gen. May. The Utah Mines Coalition and City Rocks are developed to the productive stage, and all form a contiguous group. The property of the Coalition company has been operated some time through its Solitude tunnel, which can be utilized in working the City Rocks. It is demonstrated that, by driving a 600 ft. cross-cut from this tunnel, a connection may be made with the Grizzly workings; and by other driving this haulage level can be made to serve all other properties of the group. The manager and officers of the Utah Mines Coalition Co. took the initiative in securing the agreement by which all these properties are in a fair way to be united under the control of the Michigan-Utah M. Co. These properties are in the Alta district.

MAP OF UTAH.

The Alta Tunnel & Transportation Co., in which F. V. Bodfish, C. A. Gillette, John Caine, George H. Rathman, and R. L. Mack are directors, has acquired 14 lode claims on Honeycomb mountain between Big and Little Cottonwood canyons. The plan of the company is to cross-cut the fissures of this region by driving an adit 3500 ft. from Silver fork on Big Cottonwood. The portal will be at an altitude of 8500 ft. above sea-level, and it is figured that the adit will cut several well-known fissures at depths ranging from 600 to 900 ft. below existing workings. It is the purpose to place an air-compressor at the entrance, and this will be electrically driven. The cross-section is to be 5 by 7½ ft., and the estimated cost of driving is $15 per foot. It is stated that this adit will give a depth of about 600 ft. below the Solitude haulage level of the Utah Mines Coalition Co. The fissures to be intersected are nearly parallel. They occur in a formation of shale, quartzite, and limestone, overlying granite. The fissure veins strike parallel to a series of porphyry dikes which extend northeasterly through this formation. The shoots of ore in the veins pitch toward the northeast. The dip of the veins is northwest, about 80° from the horizontal. The ores mined thus far are mostly oxidized, the metals being silver, lead, and copper, with a small amount of gold. The lead and copper in the higher workings occur as carbonates, the silver as chloride and bromide. The proposed deeper development is expected to open the bodies of sulphide ore. Former operators in this vicinity mined through shafts and were handicapped by the excessive inflow of water at their lower workings. The projected adit is to serve for both drainage and transportation, and will make it possible to mine ore in this and adjoining properties without hoisting. The course is in the direction of Alta camp, which is in Little Cottonwood canyon.

The Alta Consolidated M. Co., having a lease and bond on a group of developed claims almost at the head of Little Cottonwood canyon, has shipped over 300 tons of ore within the last five months, the gross returns of which amounted to $12,000. The ore sampled about 18% galena, 5% copper, and 75 oz. silver per ton. Originally the work here was in carbonate ore, but present operations are entirely in sulphide bodies. The lowest level is being advanced on the fissure vein in the direction of a contact which cuts the fissure nearly at right angles; according to past experience in this district, larger bodies of ore may be found at this contact. The property is at an altitude of 9500 ft., and adjoins the Michigan-Utah group. J. H. Winwood, T. and A. Jacobson, and Hans Vunder are in control of the property.

JOPLIN, MISSOURI

ZINC PROSPECTS FOR 1912 BRIGHT.—NEW CONTRACTS.—ZINC OXIDE WORKS MAY RESUME OPERATIONS.—ZINC AND LEAD NOTES.

The dawn of 1912 sees conditions exceptionally bright in the zinc industry, both mining and smelting, and the ore production from the Missouri-Kansas-Oklahoma district is much heavier than at the beginning of 1911. Spelter, which reached the highest figure of years by going to $6.85 early in December, dropped to $6.10 toward the middle of the month, but recovered, and at the close of the year was firm at $6.20; while zincblende, which had been selling for about $48, assay basis of 60% metallic zinc, earlier in the month, dropped to $44 at the close of the month, with choice lots commanding a premium, bringing the price to as high as $48. During the past year metal producers have reaped a profit much greater proportionately than have the mine operators, due to the wide margin that has existed between the price of spelter and the price of ore. At no time has the 'eight-to-one' basis prevailed. Formerly it was considered that zincblende should bring eight times as much, per ton, as spelter brought per hundredweight, but this ratio has been materially decreased. In 1910, when a $12 smelting margin prevailed, profits were said to be good; but in 1911 the margin ranged around $20, and actually went to $28 toward the close of the year. Realizing that they have not been united in their fight for higher prices, the ore producers appreciate the fact that through coöperation only will they secure a price which they believe to be reasonable. Without coöperation the heavy production of blende continues unimpeded, more than 5000 tons per week being turned out, to be placed on the market at any figure the smelters care to offer. With unity of action, the zinc-ore producers can restrict this output, and can to some degree at least have a voice in fixing the price on their product.

A new scale of buying zinc ore has been put in force by the American Zinc, Lead & Smelting Co., which a year ago inaugurated for the first time in the history of this district a method by which the mine product should be bought at a price fixed on the average price of spelter at East St. Louis. The new contracts are much less favorable to the mine operator and are not being accepted as readily as were the former contracts. While the old con-

tract fixed a smelting margin of $14.80, the new contract fixes a margin of $21, and many features of the contract are much less desirable. It means that the producer will receive from $6 to $8 per ton less for his output than under the former schedule. The contract system was employed only by the one company and was largely in the nature of an experiment. The numerous other companies buying in this market purchased their ores in the old way, by bidding in the open market. Comparison of the two methods throughout 1911 shows the contract, as originally employed, to have been much more favorable to the producer than the open market bidding. Contract prices invariably were much higher than the open-market figures, the difference between the two at times being as great as $5 per ton.

After remaining idle more than four years, operations are to be resumed at the plant of the Ozark Zinc Oxide Co. at Joplin, officers of the company having decided to spend $10,000 on repairs. The plant will be ready for work about April and will employ about 35 skilled workmen. It will open a new market for some of the zinc ores of the Joplin district, though Mexican and Western ores are used almost exclusively.

Having worked for years on an enormous ore deposit that netted thousands of tons of high-grade blende and galena concentrate, the Grace Zinc Co.'s mill on the Granby M. & S. Co.'s land at Joplin is being converted into a tailing mill, the object being to rehandle the great bulk of lime and flint gravel that passed through the plant in the years of its operation.

ARCO, IDAHO

WILBERT M. CO. ERECTING 150-TON MILL.—PROPERTY DESCRIBED AND PLANS OUTLINED.

The Wilbert Mines Co. is erecting a concentrating mill of 150 tons daily capacity at its mining property situated in Little Lost river range, Dome district, 25 miles northeast of here. It is expected that the mill will be ready to operate by next March. This plant is being equipped with a 10 by 20-in. Blake crusher, two sets of 36 by 16-in. rolls of Allis-Chalmers make, four Harz jigs, eight Wilfley tables, two slimers, and a 5-compartment Janney classifier for classifying the product of the fine rolls. The middling and tailing from the coarse tables are to be reground in a Hardinge 6-ft. conical mill, the product of the latter to be concentrated over slime-tables. A 20-ft. picking belt will extend from the bin to the crusher. It is estimated that 15% of the ore to be taken from the mine is high-grade, and this class of ore is to be picked off the belt and shipped without concentrating. The ore consists of galena and silver in a quartzite gangue. M. M. Johnson, the company's consulting engineer, has made a report on the property in which he gives an estimate of 21,958 tons of ore exposed and ready for mining. Assays of about 200 samples of this ore show an average of 23% lead and 2 oz. silver per ton, with about 15c. gold, making a gross value of $21.85 per ton. In this report it is figured that there will be a loss of 20%, or $4.54, in milling, and that costs will be 75c. for mining, 75c. for milling, $2 for wagon haulage, $1.25 for railroad freight, $5.80 as smelting charge, making a total of $14.89 per ton, leaving a net value of $6.96 per ton. It is calculated that the concentrate to be shipped will run 50% lead and 5 to 6 oz. silver per ton.

The holdings of the company consist of 15 lode claims, covering in the main a quartzite country, in which there are several well-defined fissures striking northeast. The mineralization, as indicated by the croppings, extends about 3000 ft. and has a width of 1000 ft. The principal development has been accomplished by means of No. 1, 2, and 3 cross-cut adits, the last-named giving a depth on the principal vein of about 200 ft. The orebody exposed by the development already performed has an average width of 21 ft., is 70 ft. long, and 180 ft. deep. What is believed to be the northerly extension of this orebody has been opened by a fourth adit known as the 'caved tunnel,' 150 ft. north of the former workings. The vein exposed by the caved tunnel is 10 ft. wide, the ore assaying 16% lead. There is at this place an extensive wash of surface ore. The ore reserve indicated has been blocked out and is susceptible to measurement. The mill is situated near the base of the mountain, 400 ft. from the portal of adit No. 3, and the ore is to be hauled to the mill-bins in cars over a surface tramway of that length. The intention is to drive a haulage level to the orebody from the level of the mill-bins, whereby an additional depth of 400 ft. will be gained. While a steam plant is being erected at the mill for temporary power purposes, the intention is to build a hydro-electric power-plant on one of the three creeks which flow through the company's ground, a grant for the water rights of which has been obtained from the State of Idaho. A. S. Ross, one of the principal owners of the Pittsburg-Idaho mine, at Gilmore, Lemhi county, Idaho, has a controlling interest in the Wilbert mine. W. S. McCormick, Knight & Warnock, and others, of Salt Lake, are also stockholders. The Wilbert and Pittsburg-Idaho are about 50 miles apart, and situated on opposite sides of the same mountain range, both being lead mines. The latter is connected with a spur from the Pittsburg & Gilmore railroad, which extends from Armsted to Salmon City, and is a regular shipper of ore.

JOHANNESBURG, TRANSVAAL

MINES DEPARTMENT TELLS OF MINERAL PRODUCTION.—COAL.—TIN.

According to the returns issued by the Government Mines Department, the total value of the mineral output of the Transvaal, exclusive of diamonds, was, for October, £3,137,387. Considering that gold alone amounted to £3,006,438, the balance may not appear to be a large amount to distribute among the base-mineral output, but, nevertheless, base minerals have made some progress of late. Coal, of course, has always been a drug on the market since the country became possessed of a railway system, and selling prices have been constantly falling, until in October the average price at the pits was but 4s. 6d. per ton. The district commanding the highest average pit-top selling price had to be content with 5s. 7d. per ton, while the cheapest district only obtained 3s. 9d. per ton. It is clear that the last price does not leave much margin for profit, and is obtained under somewhat exceptional circumstances. Owing to the efforts of the Transvaal Coal Owners' Association, coal prices, though low, are steady, and the majority of collieries lately have been able to earn a small dividend for the shareholders.

The value of tin ore shipped during October was again somewhat disappointing, as it only amounted to £26,181, as compared with £45,009 in July. This fall seems probably due to the Zaaiplaats mine, the principal producer in the Transvaal, not having been so overpushed to obtain a maximum output and shipments since the manager has returned, for there are few producing mines as yet in the Waterburg district, and a marked restriction of output at any one brings down the monthly returns for the whole country. Affairs at the Zaaiplaats mine have not been running smoothly of late, as the manager has persistently refused to adopt the suggestions of the acting manager and consulting engineer, regarding the equipment and policy. The directors, after agreeing to the proposed method and acting upon it, have now withdrawn their consent to its adoption, upon the wishes and threats of the manager. It is believed that the plan of the consulting engineer was largely suggested by the acting manager, and no surprise need be expressed that affairs have recently been somewhat topsy turvy. The Zaaiplaats mine is a phenomenally rich one in places, and the doings there must have some effect upon the fortunes of the whole tin deposits in that district. Copper ore also was shipped during October to the amount of only £3014, although in August shipments had grown to £5907. When once the new railway is constructed to the northern copper fields, there is every indication that copper shipments will materially increase.

NEW YORK

Dull Markets Continue.—Where Is the Copper?—Promoters in Trouble.—New Smelters Deferred.

January is the month of dividend distribution, and some $225,000,000, it is estimated, will be disbursed. Last July, when the summer semi-annual distribution was made, market authorities declared that the resulting evidences of expenditure could be found along the automobile highways; that those who before had no cars were making their first payments and taking their first trips, that those who had previously had cars were investing their dividends in new tires and other accessories, to say nothing of the gallons and gallons of gasoline required. It was hoped that in the winter season it might be possible to draw the attention of the public from other things and create some speculative interest; it is something of a shock to the old-timers to find that the public is through speculating, whether the market goes up or down. Shares bought for investment do not greatly interest the makers of markets; they prefer the trader for market profits who goes in and out every day. The sorrow of Wall Street is that, like Western big game, good specimens are becoming more and more rare.

In copper there seems to be a good deal of underlying skepticism concerning the recent upward trend in prices. Some of the large consumers are questioning the soundness of the situation and the movement in the shares hardly justifies the fears expressed by some of the producers of a runaway market. While it is not known as an absolute certainty that a pool of big producers was formed during the latter months of last year, it is so asserted in some quarters, the story being that the group included some of the more important foreign agencies, and that a large amount of copper has been accumulated in an endeavor to stampede the American manufacturer into the market. Discussion of the topic with manufacturers reveals the fact that many of them were, and are, uneasy over the prospect of higher prices and no metal on hand, but, while the report of the Producers' Association for December 1911 was expected to make a strong showing, there was a tendency to await developments. If it be true that a group of copper producers working with the larger selling agencies has purchased and is now carrying any large part of the copper which is supposed to have gone into consumption, if the decrease in the world's visible supply proves eventually to be accounted for in this way, it is safe to say that in the end the copper market will suffer more than it will gain. In the meantime, one factor may be taken as assured—every producing mine that can take out copper at a satisfactory profit on the present market is straining to bring production up to capacity. An instance of the quick expansion in production which may be anticipated is the record of the Anaconda for December, which turned out 24,400,000 lb., being an increase of some 3,500,000 lb. over the figures for the month preceding, and considerably more than any month of the year. The Phelps-Dodge output has already shown a marked increase and may be expected to grow further. December output was 13,199,042 lb., as against an average of about 11,000,000 lb. for the preceding months of the year. If similar increases are to be made by the larger mines, February or March will probably see the surplus gaining in bulk once more. The foreign visible supply is shown by fortnightly figures to show an increase on December 31 of something over 1,500,000 lb. It is rather expected that December export figures will break all previous records.

The trial of George Graham Rice and his associates is still dragging along, without other incident than the action of the court in forfeiting the bail of the principal defendant. The spectacular methods of Albert Freeman and his association with Julian Hawthorne have been the subject of a great deal of comment during the past eighteen months, during which time, these two and their co-workers, among whom was Josiah Quincy, a former mayor of Boston, Massachusetts, floated several properties in Canada. The glittering prospectuses, written by Mr. Hawthorne and spread broadcast through the mails, are now declared to have been instruments of fraud, and the six principals are held in heavy bail for misusing the mails.

Some of the projected smelting plants are evidently not to be built, at least in the immediate future. The Cronin company, which has had a long hard pull in its attempt to make a copper, is said to be making a contract with the Steptoe Valley S. & M. Co. for treatment of its ores. The Shattuck Arizona is endeavoring to obtain a satisfactory smelting contract, and if possible to postpone the erection of its own plant. The governing factor in both cases undoubtedly is the intention to take advantage of the present metal market and avoid the delay necessary to construction. The Calumet & Arizona, however, is in better stead, having a plant which can be used while the new smelter, which is to cost about $2,000,000, is being erected.

It has been a long time since the New York market took any particular active interest in Cripple Creek, but an effort is to be made to make a trading market in El Paso Consolidated on the New York Curb.

Business of the U. S. Steel Corporation continues to show improvement, and the volume of new orders is now greater than in months past. It is said that business now averages 55,000 tons per day. The Corporation has also increased its production, and operations are now at 80% of capacity. Because of the increase in business in December and the slightly higher range of prices, it is estimated that earnings for the quarter closed December 31 amounted to between $24,000,000 and $25,000,000.

BUTTE, MONTANA

Anaconda and Butte-Ballaklava May Settle Dispute Out of Court.—Work Started on Butte Central Concentrator.—Anaconda Production.

There are rumors afloat to the effect that a settlement of the litigation between the Anaconda Copper Mining Co. and the Butte-Ballaklava company might be made in the next few weeks. In the application for the hearing of the case in some other place outside of Butte, the Butte-Ballaklava company asserted that it was impossible to get a fair trial in this city owing to the powerful influence of the Anaconda company. W. H. Weed, of New York, who is the expert of the Butte-Ballaklava company, and H. V. Winchell, who acts for the Anaconda company, many months ago completed all their examinations, and are here. They have had some conferences, and while neither one of them will express any opinion, it is thought they are discussing a possible line of agreement for submission to the interested parties, both acting in behalf of the companies they represent. The contention of the Anaconda company is that the Butte-Ballaklava company was taking ore from the Right Bower and the Mountain Chief properties, and $1,800,000 is asked as the value of the ore taken. The Butte-Ballaklava company prospered for some time previous to the Anaconda company, securing an injunction prohibiting it from mining in the ground in dispute, and even paid one dividend. Since the injunction has been in force, the Butte-Ballaklava company has sunk the shaft 200 ft. and has carried on some development work in ground other than the territory claimed by the Anaconda company, but with little success.

Work has been commenced on the concentrator of the Butte Central Copper Co., and it is announced the plant is to be ready for operation by June 1. It will have a capacity of 100 tons and will be operated by electricity. The company is maintaining shipments of about 50 tons per week from its Ophir mine, and Sam McConnell, superintendent of the property, says that more than sufficient money is being received from the shipments to pay all running expenses.

It would appear from the official figures of the production of the Anaconda company for the month of December that the output was increased 2,500,000 lb. during that month, and that it was 24,400,000 lb., or within 600,000 lb. of the amount announced to be increased this year. This was the largest output of any month last year and brings the production of the Anaconda for the year

1911 up to 260,652,000 lb., and adding the East Butte company makes the total production for the year in this district 273,238,000 lb. of copper. So, while the increase was started in December, it will be continued this month, when the production probably will slightly exceed 25,000,000 lb., as the High Ore, which was closed down since August 23 of last year, has gone into commission again and some of the other mines have slightly increased their output. The Leonard has been closed down, and it was hoisting 1200 tons per day, but the High Ore will more than make up for the closing down of the Leonard. The High Ore, during the time it was out of commission, in addition to being equipped for hoisting ore by compressed air, had skip chutes built at different stations into which the ore is dumped to be held in readiness to be hoisted to the surface. The skip chutes are of the most modern kind and will greatly facilitate the work of getting the rock to the surface in large quantities. The Badger State and Tramway mines, before the end of the month, will be hoisting increased quantities of ore, but not much over one-half what they could produce if the occasion required it. These mines are among the richest in the district and are in excellent condition.

Now that the Anaconda company has announced an increase in production, both the East Butte and Tuolumne companies will follow suit in the near future. The Tuolumne company's new surface plant will not be ready to go into commission much before the last of the month, and it will therefore be along about the first of next month before this mine shows any increase. The East Butte is not likely to increase its output much before the first of the month, although there is an immense quantity of ore blocked out and ready to be brought to the surface. The smelter capacity will be increased in the near future by the adding of a new blast-furnace, the installation of which is now under way.

TEPIC, MEXICO

OLD MINES REOPENING.—RAILWAY CONNECTION SOON.

El Frontal, which is east of the town of Rosamorada, Tepic, some six hours' horseback ride from the railroad line, and is owned by an American company having offices in Cincinnati, is now attracting attention. Extensive development work has been done during the past three years and a large tonnage of ore has been blocked. A body of ore 7 ft. wide, reported to assay $11 per ton, was found last month in a cross-cut 250 ft. below the adit-level. The mill and cyanide plant which was erected two years ago, but not started for lack of sufficient tonnage, are being put in shape and will commence operations in February. A large tract of land, well wooded and watered, surrounds the property and was purchased by the company several years ago. The company also owns a promising prospect near the Southern Pacific railroad station Yago, called La Cuenarcha. No prospect work has been done on this property, but surface assays of the outcrop, which is wide, show very good values in gold and silver. There are a number of old Spanish workings on this property. With the facilities which the new railroad affords, this property ought to offer many advantages for operation.

The Muritas, situated some five minutes' ride from the Southern Pacific railroad station Rosamorada, is steadily keeping up development. The flow of water which for some time greatly impeded the work, has been controlled by the aid of a powerful pumping plant. According to records, this property, which, judging by the many old workings scattered along the vein, must have been worked very extensively by the Spaniards during colonial times, was a large producer. The company's representative, E. J. Thomas of Ray, Arizona, was on the ground during the month of December and acquired some promising claims from I. J. Hall, whose claims are situated in the neighborhood of the town of Acaponeta, near the famous El Tigre mine which has been shipping high-grade gold ore to San Francisco for the past two years. Cucharas, situated in the municipality of Acaponeta, near the village of Huajicori, is owned by the Lacy family of Los Angeles and managed by one of the three brothers, Ed. Lacy. This is a copper-gold mine and said to have large reserves of ore blocked. The Cucharas was one of the few, if not the only mine in the Territory, which shut down during the revolutionary trouble in May 1911. Work has been resumed in December, and the smelter will be started within a month.

The Zopilote property is owned by a German company with offices in Hamburg. It is one of the largest, if not the largest, mines in the Territory of Tepic. Before the German company acquired it in the eighties, the mines were owned by several Mexicans who worked them for years with large profits. Although no record of the production during those times exists, it is stated on good authority that several million pesos were taken out. The German company acquired all of the eleven mines now comprising the Zopilote group, and also a large tract of some 30,000 acres of land surrounding it, and erected a stamp mill and hypo-lixiviation plant. There are a number of substantial administration buildings and a pleasant town of brick houses erected by the company and accommodating some 2000 people, a church, a schoolhouse, etc. The German company worked the property without interruption for about 25 years, milling during the last ten years about 500 tons per month. During this time the property has produced some $10,000,000. The ore was roasted and treated by the hypo-lixiviation process, at a very high cost. In the year 1908 the property closed on account of the low price of silver. A. F. Flynt, a mining and metallurgical engineer of Minnesota, acquired the property under lease and option in May last, and, notwithstanding, the revolutionary trouble in the country, he started work at once. The 20-stamp mill and the two ball-mills were repaired and put in commission, a concentrator was erected, and the old hypo-lixiviation plant was converted into a cyanide plant. Milling commenced in August. Since that time the plant has run without interruption, the property employing some 200 men. The shipments are from ₱10,000 to ₱15,000 per month. There are large reserves of low-grade ore in the mines, as the old company did not attempt to work any ore assaying less than one kilogram of silver per ton. The ores from the Jabalina and Restauradora mines are being worked at present. Some high-grade ore running from 6 to 10 kg. of silver per ton is reported to have been found in both these mines. There is a fine water-power near the property, which it is planned to develop. This property ought to become a large producer with a further increase in the capacity of the plant.

The Tenanmeche is situated on the edge of the ground belonging to the Zopilote company and is owned by an American company controlled by a Mr. Ramsdell of Guadalajara. Development has been under way for the past three years, opening up old Spanish workings. H. Hale, who did the development work at the Favor mines in the Hostotipaquillo district before Mr. Ramsdell sold them, is in charge. The ores are silver bearing, and the mine is said to contain high-grade ore. There is no mill on the property, but a shipment is now being made ready to be sent over the Southern Pacific railroad to a northern smelter.

The Purisima is situated 60 kilometres north of the city of Tepic, two hours' horseback ride from the Southern Pacific railroad station Corte, and is owned by A. F. Flynt, who has been doing development work during the past five years. The ore is valuable for both gold and silver. The vein is from 8 to 40 ft. wide, the ore assays $12 to $15 per ton across the vein, and there is said to be 'blocked out' some 50,000 tons of ore. A steam-hoist and crusher have lately been installed at the mine, and additional cyanide tanks and a Wilfley concentrator are being erected at the mill, increasing the present capacity to 25 tons per day. No ore has been stoped, all the ore milled originating from the development work, which has paid the expenses of operating the property. The Southern Pacific railroad will be opened as far as the city of Tepic on January 15, 1912, establishing a direct connection between California and the city of Tepic, a trip of about three days, and there is no doubt that this district will receive considerable attention in the near future.

General Mining News

ALASKA

JUNEAU

The Alaska Mexican G. M. Co. in November made a gross production with an 'estimated realizable value' of $55,522, against $55,285 for October. Operating expenses were $28,367 in November, against $41,894 in the preceding month, leaving operating profits of $27,154 in November and 23,391 in October. Construction expenses amounted to $4195 in November and $7221 in October, leaving net profits of $23,959 and $16,170 for the respective months. The average yield was $2.91 per ton of ore in November and $2.76 in October.

The Alaska United G. M. Co. in November made a gross production of $92,544 'estimated realizable value,' from the Ready Bullion and 700 Ft. claims, against $114,770 in October. Operating expenses were $53,198 in November, against $52,069 in October, leaving operating profits of $39,150 in November and $62,701 in October. Construction expenses in November amounted to $3147, and in October to $7482, leaving net profits of $35,999 and $55,219 for the respective months. The average yield in November for the Ready Bullion claim was $2.32 per ton of ore, against $2.62 in the preceding month, and for the 700 Ft. claim $2.45 per ton in November, against $3.07 in October.

The Alaska Treadwell G. M. Co. in November made a gross production of $154,578, 'estimated realizable value.' Operating expense amounted to $89,835 and construction expense to $14,885, leaving a net profit of $49,858. The average yield was $2.46 per ton of ore. The October report has been published.

ARIZONA

GILA COUNTY

The Summit mine, formerly known as the Gibson, which was under option to the Summit Copper Co. for $442,375, has reverted to the original owner. The Gibson Copper Co. The latter company has a few men at work to keep the mine unwatered, but it is reported that actual development will not be undertaken for several months.

PINAL COUNTY

The Magma Copper Co., supposed to be controlled by Thompson & Gunn, is reported to be developing a large deposit of ore from which an average sample assayed 50% and 60 oz. silver per ton. The sample was obtained on the 800-ft. level. The ore is being shipped to the El Paso smelter.

CALIFORNIA

CALAVERAS COUNTY

Protest against the Penn M. Co.'s smelter at Camp Seco has been lodged by A. H. Keir, secretary of the Farmers' Protective Association, and a delegation of farmers from Amador, Calaveras, and San Joaquin counties, with the supervisors of the last-named county. Press accounts state that the Calaveras and Amador boards are waiting to see what action the San Joaquin supervisors will take.

MONO COUNTY

The Tonopah M. Co. is reported to be negotiating the purchase of the Lundy mine, owned by the Crystal Lake company.

NEVADA COUNTY

(Special Correspondence.)—The North Star Mines Co. declared a Christmas dividend of 8%, making a total of 17% on the capital stock disbursed during the year. The payment in 1910 amounted to 23%. The reduction for the present year is credited to greater depth at which the ore is mined, less production, and heavier operating costs. It is understood the company is planning for the opening of ore in the Massachusetts Hill mine, one of its main holdings. Considerable work has been performed during the year at the Cincinnati Hill group, but results were not altogether satisfactory, according to reports. The company acquired control of the Champion mine, Nevada City district, and installed machinery, including an electric pump, with a capacity of 750 gallons. The Champion is expected to prove one of the best properties of the company. The Pennsylvania M. Co. has placed its new 10-stamp mill in commission. Good ore is being opened in the lower levels, where an important discovery was made some months ago. The unwatering of the Midas mine will commence soon, and the steam pumps have been inspected and everything is in readiness to start. The shaft will be sent 100 ft. deeper. J. W. Young, of Sacramento, has a six months' option on the property.

Grass Valley, December 31.

The Murchie G. M. Co. and Murchie Extension G. M. Co. property was sold December 29 at sheriff's sale to the Pacific Gas & Electric Co. for $10,000. The sale was to satisfy a judgment of the South Yuba Water Company.

PLUMAS COUNTY

Valuable ore was discovered recently in the Brown Bear mine, about fourteen miles east of Quincy.

SACRAMENTO COUNTY

Frank Grillin was elected president of the Natomas Consolidated of California at a directors' meeting December 28 in San Francisco. Eugene De Sabla, who retired from the presidency on account of the pressure of other business, was elected vice-president.

SAN FRANCISCO COUNTY

The annual meeting of the San Francisco Stock Exchange was held January 8. A. B. Ruggles, president of the Exchange, reported that the oil and stock exchange transactions for the year closed amounted to more than $36,000,000. Officers were reëlected as follows: A. B. Ruggles, president; William Edwards, vice-president; J. J. McKenzie, secretary; C. D. Laing, treasurer. Messrs. King and Landon, respectively chairman and assistant secretary, also were chosen to serve another year.

SHASTA COUNTY

(Special Correspondence.)—The Bully Hill Copper Co. is reported to be contemplating the early resumption of

MAMMOTH SMELTER, SHASTA COUNTY.

activities at its Delamar smelter. It is said an electrical process will be employed to recover zinc and copper content. The company conducted extensive experiments with the electric iron-smelter at Heroult last summer, and results were understood to be encouraging. The Bully Hill mines are the deepest copper properties in the county, having been developed to a depth exceeding 900 ft. The ore carries zinc, gold, and silver. The General Electric Co. of New York is largely interested in the company. The Delta Consolidated is planning increased activities with the advent of spring. Shipments of gold-bearing ore recently made to the Mammoth smelter yielded fair profits. The ore is silicious and finds a ready market at Kennett. S. D. Furber recently assumed charge of the property. It is stated the German syndicate which acquired the Evening Star mine several years ago is arranging for an early resumption of activities. The mine is situated in the Old Diggings district, a few miles west of Redding. George H. Bayha is resident manager. Deep development at the Reid, another Old Diggings producer, will commence early in the new year. The Shasta Copper Exploration Co. is prospecting the Stowell claim and contiguous territory ad-

joining the Balaklala estate. The tract lies in the section situated between the Mammoth and Iron Mountain properties, and gives considerable promise. Alden Anderson and associates are reported to be planning development at the Trinity group of gold claims. The property is equipped with a 2-stamp mill, and it is understood a larger plant will be installed. The Glenn County M. Co. is preparing to erect equipment on its holdings in the Dog Creek district. Lessees opened good-grade ore during the summer, and prospects are encouraging. The Noble Electric Copper Co. has completed three large electric iron-furnaces at Heroult. Pig iron will be produced in commercial quantities in the coming year.

Redding, December 30.

Sierra County

(Special Correspondence.)—Abe Hall, the new superintendent of the Tightner Mines Co., has taken charge of the property, and is outlining plans for development. Sufficient ore is blocked out to keep the plant operating for several months, and it is understood the lower workings will be crowded ahead to open the Red Star and other veins to considerable depth. The snowfall, thus far, has not hampered work. The Sixteen-to-One company has taken a lease on the Nissen mill, owned by the Tightner company. High-grade ore is being crushed. The mill at Plumbago, controlled by the Croesus M. Co., is running largely on ore from the winze in adit No. 4. Progressive development is under way and considerable new territory has been recently opened. The power ditch has been reconstructed and other surface work accomplished. C. W. McMeekin is manager. It is reported that the Rainbow company is planning work along advanced lines during the coming summer. This was formerly one of the best properties at Alleghany, but the shoot was lost about a year ago. The property is equipped with a 10-stamp mill. Denver people principally are interested, and L. P. Woodbury is manager. Other Alleghany companies report plans for progressive work with the new year. The lack of sufficient water has forced the closing of the big hydraulic mines at Scales and Brandy City. The snow has partly blocked a portion of the ditch system, and unless heavy rains set in, considerable difficulty will be experienced in operating the gravel properties. The Neocene at Scales, and the Brandy City, are two of the largest active hydraulic mines in central California. The Oro Fino company is rapidly completing its 5-stamp mill at the Oro Fino mine, on Hopkins creek, near Downieville. The Johnson concentrators have been installed. The vein averages around 20 ft. wide, consisting of quartz, schist, and porphyry. The adit has been driven 550 ft. The ore is said to be of fair grade.

Alleghany, January 6.

Tulare County

Newspaper reports state that a deposit of pure feldspar, used in glass-making, has been found near Globe, on the upper Tule river, by agents of the Pacific Glass company.

Tuolumne County

(Special Correspondence.)—The Columbus mine has been sold for a cash price, the buyers being wealthy San Francisco men. The property is situated about three miles northeast of Tuolumne and has been idle for a number of years. Work was started on January 6 with a small crew of men. Some machinery will immediately be installed, a new head-frame erected, and the shaft repaired, after which it is the intention to sink 200 ft. deeper. T. G. Winwood is temporarily in charge of operations.

Complete operations will be resumed at the Shawmut before long, the overhauling and repairing of the large plant being about finished. A contract has been let for cutting a raise in the Jumper from the 500-ft. level north to the 200-ft. level. Development work is being done in various parts of the mine, and the shaft is being repaired below the depth of 200 feet.

The Rising Sun mine at Arastraville, owned by D. A. Porter of Los Angeles, is being unwatered and will be examined by Thomas Wilkinson of Los Angeles. The McAlpine mine, south of Jamestown, has been unwatered and development work is now in progress. The Clio, of which M. D. Kelly is superintendent, is now in full operation, the mill having just been started.

About $40,000 will be expended in surface equipment at the Black Oak mine. Some work is being done at the Mammoth, one of the group of claims owned by the Republican M. Co., commonly spoken of as the Republican mine.

The Climax mine, near Stent, owned by C. A. Fitzgerald, has just been examined for Los Angeles capitalists. The body of rich ore that was exposed by a cave on the 400-ft. level drift in the Providence mine has been opened in several places. Some of the ore is remarkably rich.

Tuolumne, January 6.

William H. Scott has bonded the Mayflower mine to W. P. Daniels, of Wonder, Nevada.

COLORADO

Clear Creek County

(Special Correspondence.)—The compressor plant at the Bellevue-Hudson mine on Columbia mountain was brought into commission today, and a force of 15 to 20 men will be given employment. J. J. White has secured possession of the Ramsdell property on Lincoln mountain. A company is now in process of organization. Work on the Rosebud group of claims is progressing, a 4-in. streak of gray copper ore having been uncovered in the lower adit. Assays show 125 oz. silver per ton. G. W. Teagarden is manager. A. D. Bryant, leasing on the Everett mine, has found a 6-in. streak of ore that shows wire silver. Assays show 700 oz. silver per ton.

Georgetown, January 1.

(Special Correspondence.)—The production from the Idaho Springs district for the past year is given as follows: gold, $656,612; silver, $176,375; copper, $69,400; lead, $60,057; zinc, $44,390; total, $1,006,834. There is little difference from the preceding year. It is reported that the Lucania M. & T. Co. will resume work in the advance of the adit. W. W. Kirby is manager. R. R. Graham and H. B. Baker have taken a five-year lease on the property of the Chicago Mountain M. & T. Co., situated on Chicago creek. The raise from the lower level of the Blue Ridge mine is nearing completion. Ore shipments will start inside of thirty days. P. H. Stanhope is manager. The Hoosac adit on Fall river is being driven steadily forward. E. D. Quigley, the manager, states that a mill will be constructed next spring. Work will be resumed in a few days on the Honest John adit up Chicago creek. The bore is in a distance of 2200 ft. J. F. Puchert is manager.

Idaho Springs, January 2.

Ouray County

Newspaper estimates place the production of gold, silver, lead, and copper in this county for 1911 at $3,829,792.

The Brown Mountain Smelting Co. has an option on the Ouray smelter and will operate it as a custom plant. Thomas B. Crawford, of Denver, has announced that a lead furnace of 50 to 100 tons capacity will be added to the equipment. The main part of the ore treated probably will come from Mr. Brown's properties.

San Miguel County

Press estimates of the production of vanadium in this county for 1911 place it at $1,884,000, against $630,000 for 1910. Shipments of ore and concentrate amounted to less than last year, largely due to interruption of traffic to the Durango smelter. The number of cars shipped was 1602, of which 1068 were from Telluride.

Teller County (Cripple Creek)

Arthur Carnduff, of Cripple Creek, has obtained a lease on the Dead Pine claim, owned by the Ophir M. & M. Co., and the Crown Point claim, owned by the Crown Point G. M. Co., on Battle mountain.

Exceptionally rich ore recently was found in the Kalamazoo mine on Bull hill, according to report. James Giglen, of Altman, is one of the lessees operating the mine.

The South Burns has resumed operation after a shut down of over a month.

The Vindicator Con. G. M. Co. has declared its regular quarterly dividend of 1c per share, payable January 25.

The recent cold weather has in some instances frozen the air lines in the district, says a press report. Owing to the freezing of water in pipes supplying the boilers of the Logan shaft house, the compressors there had to be shut down for two days.

IDAHO

Blaine County

The Wilbert M. Co., Ltd., has been financed through Dern & Thomas, of Salt Lake City. The mill is almost completed and it is hoped it will be in operation before March.

Shoshone County

The foundation of the compressor of the Black Horse M. Co., near Murray, has been completed, and the compressor will be erected in a few days. The property is to be in full operation during this month. J. Thennes is manager of the property.

A 250-ton concentrator is to be erected at the Tusemnbia mine, on Beaver creek, nine miles from Wallace, says a recent report. The property, which is near the Hercules mine, recently was purchased by G. A. Lauzier, Paul Wolcott, and W. J. Dawson of Butte, Montana.

MONTANA

The present depths of the principal mines of the Anaconda Copper Mining Co. are as below:

	Feet.		Feet.
Diamond	2900	Pennsylvania	1800
High Ore	2800	Leonard	1800
Neversweat	2500	West Colusa	1800
Original	2500	Badger State	1800
Anaconda	2400	Buffalo	1500
Gagnon	2400	Moonlight	1500
Mountain Con.	2400	West Gray Rock	1300
St. Lawrence	2300	Silver Bow	1000
West Stewart	2300	Berkeley	1000
Mountain View	2200	East Colusa	900
Tramway	2000	J. I. C.	600
Belmont	2000		

The depths of the shafts of other Butte mines are:

	Feet.		Feet.
North Butte	2800	Raven	1500
Tuolumne	1800	Butte-Ballaklava	1500
Butte-Alex Scott	1800	Pilot Butte	1300
Colorado	1700	Ophir	1000
Butte & Superior	1600	Elm Orlu	1000
East Butte	1500		

Flathead County

(Special Correspondence.)—J. H. Ehlers, in charge of the extensive mining and water-power development work at Yakt falls, in the extreme northwestern part of the State, has interested Eastern capitalists in the great amount of timber suitable for paper pulp in the Yakt watershed, and expects to have these men on the ground early next summer to perfect plans for a large sawmill and wood-pulp plant in the vicinity of Yakt falls, where electric power will be developed. His plans include building an electric railroad in the Yakt basin and the use of the most modern electric logging and manufacturing appliances in utilizing the immense stands of timber in that locality. It is expected to develop 3400 hp. at the falls, which will also be used in the operation of the mines at Sylvanite. Mr. Ehlers has just returned to Spokane after a visit to Libby in connection with this work.

Libby, January 7.

Silverbow County

(Special Correspondence.)—An attempt is to be made in behalf of the shareholders in the United Copper Co. An organization called the United Copper Securities Co. has been incorporated under the laws of the State of Maine, with a capital of $4,000,000. The evident purpose is to form a stockholders' pool in the shares of the United Copper Co. Present holders are asked to accept notes, in part exchange for stock, which is to be held by a trustee as collateral for the payment of the notes, when a market is made and shares sold, the excess above a certain agreed price is to be divided, one half to be for the purpose of rehabilitating the subsidiary companies of the United and one half to go to the depositing shareholders. If the new organization can get far enough into the heart of the United Copper Co. to make an inventory of its assets so that outside stockholders may know what their certificates really represent, they will have accomplished what has so far proved an impossibility.

Butte, January 6.

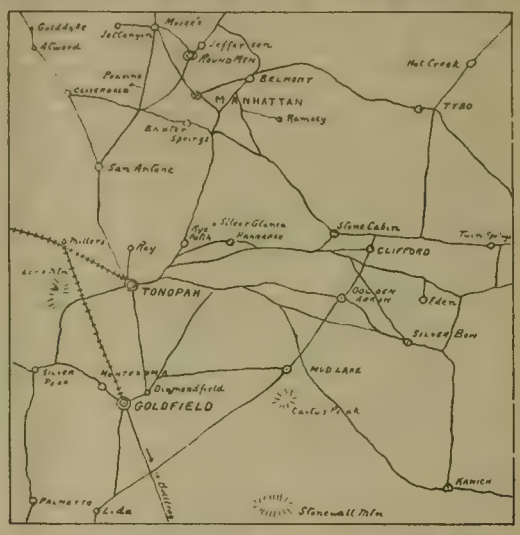
NEVADA

Churchill County

The new mill of the Nevada Wonder M. Co. was temporarily shut down recently on account of the cold spell, which through contraction of the steel pipe-line sprang a leak. By cooling the compressor with the cyanide solution on hand, the agitating-vats were kept 'alive', although other machinery was stopped and two shifts were laid off at the mine.

Esmeralda County

The Continental Development Co. is about to start work at the Yellow Top and White Jacket groups of claims, say advices from Goldfield. J. E. Meyer is general manager and Lewis Cruikshank, of Los Angeles, secretary for the company, which is reported to have purchased 587,000 shares of Yellow Top stock.



PART OF ESMERALDA AND NYE COUNTIES.

At a miners' meeting at Antelope Springs, the name 'Antelope Mining District' was chosen to designate that part of the county. The district is to extend from the spring north six miles, east four miles, south six miles, and west six miles. A regular wage-scale is to be adopted, and it is thought $5 will be selected. A recorder, sanitary committee, and other officials for the district were chosen. The boundaries of the district were chosen by a committee of old-timers. The Jordans, represented at the meeting, have 225 sacks of ore from the original 'find' ready for shipment.

E. Perrier de la Batne has purchased the Orleans group of five claims in the Hornsilver district, south of Goldfield. Development will be started this spring.

Reports from Goldfield state that the Tonopah M. Co. is to buy the Lucky Boy property, situated in the Lucky Boy district.

Lincoln County

The Virginia Louise M. Co. has been organized to operate the Louise claim at Pioche. Portland capitalists are reported to be heavily interested in the property. William Lloyd is president of the company.

Lyon County

J. K. Cameron and F. J. Wilson, lessees operating on the upper levels of the Ludwig mine of the Nevada-Douglas Copper Co., will start shipping ore to the Mason Valley smelter in the near future.

The first furnace of the Mason Valley Mines Co.'s new smelter at Thompson was blown in January 6. The smelter has a capacity of 800 tons of ore per day. Construction was started in November 1910, and it is said that almost a million dollars has been expended on the plant. It is expected that of the ore treated, 500 tons will come from the Mason Valley mine.

Mineral County

Unauthenticated reports say that the Tonopah M. Co. has purchased the Aurora property, on which it has held a lease. The same report states that the company is negotiating the purchase of the Lundy mine, situated in Mono county, California.

Nye County

(Special Correspondence.)—It is currently reported that the Montana-Tonopah company has struck a rich vein on the 800-ft. level, the deepest working point. The vein is said to be 6 ft. wide, with 15 in. rich ore. Estimates of the ore range from $80 to $1000 per ton. Rumors credit the discovery as the most important in the history of the property. Officials admit the intersection of good ore. On the 465-ft. level the Triangle vein has widened to about 4 ft. Ore is being stoped from the A. B. K. vein on the 615 and 665-ft. levels. The South, McDonald, and Mizpah Fault veins are also reported to be improving. The Tonopah Extension has recently opened good ore in the western portion of the property. The principal reserves are situated in the eastern section, but development in the extreme western section is progressing vigorously. The North Star company has levied an assessment of 2c. per share to provide funds for additional work. Considerable development work is going on. It is believed the new vein recently opened in the Montana may extend into North Star estate. An option on the unissued stock of the Tonopah Gypsy Queen M. Co. has been taken by San Francisco, Goldfield, and Tonopah capitalists. The property adjoins the Montana on the east and the North Star on the south, and embraces three claims and a fraction. It is reported A. B. Ruggles, president of the San Francisco Stock Exchange, will be selected as president. The Priest mill has been purchased by C. E. Webb, of Philadelphia, and will be operated by the Peak-Steen-Cicala lease on Manhattan Big Four. A recent milling of 1072 tons at the War Eagle plant averaged $24 per ton. The vein is said to be 25 ft. wide on the 300-ft. level, and has been tapped at the 400-ft. point. A tube-mill will be added to the War Eagle plant, increasing its capacity to 70 tons per day. The mill is idle pending repairs. The discovery of commercial coal at Coaldale, 30 miles north of Tonopah, is causing much interest. Two veins have been found, one 11 ft. wide.

Tonopah, January 7.

Storey County

The Ophir company last week produced 387 tons of ore valued at $11,904. Ore in the 2400-ft. level stope has decreased in value, but still is profitable. The sill floor, south drift, 2400-ft. level, was extended 13 ft. and timbered. The south drift, west cross-cut, 2400-ft. level, was extended 16 ft. through ore of low assay-value. The shipments for the week included 346 tons of second-class ore.

The Ophir M. Co. on January 10 declared a dividend of 10c. per share, payable January 25 to stockholders of record on the 15th. The dividend will mean the disbursement of $20,160.

The Mexican mill has resumed operating on 'waste rock'. One shift per day is worked in the mine.

General repairs were made in the Union shaft and the winze used jointly with the Sierra Nevada company.

The southwest drift, 2550-ft. level, of the Con. Virginia was advanced 20 ft. The face is now in vein formation.

Pumping operations were carried on as usual at both the C. & C. and Ward shafts. In addition to repairs at the Ward, a drill-hole was sent 64 ft. from the raise on the 2000-ft. level without finding the old workings. On the 2200-ft. level cutting out ground has been started preparatory to cross-cutting beyond the bulkhead. After present preperations in the Julia winze, a relay blower will be installed to permit exploration in the old workings. Operation will be resumed soon in the Brunswick No. 1 shaft. The east cross-cut, 1200-ft. level, of the Overman, was extended 9 ft. Work was resumed at the Gold Hill mines. The Yellow Jacket mill finished run No. 4, making 520 tons for the week, and one carload of concentrate shipped to the smelter. Repairs were made to the Yellow Jacket shaft. The Belcher resumed work on the 1400-ft. level.

A committee of miners selected from the grand jury to investigate the conditions underground of the Chollar Leasing Co., whose operations were claimed to endanger a school-house, stated that the structure was in no danger, and that the company's maps of the workings were correct. Development of the property, it is reported, will be resumed in the near future.

The De Sabla-Slosson pool, at the Savage stockholders' meeting, January 8, wrested control of the company from the Leonard interests. H. L. Slosson was elected president, W. C. Ralston vice-president, and Whitman Symmes superintendent. The board of directors is composed of A. F. Coffin and W. B. Bannan, of the old directorate, and Messrs. Slosson, Ralston, and C. B. Sessions.

Washoe County

C. E. Mack and George Green, of Reno, will operate the Reno-Mizpah mine in the near future, according to recent newspaper report. They had a judgment for $370 on the property, and bought it for that sum at a creditors' sale.

White Pine County

The Gold King Mining & Milling Co. has been organized to develop 21 claims on Ruby mountain, which were located by Joseph Mayer. August Munter is general manager for the new company, states a report from Ely.

The American Rare Metals Co. has been incorporated at Salt Lake City to develop six tungsten ore claims about 75 miles east of Ely. Jeremiah Nolan is president, J. T. Burns vice-president, and C. L. Olson secretary-treasurer of the company.

Exploration work on the property of the Ely-Nevada Copper Co. was taken up recently under direction of Fred H. Strelbke. Ten men are reported to be employed.

NEW MEXICO

Lincoln County

The Wild Cat Leasing Co. has purchased from the White Oaks company the mill built at the latter company's property at Nogal at a cost of about $100,000. The Wild Cat has started hauling the equipment to White Oaks, where its property is situated.

OREGON

Baker County

A series of lectures on mining geology is to be given at Baker by the mining engineering department of the Oregon Agricultural College, beginning January 29. These will be illustrated with a large number of mineral ore and rock samples and with several hundreds of photographs.

UTAH

Juab County

A new orebody recently was opened on the 300-ft. level of the No. 2 workings of the Colorado mine, state press reports. Work has been resumed in the Richmond & Anaconda mine, which has been idle for about eight years. The operations will be through the Uncle Sam mine. Both properties are being developed by the Uncle Sam Con. M. Co., for which C. C. Griggs is superintendent.

The Eagle & Blue Bell M. Co. has completed preparations for shaft-sinking. Three shifts will be used, and it is ex-

pected that progress will be made at a rate of about 145 ft per month.

The recent discovery on the 1600 ft. level of the Grand Central has been followed for 150 ft. The management will drive still further to develop the ore before raising or sinking.

The power plant at the portal of the Holden adit has been put in operation to supply power to the Centennial Eureka pump, which has been getting power from the Knight company.

TOOELE COUNTY

At a meeting of the stockholders of the Lion Hill Con. M. & M. Co., on January 6, arrangements were made for supplying the company with at least $2000 per month for development expenses for the next 15 months. October 15 was selected as the date for exchanging stock in the company for stock in the Lion Hill Con. Mines Co., which will take over the property together with claims purchased from the Buffalo Con. M. Company.

WASHINGTON

SPOKANE COUNTY

Recent reports state that bills modeled after the Kansas 'Blue Sky' law will be presented to the legislatures of Washington and Oregon at their next sessions. These proposed bills, which are to require all corporations to give detailed and thorough information to the bank commissioner of the State, who will then pass on their legitimacy, will be discussed at the Northwestern Mining Convention, to be held in Spokane, February 15 to 17.

CANADA

BRITISH COLUMBIA

A contract has been let for doing 2000 ft. of development work on the No. 6 cross cut adit of the Slocan Star mine, which it is reported will be on a producing basis by the first of the year.

ONTARIO

A 5-drill compressor and three hoists have been ordered for the Gold Reef property, formerly known as the Clark Syndicate claims, at Porcupine. Sixteen men are employed.

MEXICO

CHIHUAHUA

(Special Correspondence.)—Milling was resumed at the La Republica by the Compania Minera la Republica, S. A., December 1, after a shut-down of four months, and normal production will be resumed in the near future. The shut-down was caused by the floods of the last rainy season.

Chihuahua, December 29.

Arturo Longega has purchased the America, Monte Cristo y Anexas, and Abundancias properties in the Guanacevi district from Antonio Sanchez. The price is reported to have been ₱40,000.

The Rio Tinto smelter has resumed after a shut-down of three weeks. The fire in the Veta Colorada mine has been extinguished with the loss of part of the timbering.

The American Smelters Securities Co. is building an experimental plant at its Tecolotes mill. The plant will be equipped with two Elmore vacuum-process separators, for treating zinc middling.

The Europa M. Co., S. A., has been organized to develop the Europa property, Parral district. The property, which consists of 18 pertenencias, recently was purchased by L. W. Knotts.

The San Cristobal M. Co., Parral district, is considering the erection of a mill. B. V. Gordon, manager for the company, recently was in New York to confer with the directors of the corporation.

HIDALGO

(Special Correspondence.)—In 1905 the properties of the Compañia Real del Monte y Pachuca were acquired by the United States S. R. & M. Co., which operates an extensive list of mines and smelters in the United States. Up to the present the Mexican operations of the company have been confined to the Pachuca and Real del Monte districts. However, in the last few months their engineers have been making examinations in many parts of Mexico. In order to facilitate the work of an energetic campaign of enlargement in the Mexican Republic, offices have been opened in the Mutual Life building, in the heart of Mexico City, for the receipt and consideration of all data regarding mining properties which may be in the market. This office and the field work in Mexico will be directed by Ezequiel Ordoñez, as geologist. The management of the company's interests in Mexico will remain in the hands of C. W. Van Law, the director of the Compañia Real del Monte y Pachuca.

Pachuca, January 5.

SONORA

(Special Correspondence.)—A stampede is in progress to the head of La Cañada and Buboyohui rivers, about 40 miles southeast of Navajoa, Sonora, as a result of the recent rich gold discoveries made in these streams. The gravel is said to average $2.50 per cu. yd., and in many places bedrock dirt has been found that is reputed to be worth from $35 to $40 per cu. yd. Many prospectors are going into the new diggings and are cleaning-up from $10 to $15 per day with a pan. Mining men who have been over the ground are favorably impressed. Coarse gold has been found in the beds of these streams for hundreds of years by the Indians, who make their living picking up gold after every rain. Most of the ground on the La Cañada river has been taken up, but there is still 15 or 20 miles of rich bedrock on the Baboyohui river that can be located. Most of this gravel, it is believed, will average better than 40c. per cu. yd. The conglomerates on each side of the rivers are also rich. There is plenty of water in these streams at the present time for sluicing. The National Place M. Co. of Navajoa, recently organized to work a group of 30 claims on the headwaters of the La Cañada river, is preparing to build a dam in a narrow canyon near the head of the property for the purpose of storing enough water for hydraulic purposes. When this plant is complete, this company intends to handle between 8000 and 10,000 cu. yd. of gravel per day. San Francisco people have secured a group of seven claims joining the property of the National Placer M. Co. on the south, where the Cañada river empties into the Baboyohui river, and have erected gasoline pumps and are meeting with good success. They are handling gravel that averages better than $2 per cubic yard.

Navajoa, January 4.

L. Kelly, formerly with the Calumet & Sonora company, has taken a lease on part of the Cananea-Boston M. Co. property near the Catalina No. 2 shaft. He is erecting a head-frame and hoist, and plans active development. The Cananea-Boston company is concentrating its work on the northwestern part of the property, and has the shaft there down nearly 200 ft., according to recent reports.

Ore assaying about $1000 per ton in gold was discovered a short while ago at the Santa Rosalia. The Corriente placer property, Altar district, has been sold for $125,000 to Californians represented by U. F. Bender, of Tucson, Arizona. On December 6 the Amelia mine, near Noria, reverted to its former owners, the Holt brothers, of Magdalena.

NICARAGUA

According to Frank York of Kentucky, part owner of the Cypress mine in the Pis Pis district, exceptionally rich ore is being mined at that property. The Panama M. Co. is working only 12 hours per day at present, owing to a shortage of men and difficulty in getting wood.

SOUTH AMERICA

According to the Hamburg *Fremdenblatt*, the German Transmarine Electricity Co. of Berlin has concluded a contract with the Argentine Government, or the Petroleum Commission appointed by the latter, whereby almost the whole of the production of petroleum near Comodoro Rivadavia, in the south of the Argentine Republic, will devolve upon the company.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

H. S. Gale is in San Francisco.

S. C. Herold, of Tonopah, is in town.

F. L. Sizer has returned from Montana.

W. H. Storms has gone to Los Angeles.

C. W. Purington has been in St. Petersburg.

John B. Farish was in San Francisco recently.

B. C. Austin, of British Columbia, is at the St. Francis hotel.

J. F. Kemp was at Butte recently and has returned to New York.

Courtenay De Kalb was in San Francisco and has gone to Oregon.

James F. Park is superintendent at the Plymouth mine in California.

William Knox will be in San Francisco January 25 on his way to Siberia.

Charles C. Moore and Curtis H. Lindley have gone to Washington, D. C.

Walter W. Bradley has been appointed librarian at the State Mining Bureau.

E. K. Soper, of Minneapolis, Minnesota, was in San Francisco for Christmas.

Frederick Hellman, who lately returned to New York from Europe, is in the West.

Fred T. Williams has returned to Park City, Utah, from New York and Washington.

M. N. Short, formerly of Natoma, California, is at Santa Barbara, Chihuahua, Mexico.

Karl P. Swensen has been visiting mines in Japan, but will return to Nanking, China.

H. A. Morrison is assistant manager for the Uwarra Mines Co., at Candor, North Carolina.

I. Rogovin has resigned his position as editor of *Gold and Platinum* to resume private practice.

E. L. Lepper is doing field work in Eldorado county in the employ of W. J. Seaborn, of Berkeley.

R. E. Smith and D'Arcy Weatherbe are examining platinum placers near Ekaterinburg, Russia.

Gelasio Caetani is in British Columbia, and expects to return to San Francisco at the end of the month.

George E. Collins will leave New York January 13 on the *Oceanic* for a short business trip to London.

H. Kenyon Burch spent the holidays with his family at Los Angeles. He has returned to Globe, Arizona.

F. G. Lasier will be at Cripple Creek and Salt Lake City in January, returning to Detroit about February 15.

Sydney L. Shonts will make San Francisco his headquarters hereafter. His address is 1418 Larkin street.

Henry F. Lefevre has returned to New York from Central America, and will remain there until the latter part of February.

F. M. Freeborn has returned from Mexico to engage in practice as consulting metallurgist, with offices at Alhambra, Los Angeles.

H. C. Wilmot sailed on the *Manchuria* for the Philippines, where he will be engaged in professional work for several months.

C. B. Whitwell has opened an engineering office at Marysville, California, under the name of the Whitwell Engineering Company.

W. H. Yeandle has been transferred from the position of assistant general superintendent of the mining department of the Cia. Real del Monte y Pachuca, and is now connected with the exploration department of the United States S. R. & M. Co., rooms 411 and 412, Mutual Life building, Mexico City.

Market Reports

LOCAL METAL PRICES.

San Francisco January 11.

Antimony	11—11½c	Quicksilver (flask)	43.50
Electrolytic Copper	15—16¼c	Tin	47—48¼c
Pig Lead	4.70—5.65c	Spelter	7¼—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

COPPER SHARES—BOSTON.

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, Jan. 11.		Closing Prices Jan. 11
Adventure	6	Mohawk	$ 57
Allouez	42½	North Butte	27½
Calumet & Arizona	62	Old Dominion	46½
Calumet & Hecla	440	Osceola	108
Centennial	17	Parrot	14
Copper Range	54½	Shannon	10
Daly West	5½	Superior & Boston	4½
Franklin	11⅛	Tamarack	30
Granby	36½	Trinity	5½
Greene Cananea, ctf.	8½	Utah Con	16½
Isle-Royale	21½	Victoria	4⅜
La Salle	5½	Winona	5¼
Mass Copper	8½	Wolverine	100

NEVADA STOCKS.

(By courtesy of San Francisco Stock Exchange.)

San Francisco, January 11.

Atlanta	$ .19	Mayflower	$ .02
Belcher	.55	Mexican	4.15
Belmont	8.00	Midway	.21
B. & B.	.18	Montana-Tonopah	1 07
Booth	.06	Nevada Hills	2.37
Chollar	.15	Ophir	1.60
Combination Fraction	.13	Pittsburg Silver Peak	1.32
Con. Virgina	.91	Round Mountain	.54
Florence	.61	Savage	.18
Goldfield Con.	4.25	Tonopah Extension	1.15
Gould & Curry	.06	Tonopah of Nevada	6 95
Jim Butler	.34	Union	1.15
Jumbo Extension	.23	Vernal	.16
MacNamara	.26	West End	.75

METAL PRICES.

(By wire from New York.)

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Dec. 28	14.03	4.45	6.30	54⅜
" 29	14.03	4.45	6.30	54⅜
" 30	14.03	4.45	6.30	54⅛
" 31	Sunday.	No market.		
Jan. 1	Holiday.	No market.		
" 2	14.05	4.45	6.13	54⅜
" 3	14.05	4.45	6.13	54⅜
" 4	14.07	4.45	6.37	54⅞
" 5	14.12	4.45	6.37	55
" 6	14.12	4.45	6.40	55
" 7	Sunday.	Nu market.		
" 8	14.25	4.45	6.45	55
" 9	14.30	4.45	6.47	55
" 10	14.25	4.45	6.47	54⅞

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. Jan. 11.		Closing Prices. Jan. 11.
Amalgamated Copper	$ 65¼	La Rose	$ 3⅜
A. S. & R. Co.	71⅛	Mason Valley	11¾
Braden Copper	4¾	Miami Copper	24⅛
B. C. Copper Co.	4⅜	Mines Co. of America	3¼
Butte Coalition	22¾	Nevada Con	19⅜
Chino	26	Nevada Utah	⅛
Davis Daly	¾	Nipissing	6⅜
Dobie	¾	Ohio Copper	1
Dolores	4	Ray Central	1⅛
First National	2¾	Ray Con	18⅜
Foley O'Brien	⅜	South Utah	⅜
Giroux	4½	Superior & Pittsburg	16
Goldfield Con.	4½	Tenn. Copper	38
Greene-Cananea	8½	Trinity	6⅜
Guanajuato Con.	⅜	Tuolumne Copper	3½
Hollinger	12¾	United Copper	11½
Inspiration	10½	Utah Copper	56⅜
Kerr Lake	2¾	Yukon Gold	3¾

Report of the Oriental Consolidated Mining Company for 1910-11

The report of this company for the year ended June 30, 1911, is replete with interesting detail. The main features are summarized in the table below. The profits were greater than for any preceding year, and despite the large amount of ore treated, the reserve has been increased in all the mines except the Chintui, and Kuk San Dong. The company, it will be remembered, owns a concession covering 600 square miles in the Wunsan district of Korea and has opened a number of mines besides maintaining necessitated minor readjustments in the affairs of the company and has involved the management in some anxiety though Mr. Perkins apparently is satisfied with the prospects of a satisfactory outcome. He says truly, and appropriately: "The company's officers are quite in sympathy with the Government officials in their desire to protect the forests of the country; the use of timber and wood is of vital necessity if the mines are to be operated. In view of the friendly attitude heretofore of the Japanese au-

MINING OPERATIONS FISCAL YEAR JULY 1, 1910, TO JULY 1, 1911. ALL VALUES IN U. S. GOLD.

Name of Mine.	Tons Ore Mined.	Total Value Ore.	Value Ore Per Ton.	Bullion Secured.	Bullion Secured Per Ton.	Tons Concentrate Saved.	Gross Value Concentrate Saved.	Value per Ton.
Tabowie.....	121,257	$614,603.17	$5.07	$273,318.36	$2.26	11,335	$283,958.32	$2.34
Taracol.....	85,062	418,874.14	4.93	195,321.71	2.30	8,886	189,276.94	2.22
Chintui	29,637	148,695.87	5.02	69,094.22	2.33	2,940	67,550.74	2.28
K. S. D. North..	28,659	88,573.17	3.09	52,876.13	1.85	2,937	27,522.07	.96
K. S. D. South..	29,734	75,507.92	2.54	44,787.09	1.51	2,564	23,610.68	.79
Charabowie.....	39,610	332,122.28	8.38	208,213.72	5.25	897	75,865.75	1.91
Candlestick	8,997	98,094.20	10.90	73,258.24	8.14	7,294	23,032.13	2.56
Total.....	342,956	$1,776,470.75	$5.17	$916,870.02	$2 67	36,343	$690,511.63	2.01
Tribute Mines..	..	..	..	..	..	..	..	..
Taracol	1,141	11,157.95	9.77	4,861.07	4.26	235	5,368.59	4.70
Total.....	344,097	$1,787,628.70	$5.19	$921,731.09	$2.68	36,578	$695,880.22	2.02

Name of Mine.	Net Yield Concentrate	Net Yield per Ton.	Net Total Yield.	Total Yield per Ton.	Per Cent. Free Milling	Per Cent. Gross Saving	Per Cent. Net Saving	Value Mill Tails Per Ton.	Cost of Mining.	Cost of Mining per Ton.	Gross Loss in Tailings.
Tabowie.	$245,321.17	$2.02	$518,640.03	$4.28	44.5	90.6	84.4	$0.47	$153,447.62½	$1.26	$57,380.99
Taracol.....	165,789.62	1.95	361,111.33	4.25	46.7	91.8	86.3	.40	135,668.96	1.59	34,275.49
Chintui.....	57,993.31	1.97	127,087.53	4.30	46.5	91.9	85.4	.41	41,898.97	1.41	12,050.91
K. S. D. North..	18,437.78	.64	71,313.96	2.49	59.7	90.8	80.5	.28	20,814.36½	.72	8,174 92
K. S. D. South	15,756.28	.53	60,543.37	2 04	59.3	90.6	80.2	.24	19,503.05	.65	7,110.15
Charabowie.	62,042.21	1.56	270,255.93	6.81	62.7	85.4	81.4	1.22	70,052.44	1.77	48,342.81
Candlestick.....	12,556.04	1.40	85,814.23	9.54	74.7	98.2	87.5	.20	43,166.24½	4.80	1,803.83
Total.....	$577,896.41	$1.69	$1,494,766.48	$4.36	51.6	90.5	84.1	$0.49	$484,551 65½	$1.41	$169,089.10
Tribute Mines ..	..	..	..	..	..	..	..	..	..	..	..
Taracol.....	4,101.11	3.59	8,962.18	7.85	43.5	91.6	80.2	.81	..	..	928.29
Total.	$581,997.52	$1.69	$1,503,728.61	$4 37	51.6	90.5	84.1	$0.49	$484,551.65½	$1.41	$170,017.39

towns, local railroads, and other incidental enterprises. It is the largest business organization in Korea, and prior to establishment of Americans in the Philippines was the principal American outpost in the Far East. In all, 2,598,812 tons, valued at $15,954,358, have been mined and treated.

Dividends for the year under review totaled $644,085, and the surplus at the close was $561,146. The total ore reserve is estimated by the general manager, Alf. Welhaven, at $802,280, valued at $3,854,770, and a force of native prospectors is kept steadily at work in the effort to develop additional mines. The president of the company, H. C. Perkins, notes that a settlement of disputed questions regarding wood and water rights has been reached on the basis of the company paying 25,000 yen per year as a reforestation tax. Evidently the transfer of authority from native hands to the Japanese Government has thorities, I am confident that some method will be found which, while protecting the forests as far as possible, will enable the company to pursue its operations without being called upon to submit to harassing regulations or unduly onerous taxation. The position of the Oriental Consolidated Mining Co. is exceptional—it is the pioneer in successful working of the low-grade mines in the Far East. Its enterprise was undertaken in the belief that the existing government regulations would not be essentially changed to its detriment. It has established an organization that is an excellent mining school for the people of the country, and has set an example of honest and successful mining practice that is attracting capital to Korea. In view of these circumstances, I have confidence that we will receive every proper consideration from the Governors of the country in adjusting the wood and other problems that may come up."

Among the Copper Mines

Since 1900, it is said, the world production of copper has increased 73% and the consumption 77 per cent.

The Mohawk M. Co., Keweenaw county, Michigan, with copper selling at 14c., may increase the dividends to $2 per year, according to late reports. It has been paying $1.50 with copper at 12½ cents.

The Chino Copper Co., Grant county, New Mexico, over a period of four weeks through one section of the mill, recently treated an average of 850 tons of ore per day. The yield averaged 66% from oxidized surface ore assaying 2.75 to 3% copper, the ore coming from the Whim Hill part of its holdings.

D. C. Jackling recently stated, after a personal inspection, that the Chino is producing 1,000,000 lb. of copper per month with one section of the mill in operation. The yield is 40 lb. of copper per ton of ore, which is oxidized as the workings so far are near the surface. He stated that the December production of the Ray Con. Copper Co. would be about the same as the November production, 2,650,000 lb. of copper.

Boston reports are to the effect that supposed representatives of the General Development Co., controlled by the Lewisohns, have secured further extension of option on the South Side, Dacotah, Naumkeag, and Montezuma properties, just west of Houghton, Michigan. It is believed the properties will be taken over by a new corporation already organized, in which only the underwriting remains to be done.

The North Butte M. Co., while going through the Butte 'lean streak,' has maintained a production of 2,000,000 lb. of copper per month, and dividends of $1.20 per share per year, even with copper at 12c. The company recently opened a body of high-grade ore on one of its northern claims, from which it is shipping 150 tons per day, and has good ore on the 2600 and 2800-ft. levels, from which it hopes soon to accomplish an increase in production and earnings.

The December output of the Miami Copper Co., Gila county, Arizona, amounted to nearly 3400 tons of concentrate which should yield over 2,580,000 lb. of refined copper. Five units of the concentrator have been in operation since December 1, and the sixth and last unit is expected to be running by February 1. The ore milled during December averaged 2.6% copper, and the daily tonnage now being handled is about 2500, of which about 12% comes from the dump, 35% from square-set and sub-level caving operations, 35% from development, and the rest from shrinkage stopes. At the east side of the mine, ore is being mined by square-sets and sub-level caving, and in the northwest part by shrinkage stopes, there being in this part of the mine an available tonnage of 2,740,000. The total developed tonnage above the 420-ft., or first tramming level, is over 9,000,000 tons. Development keeps pace with mining, averaging 4000 ft. per month. The cross-cut from the main shaft, on the 570-ft., or second tramming level, is in 475 ft. and has 250 ft. more to go to reach the orebody. The equipment of the pumping station at Burch now consists of two Aldrich triplex pumps, each driven by a 400-hp. motor, and having a capacity of 1600 gal. per minute. An air-compressor has recently been installed to furnish air for air-lift pumping in testing some wells in the vicinity of the pumping station, one of which is now flowing at the rate of 250 gal. per minute and is increasing. The total number of men employed is over 700, of whom 370 are employed underground, 120 in the mill, and the rest in the power-house and shops. B. B. Gottsberger is general manager, N. O. Lawton mine superintendent, and F. W. Solomon, mill superintendent.

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

THE MINING INDUSTRY OF MEXICO. Compiled and edited by F. Gonzalez, A. Grothe, and L. Salazar S. No. 2, State of Hidalgo, Part II. Pp. 108. Maps and plans. Mexico, 1911. For sale by *Mining and Scientific Press*. Price, $1 postpaid.

This is a continuation of the comprehensive work on Mexican mines and mining of which the first number has been noticed already. It maintains the high standard set by the opening number, and contains accounts of mines at Pachuca, Zimapán, and Jacala.

EXPERIMENTAL ENGINEERING, AND MANUAL FOR TESTING. By R. C. Carpenter and Herman Diederichs. Pp. 1132. Ill. John Wiley & Sons, New York, 1911. For sale by *Mining and Scientific Press*. Price, $6.

This is the seventh edition of a standard work and contains much that is new. Indeed, the whole book has been thoroughly revised and rewritten and is now up to date in every particular. To mechanical engineers the book has long been favorably known, but mining engineers have not profited as much by it as they might have done. To them it may be stated that it covers in a broad way the underlying principles and the methods of testing materials and machines in general engineering. Exclusively metallurgical, electrical, and like problems are not touched, but the field covered includes problems of the use of fuel, lubricants, structural materials, power generators, and a wide variety of special engines. The mining engineer is often called up to work alone and must be prepared always to understand and often to make the simpler tests of the sort mentioned. To him, therefore, the book will be extremely valuable for reference at the same time that for mechanical engineers it is a text.

THE AUTOBIOGRAPHY OF JOHN FRITZ. Pp. 326. Illustrated. John Wiley & Sons, New York, 1912. For sale by *Mining and Scientific Press*. Price, $2.

This is one of the most interesting and delightful stories of achievement that has been given the public in a long time. To write an interesting biography, it has been said, one must have an experiencing nature. He must be of the class to whom all happenings are events and most events are adventures. Surely no class of men have more material at hand for making good autobiographies than have engineers, and yet too few of them have written of their lives for other people. Probably it is because the unusual becomes usual to them and they lose the sense of novelty. Fortunate indeed is the man who hangs on to the spirit of youth and sees always with the eager interest of a boy, however much he may estimate as a man. John Fritz is one of these fortunate ones, and a wide circle of admirers are fortunate in that his intimate friends have persuaded him to write and make public this story of his life. It is a plain story of a simple, rugged, self-made American. Of one who, fortunate in his time and place, had a hand in the doing of great things in the iron and steel industry. We shall not spoil the story by quoting, and the 'Father of the Iron Industry' is so well known that the outlines of his life are already of record. What is given now conveys the flavor of the man himself. It is characteristic, after all, that he should 'have the fun' of doing this himself instead of depending on a Boswell after death. It is as when he revoked the provision in his will leaving money for the building of an engineering laboratory for Lehigh University, and then pitched in and built an excellent laboratory almost with his own hands. John Fritz, the self-made man, it may be noted, was ever the staunch friend of education, and his services to that cause are not the least among his services to his fellow men. Here's to him, may he live long and prosper, and may there be many more like him!

Decisions Relating to Mining

Specially reported for the Mining and Scientific Press.

Injury to Miner—Contributory Negligence and Assumption of Risk

A miner accepting employment in a coal mine assumes all the risk incident to such employment—such risks as naturally arise out of, or were necessarily connected with, such employment. It is the duty of a miner to exercise ordinary care for his own safety, and not knowingly to expose himself to unnecessary risks or dangers connected with the employment. But a miner is not guilty of contributory negligence for continuing to work in a mine or entry where the roof is not propped, where on request the operator of the mine has promised to furnish, and is required on application to furnish, props with which to prop and support the roof. In such case the miner may continue the work of mining for a reasonable length of time, unless the place is obviously unsafe. But in all such cases the question of contributory negligence is one of fact to be determined on all the evidence in the case.

Kentucky Block Cannel Coal Co. *v.* Davis, (Kentucky) 128 Southwestern, 888. June 1910.

Construction of Mining Lease

While a lease of land for the specific purpose of taking phosphate rock of a specified character and volume therefrom did not expressly covenant that such rock actually existed in the land, and while the lessee did not covenant to actually find such rock in the land, yet the contract contemplated the existence of such rock and a search therefor by the lessee, and there was an implied obligation upon the part of the lessee to make due and reasonable effort to find upon or in the land, rock of the quantity and quality specified. But what constitutes a due and reasonable effort to find the rock depends upon the fair and just requirements of the enterprise, to be determined as a fact by the application of practical knowledge and experience. A failure upon proper endeavor to find such rock was held to be a good defense in an action to recover the royalties, provided for in such lease, in the absence of an agreement to the contrary, and this was true notwithstanding the lease made provision for a minimum royalty in gross whether the mining was carried on or not, as such provision related to a failure to mine and not to a failure to find specified rock.

Hiller *v.* Walter Ry. Co., (Florida) 52 Southwestern, 623. June 1910.

Injury to Miner—Insufficient Inspection

A driver in a coal mine notified the inspector of a defective and dangerous place in the roof. The inspector thereupon directed a roof-man to go to the place and remove any slate or rock that was likely to fall, and pursuant to such direction the roof-man, with the assistance of the driver, made an inspection of the roof and removed the rock which from such inspection appeared to be dangerous. Notwithstanding such inspection and removal of dangerous rock, early on the following morning, without any intervening cause, slate fell from this particular place and struck and killed the driver. In an action for damage for his death it was held that the statement of the inspector concerning the inspection and the removal of the rock could not be accepted as conclusive of the fact that the mine owner, a corporation, had fully discharged its duty to keep the mine in a reasonably safe condition. If proof of such an inspection were conclusive, then in all like cases the master would be absolved from liability if he can prove that the place or appliance was examined and inspected shortly before the injury and found to be reasonably safe for the use of the servant. Especially would this be true where there is no evidence to show that the inspection was not made, or to contradict the evidence as to the extent or degree of care in making the inspection. If this were the law then, when a servant is injured or killed by a defective appliance or an unsafe place, the master would be freed from liability by the uncontradicted evidence that an inspection had been made and that no change had taken place between the time of inspection and the accident. On the contrary, the jury may be authorized to believe from the physical facts shown in evidence that, as the roof fell soon after the inspection, a proper and careful inspection was not made, or, in other words, that the master did not exercise ordinary care to put and keep the place in reasonably safe condition.

Huddleston *v.* Straight Creek Coal Co., (Kentucky) 128 Southwestern, 589. June 1910.

Montana Gold and Silver Production

Gold and silver bullion to the amount of $143,979 was received at the Government assay office at Helena, Montana, during December, according to the December report of T. B. Miller, assayer in charge. Of the above amount $143,106 was received from the Montana counties, each county contributing as follows: Beaverhead, $66; Broadwater, $270; Chouteau, $39,743; Deer Lodge, $283; Fergus, $20,222; Granite, $1672; Jefferson, $171; Lewis and Clark, $6048; Lincoln, $78; Madison, $70,031; Missoula, $1577; Park, $55; Powell, $369; and Silverbow, $2504.

California Oil Dividends

During the month of December 1911 dividends paid on California oil stocks amounted to $820,070. The largest single dividend paid was by the Union Oil Co., the amount being $183,387. Of this sum, $139,218 was repaid to shareholders by the United Petroleum and the Union Provident. The Union's dividends have reached a total of $9,907,192. The totals of the United Petroleum and Union Provident were $3,139,896. Of the December dividends, $134,500 was English money paid to the Imperial, Gypsy, and Mountain Girl, which were sold to British capitalists. The following is the table of dividends:

Company.	Rate.	Amount.
Amalgamated	$1.00	$50,000.00
*Buick	0.04	127,252.16
Caribou	0.025	8,070.30
Central	0.015	15,400.00
Claremont	0.015	7,500.00
Columbia	0.01	9,992.26
Euclid	0.005	1,750.00
Four	0.01	3,000,00
Fullerton	0.05	30,000.00
Gypsy	0.10	50,000.00
Home	0.01	7,500.00
Homestake	0.01	1,000.00
Imperial	0.006	60,000.00
Mascot	0.01	5,000.00
Monte Cristo	0.05	25,000.00
*Mount Diablo	0.02	10,000.00
Mountain Girl	0.07	24,500.00
New Pennsylvania	0.015	2,500.00
Paraffine	0.01	3,000.00
Rice Ranch	0.01	3,000.00
Sauer Dough	0.02	4,000.00
Section 25	0.25	10,000.00
*State Consolidated	0.005	5,000.00
Traders	0.006	9,000.00
Union	0.006	183,387.60
Union Provident	0.006	90,767.93
United Petroleum	0.006	48,450.60
Western Union	0.005	10,000.00
W. K.	0.03	15,000.00
Total, California companies	....	$820,070.85
Mexican Petroleum, Ltd., pfd	0.002-3	80,000.00
Grand total		$900,070.85

*Unlisted.

Catalogues Received

AMERICAN SPIRAL PIPE WORKS, P. O. Box 485, Chicago. 'Lap Welded Steel Pipe.' 32 pages. Illustrated. 8 by 10 inches.

INGERSOLL-RAND CO., 11 Broadway, New York. Form 4108, 'B-104, Sergeant Rock Drill.' 4 pages. Illustrated. 6 by 9 inches.

GENERAL CHEMICAL CO., 25 Broad street, New York. 'The New Herreshoff Furnace.' Bulletin No. 2. 12 pages. Illustrated. 7 by 10 inches.

ELECTRIC WEIGHING CO., 183 Thirteenth avenue, New York. Bulletin describing the 'Electric Weigher,' for recording the weight of material flowing over conveyors.

THE WEBSTER MFG. CO., Tiffin, Ohio. 'Webster Method,' November issue. 26 pages. Illustrated. 6 by 9 in. Describing installations of conveying equipment made by this company.

THE ALEXANDER MILBURN CO., Baltimore, Md. 'The Milburn Light.' 48 pages. Illustrated. 6½ by 9¼ in. The Milburn acetylene light for mines, quarries, steam-shovels, search lights, etc., with full details and prices.

NEW YORK ENGINEERING CO., 2 Rector street, New York. 'Empire Gold Dredges.' 68 pages. Illustrated. 6½ by 10 in. A handsome catalogue giving full information about the Empire dredge, the Empire prospecting drill, and the Empire mechanical tailing elevator.

KEYSTONE PLACER DRILL CO., Beaver Falls, Pennsylvania. 'The Rescue of Joseph Clary.' An interesting booklet telling of the rescue of a miner from a mine near Joplin, Missouri, where a Keystone drill was used to find him and to furnish food, etc., until he was rescued.

ROBINS CONVEYING BELT CO., Park Row building, New York. Bulletin No. 47. 80 pages. Illustrated. 6 by 9 in. A description of typical ore and material handling plants in large mining and smelting operations, in which the use of conveying machinery has reduced operating costs.

ALLIS-CHALMERS CO., Milwaukee, Wis. Bulletins No. 1523, 'Portable and Stationary Air Compressors'; No. 1524, 'Price List of Repair Parts for Auxiliary Air Brake Apparatus'; No. 1625, 'The Hydro-Electric Development of the Great Northern Power Co.'; No. 1800, 'The Richards-Janney Classified.' All 8 by 10½ in. Illustrated.

SULLIVAN MACHINERY CO., Peoples Gas building, Chicago. 'Mine and Quarry,' for November. The leading articles in this issue comprise the following: 'Mining Slate in Maine,' 'Michigan Coal Mining Problems,' 'Hoisting Economy for Shallow Mines,' 'Diamond-Drilling in Mexico,' and 'Portable Rock-Drills on the Havana Sewer.'

CARNEGIE STEEL CO., Pittsburg, Pennsylvania. 'Shape Book.' Fourth Edition. 256 pages. Illustrated. 5 by 8 in. This valuable book is beautifully published with flexible leather cover, gilt edges. It contains profiles, tables, and data appertaining to the shapes, plates, bars, rails, and track accessories manufactured by Carnegie Steel Co. It should be in the library of every engineer.

ALLIS-CHALMERS CO., Milwaukee, Wisconsin. Revised index of this company's publications in force October 1, 1911. Also Bulletins No. 1074, 'Direct Current Motors and Generators'; No. 1075, 'Belted Alternating Current Generators'; No. 1077, 'Lighting Transformers'; No. 1078, 'Alternating Current Generators'; No. 1082, 'Engine Driven Direct Current Generators'; No. 1083, 'Direct Current Motors and Generators'; No. 1211, 'Feeders for Roller Mills'; No. 1519, 'Barometric Condensers'; and No. 1721, 'Trimmers, Slashers, and Cut-Off Saws.' All illustrated. 8 by 10 inches.

THE DEANE STEAM PUMP CO., 115 Broadway, New York. Bulletin D 205, 'Triplex Power Pumps.' 32 pages. Illustrated. 6 by 9 inches. An extensive discussion of the construction of its triplex power pumps of the vertical, double-acting type. It explains the advantages of the triplex machine over other forms of power pumps. The analyzed dissection of the pump, pointing out the features of design that are the outcome of this company's forty years specialization in the building of power pumping machinery, will be found of particular interest. The simplicity, durability, accessibility, and solidity of the Deane triplex power pump are points that are specially emphasized. The pumps listed range in size of cylinders from 2 by 3 in. to 12 by 13 in., and in capacities from 11½ to 2475 gal. per minute. Some nine different styles of these pumps are illustrated and tables of dimensions, capacities, speeds, etc., are given of each. The pumps are arranged for belt or gear drive from any power source.

Commercial Paragraphs

The Salt Lake office of the SULLIVAN MACHINERY CO. has been moved from the Dooly building to the Kearns building. M. G. Doll is local manager.

THE MINE & SMELTER SUPPLY CO. has been appointed sole agent for the sale of the patented Paterson agitation tanks in the Republic of Mexico.

The OLIVER CONTINUOUS FILTER CO. reports the shipment of two 75-ton steel-tank filters to the Amparo Mining Co., Etzatlan, Jalisco, Mexico.

THE BRODERICK & BASCOM ROPE CO., of St. Louis, reports the sale of two more yellow strand ballast cables to the Government for Panama, repeating former order.

W. D. Hawkins, formerly of the Hill-Hawkins Boiler & Tank Works, is now connected with the tank department of THE KENNICOTT CO., with headquarters in the Corn Exchange Bank building, Chicago, Illinois.

ALBERT BURCH, GELASIO CAETANI, and OSCAR H. HERSHEY have joined in a firm for general practice in mining engineering, ore dressing, and economic geology, and will maintain offices in the Crocker building, San Francisco, California.

By reason of the death of A. J. Bettles the assay office and laboratory of Bettles & Bardwell, at Salt Lake City, Utah, has passed to the ownership and control of A. F. BARDWELL, who as the junior partner was in charge of the business during the past four years.

THE AMERICAN DIRECT CONCENTRATOR CO., Salt Lake City, Utah, has received an order from the Federal Mining & Smelting Co. for 128 concentrating tubes to be installed at the latter's Morning mill, Mullan, Idaho, where 119 similar tubes have been in use since May 1911.

Among the recent installations made by the AMERICAN SPIRAL PIPE WORKS, of Chicago, is that of a 60-carload shipment of 30 to 34-in. lap-welded steel pipe for the Spearfish hydro-electric plant of the Homestake Mining Co., Lead, South Dakota. The pressure on this line is approximately 3000 lb. per square inch. A portion of the line is equipped with forged-steel bolted-joint connections, the remainder with forged-steel flanges.

A BUREAU OF ASSOCIATED GEOLOGICAL ENGINEERS has been formed under the auspices of M. L. Fuller and F. G. Clapp. Offices will be maintained at 131 State street, Boston, Massachusetts, and 331 Fourth avenue, Pittsburg, Pennsylvania. Geological examinations along engineering lines will be undertaken and analyses and tests made. The new firm expects especially to handle problems relating to oil and gas, water supplies, bridge and dam foundations, coal, cement, and ore deposits.

Weadon & Rockfield, who have been representing the JEFFREY MFG. CO. for a number of years in the southern part of California, south of Bakersfield, and in the western portion of Arizona, have changed the name of their concern to the California Machinery & Equipment Co. They will specialize in designing and equipping alfalfa milling plants, portable track, contractors' equipment, as well as elevating, conveying, and power transmission machinery, brick and cement machinery, and placer mining plants.

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TABLE OF CONTENTS

EDITORIAL

EXPORTS of iron and steel manufactures from the United States in 1911 amounted to $250,000,000, according to figures furnished by the Department of Commerce and Labor at Washington. The United States ranks third, being exceeded by Great Britain and Germany.

ANNUAL meetings of two of the engineering societies were held in New York last week, those of the American Society of Engineering Contractors and the Mining and Metallurgical Society of America. Both are among the younger organizations, but both are vigorous and helpful.

SPOKANE is making preparations for a large attendance at the Northwest Mining Convention to be held in that city February 15, 16, and 17. Delegates are invited from British Columbia and the Northwestern States, and matters relating to mining on the public domain, water-power development, and similar topics will be discussed.

ANNOUNCEMENT is made of the formation of the Inspiration Consolidated Copper Company to combine the present Inspiration Copper Company and the Live Oak Development Company. The new company is to have a capital of 1,500,000 shares having a par value of $20 each, and there is to be a $6,000,000 bond issue. Stock is to be exchanged on the basis of one share of the new stock for two shares of the present Inspiration, and two shares of the new for one of Live Oak. This consolidation has been previously announced, but only now are details available. The merging of the two companies brings together two adjacent properties of merit and is in the interest of economy and efficiency in operation.

GOLD in sea-water has been the basis for flotation of more than one unprofitable venture, and yet, as Mr. Coghill shows in another column, figures as to the amount of gold present are none too plentiful or certain. Mr. Henry S. Blackmore, in *Cassier's Magazine* for January, discusses the evidence upon which conclusions as to its presence have been based and also the engineering problems concerned in its recovery. Wisely he assumes no responsibility for the estimates of the amount available, and in view of the scientific importance of the question and the meagerness of the data now available, it would seem appropriate that a thorough re-study of the subject be undertaken by the Geophysical Laboratory, the Geological Survey, or some similar institution.

THE second annual meeting of the president and trustees of the American Museum of Safety, held in New York this week, was made the occasion for public award of three gold medals. The first, the Travellers Insurance Company medal, went to the Pennsylvania Railway Company, it being adjudged to be "the American employer who has done the most for the protection of lives and limbs of its workmen, by means of safety devices for dangerous machines and processes." The second, the Scientific American medal, was awarded to the Norton Company of Worcester, Massachusetts, for the most efficient safety device invented during the last three years and exhibited at the Museum. The Louis Livingston Seaman medal is given for

progress and achievement in the promotion of hygiene and sanitation and the mitigation of occupational disease. The name of the winner was not announced in advance. The American Museum of Safety maintains a permanent exposition on the sixth floor of the United Engineering building, 29 West Thirty-Ninth street, New York. It is well worth a visit and the society itself is deserving of general support.

CORRECT use of proper names is the cause of much effort to those who are at pains to be precise. The rule is simple, a name should be given exactly as written by the owner, but its application to foreign names involves phonetic difficulties and many an American of foreign descent has perforce modified either the pronunciation or the spelling of his name to adapt it to the Anglo-Saxon eye and tongue. Geographic names often present so much difficulty that the attempt is frankly abandoned and an English name applied that little more than approximates the native word, such as Vienna, Moscow, and Peking. Use establishes these as the correct English names. It is the more remarkable, therefore, that many well informed people have been led into referring to Korea as *Chosen*. Korea originally had two names, one applying more particularly to the northern part, the other to the southern, the latter being recognized by the natives as properly applying to the whole country. Korea, derived from a French attempt to reproduce the name of the northern part has, through use in gazetteers and atlases, become established as the English name for the country, and the fact that the Japanese Government, upon taking over the Korean Government in 1910, officially endorsed the name *Chosen* (the Japanese rendering of the name of the southern part) does not affect English usage. If we attempt at this late date to revise our atlases Japan must appear as *Nippon*, China as *Chung-kuo*, Formosa as *Tai-wan*, and so on *ad infinitum et confusionem*. To refer to Korea as *Chosen*, is therefore, the reverse of evidence of erudition.

COMPETITIVE railroad building is a feature of contemporaneous development in Central Africa, as it was a quarter of a century ago in America. There is the difference that in Africa the lines are backed by various governments and are planned with a view to political as well as commercial strategy. In many cases they will probably not pay for a number of years but the majority, just as in America, may be expected in time to stimulate a traffic that will permit some return on the investment. How seriously development is handicapped at present is illustrated by the fact that tin concentrate from Nigeria must face a $125 per ton rate for transportation to the furnaces in England. Mr. S. H. Ball, in his account of present conditions in the Congo country, shows how intimately railway expansion is related to mineral development. In our Rhodesian and London letters further data on the mines of this far away region are given. Evidently there are considerable bodies of ore of a grade that would be considered rich elsewhere, and evidently also transportation is being provided more rapidly than is generally recognized. The expansion of the English railway lines in Africa has been watched with much interest in America, but the speed with which the Portuguese, Germans, and Belgians are building, is less generally known. Engineers returning from Benguella report that the tedious work of crossing the sea-coast swamps and mounting to the plateau has been accomplished. From the present terminus the way to the copper country is long but not difficult. In German East Africa the rails have penetrated almost to Tabora, a station on the great north-south telegraph line, and from there to Lake Tanganyika it will be a race with the Belgians building to Lukuga. Another German line has reached Mount Kilimanjaro, on the way to Lake Victoria Nyanza. In the Congo proper, tracks are being extended rapidly. Mr. Ball's statement that within three years it should be possible to go from London to Cape Town by way of Boma and the Katanga country, will come as a surprise to many. It would be pleasant to signalize the establishment of connections by an international engineering excursion over the route.

China in Transformation

The most important item of news which has appeared during the progress of the revolution in China is the report, early in the week, by the *Times* correspondent in Peking that the abdication of the Manchu dynasty is about to take place, and will be preceded by an edict establishing a republican form of government. Presumably the Manchu court will be liberally pensioned, and retire to Jehol (pronounced 'ro-her'), where there is an Imperial residence. We have earlier discussed the cause of the revolution, but have abstained from comment on its progress, as authentic information has been scanty. British journals generally have shown a commendable insight into the situation, but their American contemporaries have been led by their desire for sensational news into the publication of inaccuracies and misstatements, for the revolution has not been sensational in character, except in its significance. The statements in French journals have been similar to those in America. But Japanese comment is most striking for its naivete. The Tokyo *Yorodzu* argues that nations, like business firms, do not "advance by neglecting opportunities," and in the *Gaiko-jiho*, Dr. Ariga, a Japanese authority on international law, urges the Japanese Government to intervene, with the object of securing in the future some advantage for Japan. Russian comment evidences a similar feeling in that country, but the obvious undesirability of foreign intervention has enabled the United States and the European powers to restrain these nations from precipitate action.

It must not be forgotten that China's foreign loans amount to about $750,000,000 (representing an interest charge of $37,500,000 yearly), of which very little is held by either Russia or Japan, both of those countries being also heavily indebted to European financiers. It is evident that the immediate interest of Europe lies in the securing of stable conditions as quickly as possible, and it seems probable that more profit at less trouble will be secured by lending China money to develop her resources than by attempting their development under foreign control. Germany has expended enormous sums in her 'zone of influence' in Shantung, with but little return as yet and with no indubitable evidence of the reaping of an eventual profit. The essential integrity of China is likely to be respected because it is good business. The dependencies in the northwest may be lost to Russia, but as they have never been a source of advantage to China, little disadvantage can accrue from their loss. The danger of allowing Russia to advance so near Peking is probably imaginary; she is already equally near Berlin, with no very disastrous result.

Several phases deserve further comment. The establishment of a republic by edict of the retiring monarchy is remarkable, from a Western viewpoint, and is curiously similar to the efforts of the retiring Tokugawa Shoganate of Japan, in 1868, in aiding the formation of a new government. It seems not at all improbable that Yuan Shih-kai will be elected president, though it is dangerous to prophesy what course events will take in Oriental countries. The American press generally seems to have failed to perceive that the election of Sun Yat-sen as the president of a so-called republic was little more effective than would be the election of Mr. Robert La Follette as emperor of the United States by the Fraternal Order of Eagles, for example. The

opinion has been freely expressed that the establishment of a republican form of government in China is an impossibility, but the expression of any such opinion is *prima facie* evidence of lack of competent knowledge. The government of China has always been intensely democratic, and in the 'Book of History,' compiled by Confucius about 600 B.C., such expressions as "Heaven thinks as my people think," and "The root of a nation is its people," frequently occur. Societies and guilds for the control of various phases of social and economic activity are ubiquitous, and there seems little danger that a republic would not prove feasible. But it would be likely to be non-progressive, for the reason that prompt and effective action can always best be assured by concentration of authority. China is in much the situation of the little boy who is hoeing the garden chopped down the vegetables along with the weeds. The nation suffered the Manchu dynasty so long as the central government had but little authority. But when, under the auspices of Prince Ching, Duke Tsai, Shêng Hsuan-huai, Tuan Fang, and others, the creation of a strong government was initiated, the reaction swept away everything. So long as China was isolated by lofty mountains, broad deserts, and unsailed seas, her inchoate form of government was a feasible one. Now, close pressed on every hand by vigorous and often unscrupulous competitors, her situation is critical, and wise and vigorous constructive statesmanship to create a strong and effective government is needed. Fortunate indeed will she be if the well meant attempts at national liberty do not prove her national ruin.

American Institute Affairs

Attention is being attracted in an unusual degree to the annual meeting of the American Institute of Mining Engineers to be held in New York next month. It has been one of the striking features of the conduct of that great organization that only nine members should constitute a quorum, and it is said that at times the annual meeting could not proceed until another member or two had been called in by telephone. For an engineering society of over 4000 members this is certainly an anomalous situation. That it has obtained so long, not only without protest but almost without the knowledge of the members, is a striking tribute to the general tact and ability with which affairs of the society have been conducted. Those in control have judged, and rightly, that the members have cared more for results than method. Now, however, that Dr. Raymond has retired from the secretaryship there are signs that the members are disposed to take a more active interest in the conduct of what after all belongs to them collectively. This we believe is a healthy sign of growth rather than of belligerent criticism. After all, the Institute belongs to its members and should be what they want it to be. If the members in general exhibit a keener interest in its affairs they must inevitably also assume more responsibility, and no organization can have too broad a base or too active a membership.

Important changes in the constitution have been proposed and will be voted upon at the next meeting. While these proposals have been before the Institute for many months they have neither been actively discussed nor adequately explained. Doubtless the majority of the members know too little about their purposes and probable results to vote on them intelligently, and yet beyond a brief, formal, printed statement sent to the members, nothing has been done to inform them. At none of the sessions of the Institute held in San Francisco or in Japan was the matter even brought up for discussion. It is true that the fall meeting was a professional session and that no business could be legally transacted, but an excellent opportunity was afforded for getting those present a little friendly insight as to the business side of the institution, at which they are partners. There may be the best of reasons for voting for all the proposed amendments, for our part we believe there are, but that does not alter the fact that the members are being asked to vote, practically in the dark, for an increase in dues, a grading of membership, and for other far-reaching proposals. No committee on reorganization of an ordinary business enterprise would expect to carry through equivalent proposals without a better campaign of education. This, however, is but one instance of several. No really informing statement of the finances of the Institute is available to members. That which is printed is far from adequate. This, we are sure, is merely oversight, due to a desire to reduce things to simplest terms in public statements. The officials have always been willing to give inquiring members the fullest information. It ought not, however, be left to them to inquire. Within the year, too, important negotiations regarding a possible consolidation of the Institute and of the Mining and Metallurgical Society have been conducted. What proposals were made and what rejected, and exactly why the matter came to nothing has never been made clear to the members of either organization, and in the case of the smaller society details were not even given to all the members of its council. This policy of centralization and, in practical result, 'kitchen cabinet' control, is not therefore singular to the Institute. Surely more pains should be taken to enlist the interest of members of the societies if their continued financial support is to be asked.

In the past the nominations for office in the Institute made by a committee appointed by the council, have usually been the only ones before the annual meeting, though any member or members may make nominations, provided they be sent to the secretary in writing at least thirty days before. The time of the meeting is fixed by the constitution, being the third Tuesday in February in each year. As already stated, the meeting has degenerated into a mere form. The members necessary to make a quorum are called together and business is transacted mainly on the basis of three or four hundred proxies gathered in advance and placed in the hands of some one resident in New York. Not more than ten per cent of the members even bother to send proxies, and those who do only in the rarest instances send any instructions as to how they wish their votes recorded. In the absence of instructions and competing nominations, the member holding the proxies has had only an obvious duty to perform, and has done it. The result has been surprisingly good, but it is evident that membership in an engineering society involves responsibilities and rights that have been too lightly regarded.

It is well to follow good leaders, but it is also well for each to do his share. The American Institute of Mining Engineers voted cheerfully and almost unanimously to assume a debt of $188,000 and to place its business affairs exclusively in the hands of a small self-perpetuating board of directors. The gentlemen who have served on that board have done so with signal ability and self-sacrifice, but that does not absolve their fellow members from obligations. That they now show some disposition to recognize the facts of the situation, is, we think, hopeful. An occasional lively contest for office would do the Institute much more good than harm. It is better for the society to have its officers elected than selected.

We have no program for the Institute, and our purpose in calling attention to conditions at the present time is to urge members to take a more active part in its work. It is a great and influential organization. We confidently expect to see it grow larger and stronger with the years, and we will gladly co-operate in every effort for its good.

Mining in the Belgian Congo, West Africa, for 1911

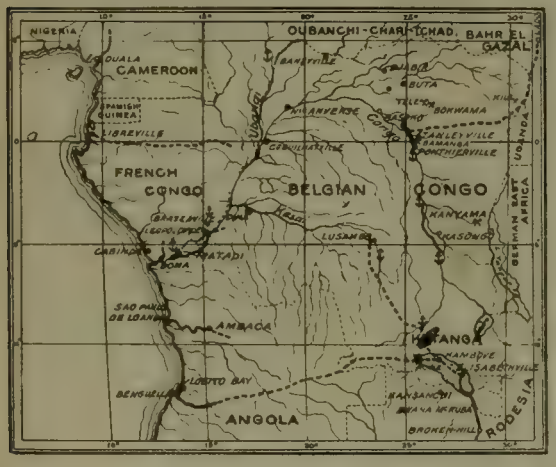
SYDNEY H. BALL

Mining in the Belgian Congo in 1911, although marked by no large mineral output, was notable because of the commencement of copper smelting in the Katanga; the advances made in the means of transportation and communication; and important diamond discoveries. The Katanga, in the southeast portion of the colony, has been thrown open to prospecting, and its mining laws will probably form the models to be followed by the Government when in the course of the next twenty years other parts of the colony now under concession to various large companies, are opened to general prospecting. It is worthy of note that the Belgian Congo has become one of the few countries in which almost 50% of the white population is dependent directly or indirectly upon mining. The relative increase of the mining element, although due largely to the activity of the Tanganyika Concessions, Ltd., is partly due to the expansion of prospecting and mining in other parts of the colony.

TRANSPORTATION AND COMMUNICATION

The high transport costs in the Belgian Congo will presumably be lowered by improvements now under way.

Steamers to Europe.—Steamer service between Antwerp and Matadi, the Congo port at the head of navigation on the Lower Congo, has long been satisfactory. The three comfortable steamers of the chief steamship line (Compagnie Belge Maritime au Congo) ranging in tonnage from 5850 to 7000 tons, make the voyage in 21 days, and this company is now reported to be building two steamers of almost 12,000 tons displacement.



MAP OF BELGIAN CONGO, WEST AFRICA, SHOWING MINES AND TRANSPORTATION LINES.

Railroad Construction.—The Mayombe railroad, a narrow-gauge road starting at Boma, the capital, in the Lower Congo, is being pushed northward. The road, unless it reaches the copper mines at Mindouli, French Congo (at last reports being worked) will serve no mines, though the country through which it is to pass is being prospected.

The railroad from Matadi to Leopoldville around Livingstone Rapids (250 miles long and of 29½-in. gauge) handles all traffic between Europe and the rich up-country Belgian Congo, and much of the French Congo hinterland. As traffic has outgrown the line's capacity there are rumors that the road may be double-tracked, the gauge broadened, and the running time cut from two days to one. Studies are now being made as to its possible electrification, and to the future use of oil as fuel. Between the terminus of this road (Leopoldville), and the terminus of the Grand Lakes railroad (Stanleyville), 1125 miles, travel is by steamer. The fleet on this part of the Congo river has been increased not only by another 500-ton stern-wheeler, but by other smaller boats, one of which, a mail boat (speed 13½ knots an hour), now being built, is the gift of the present King. Better surveys and the placing of buoys in the more dangerous channels are increasing the safety of navigation on this part of the river.

The Grand Lakes railroad from Stanleyville to Ponthierville (80 miles) has been running for some three years now, and four steamers belonging to the same company regularly ply on the navigable stretch of the Congo river from the latter point to Kindu (200 miles). A fifth of 375 tons has been ordered.

The railroad from Kindu to Kongolo was completed on December 31, 1910, and is approximately 225 miles long. This road uses iron ties (almost necessary in the tropics) and connects with the navigable stretch of the Congo river from Kongolo to Bukama (405 miles), which is negotiated by steamers. One of 125 tons has already made the voyage in six and one-half days, although the deepening of Lake Kisale has not as yet been completed.

THE COPPER BELT AND LOBITO BAY RAILWAY.

Preliminary surveys have been made of the railroad route from Bukama to Elizabethville, where the Katanga copper smelters are situated (about 300 miles). Already 170 kilometres (106 miles) of this road between Elizabethville and the Kambove copper mine is under construction and will presumably be completed in September 1912. Construction of the line from Elizabethville to Bukama, including rolling stock, is expected to cost about $37,000 per mile. As Elizabethville was connected with Cape Town by rail in October 1910, the traveler will be able three years hence to book a passage by boat and railroad from England to the Cape by way of the Congo mouth, viewing on the way the Equatorial forest, the Katanga copperfield, and Victoria Falls. This Grand Lakes railroad will connect at Bukama with the Lower Congo-Katanga railroad, which is projected from Piana Mutombo on the Sankuru river above Lusambo. Further, the Grand Lakes railroad is now building a line from the Congo at Kabalo (50 miles above Kongolo) to a point on Lake Tanganyika opposite Ujiji (128 kilometres by boat), which, in connection with a German East African railroad, will in four or five years, form a direct route from the East Coast to the heart of Africa. The railhead from

Dar-es-Salaam westward toward Lake Tanganyika, through German East Africa, was on July 31, 1910, at Tura, 142 kilometres from Dar-es-Salaam. In another year it is expected that it will be at Tabaro (125 kilometres farther), from which point, under a subsidy granted by the German Government, it is to be pushed to Usumbura on Lake Tanganyika (about 750 miles from Dar-es-Salaam).

The Wilhoes railroad, starting from Benguella Bay, Portuguese West Africa, and heading for the Katanga, has now attained the plateau level, and is being operated for about 225 miles. This railroad is of 3 ft. 6 in. gauge, and although having some gradients of 1:40, and curves of 150 metres radius, the journey has been made at an average speed of 21¾ miles per hour, or 17½ miles, counting stops. From an engineering point of view, the remaining 1000 miles is comparatively easy, but whether or not this railroad is completed in three years, as some predict, will depend upon its financial backing.

Entrance to the northeast part of the colony has been facilitated by better steamer service on the Nile. Steamers leave Kosti, a station on the Cape to Cairo railroad south of Khartoum (about 5 days from Cairo), on the eighth of each month, making the voyage in about 15 days. At Redjaf a five-day portage around a succession of rapids begins, after which a second steamer is taken for four days to Butiaba, from which Mahagi, on the Congo side of Lake Albert, is about six days march. Lake Albert is thus reached in about 35 days from Alexandria.

Eleven kilometres of the permanent way of the Buta-Bambula railroad to connect the Rubi and Welle rivers in the northeastern part of the colony, is reported finished; it was the late King Leopold's plan that this should form part of the Congo-Nile route, but it presumably will be still many years before its completion.

The grandiose scheme to build a French railroad from Algiers, southeast across the centre of Africa, to connect at Stanleyville with the Grand Lakes railroad, and thus to give an all-rail route through Africa, from north to south, shows the interest foreign capital is taking in African affairs. This line, if ever built, should place Stanleyville in the Belgian Congo, at present about 45 days from Europe, within five or six days of Paris. There are thus four trans-African railroad lines under consideration: two from north to south, the French line just mentioned, and the Cape to Cairo railroad, and two from east to west, Cameroon to Dar-es-Salaam and Matadi to Dar-es-Salaam.

Telegraphs and Wireless.—Elizabethville, Katanga, is now connected with Cape Town by telegraph and for many years telephone lines have existed between Boma and Coquilhatville and Kasongo and Uvira. A telegraph line between Ponthierville and Kindu is being rapidly pushed to completion. At present wireless messages are flashed between Leopoldville, on Stanley Pool, and the end of the cable line at Libreville, on the French Congo coast. Other stations are to be established at Stanleyville and Elizabethville and intermediate points, and in two years' time it is hoped that communication will exist between all of the more important State posts.

Fuel

The company mentioned in this review last year, formed to construct a pipe-line for petroleum between Matadi and Leopoldville (that is, around the non-navigable portion of the Congo river), is actively engaged in construction, and expects to have all pipe-lines and pumps erected during 1912, or, at the latest, the beginning of 1913. Tank-steamers will discharge at Ango-Ango, a short distance below Matadi, where a new harbor and tank-farm are being built. The Congo railroad between Matadi and Leopoldville recently introduced several oil-burning engines, with a saving of 50% of the fuel cost. The completion of the pipe-line should presumably partly solve the fuel question, and should cut down the running time of the Congo river boats, which now lose much time while cutting wood. With its numerous waterfalls the Congo will in the future look mainly to electricity for power. The Grand Lakes Railroad Co. has had no particular success drilling for oil to the southeast of Stanleyville, and, notwithstanding rumors, it is believed that no exploitable coal deposits have been found in the Katanga.

Copper

The Katanga copper belt in the southeastern part of the Belgian Congo is now holding the centre of the Central African mining stage. The copper belt is about 200 miles long and contains over 100 deposits, some of which are of large tonnage. The sedimentary country rock consists predominantly of sandstone, sandy schist, and limestone. The Tanganyika Concessions, Ltd., works these mines as open cuts, the ore of the Star of the Congo mine at Elizabethville being hauled by endless ropes from three open pits. Rumors indicate that tonnages have been reckoned on development that in our West would be considered insufficient, and it is probable that the ore will more nearly run 9% copper than 12 or 14%. Notwithstanding this, it is believed that large reserves of comparatively rich silicious oxidized copper ores exist in the district. The results of the treatment of this ore in Central Africa at a profit and at a sufficient profit to give a fair return upon an expenditure of over $10,000,000 directly or indirectly dependent upon it, is awaited with interest.

The railroad connecting Cape Town with Elizabethville (formerly known as the 'Star of the Congo' mine, but renamed in honor of the Queen of the Belgians), was completed October 2, 1910. It has branches to the limestone quarries at Mikola and the smelter on the Lubumba river (the town is known as Lubumbashie). Four trains per week, each way, go between Elizabethville and the Rhodesian border. Cape Town is now but seven days from the camp, and Europe but eighteen days farther. A railroad extension (107 miles) to the Kambove mine, one of the richest of the other copper properties, has been begun, and, as already stated, should be finished in the fall of 1912. The Kambove mine is expected to be ready for exploitation at that time. The Great Lakes route to the mine will soon be completed, and two other railroads, as mentioned above, are headed for the field. In consequence, the Katanga will eventually not be lacking in competing lines.

Upon the arrival of the railroad the next important event was the erection of the metallurgical plant. The transport of this plant after arrival in Biera (Portuguese East Africa, the port of entry for Tanganyika freight) was delayed by unusually heavy rains, resulting in many washouts on the railroad. One of the blast-furnaces (water-jackets) of 300-ton capacity (48 by 192 inches at the tuyeres) was blown in on June 30 for a day or two, and then, for what proved to be a short experimental run, from August 4 to 26; power being generated by the erection of a temporary engine. It was hoped that the power-plant would be completed some time in September. From September 16 one blast-furnace has been running continuously, according to cables to the 'Tanks' home office, and 12 tons of copper produced daily, with the expectation that this product would be largely increased in the near future. While smelting clayey and silicious ores averaging 12½% copper, a recovery of 87% is claimed, 10% being lost in the slag and 2½% in flue-dust. The fine material is giving trouble, and briquetting is being considered, as is also the possibility of electric smelting. Less is heard of the plant by which the copper content of the silicious oxidized ores was to be reduced to grains of metallic copper and later concentrated. A plant with this object in view was shipped from the United States this year, but was, at last information, still at Beira, and all efforts are evidently wisely being bent toward increasing the output by ordinary smelting.

In 1910 153 tons of copper ore was exported from the Belgian Congo, valued at $17,400. About the first of October, 1911, 500 tons of copper arrived in London, but this was from the Kansanshi mine, just over the Rhodesian border, owned by the Rhodesia-Katanga Junction railroad (which, by the way, is now on a paying basis, owing to the large amount of transport provided by Katanga mining). Of this railroad, 75% is owned by the Tanganyika Concessions, Ltd., and 25% by the British South Africa Co. The Kansanshi mine was opened long before the

Katanga mines, and in February 1911 had about 2000 tons ready for shipment. The ore somewhat resembles the Katanga ore; European coke was used in smelting, and the slag is rumored to have run but from 1 to 1½% copper. Early in October, however, 200 tons of copper arrived at Beira, the first considerable shipment of Katanga metal, and by the end of October 1911 some copper had arrived at Antwerp. Up to November 6, 1911, the product is reported to have been 834 tons of copper. 'Tanks' shares had this year their usual spectacular ups and downs. Severe selling carried the shares to about $9.85 (par $4.87) on November 7, 1911, although in October 1910 they had been $32.85; on December 13, 1911, they had risen to $14.14.

As to the cost of this copper per pound, few data are at hand. The contract between the Rhodesian railroad system and the Tanganyika Concessions, Ltd., is said to be 1d. per ton-mile for ore (about £6 2s. 8d. per ton of copper from the mines to Beira, or say £7 2s. 8d. per ton to London, or $1.75 per lb., not including insurance, landing charges, and selling costs). When to this must be added the cost of mining under tropical conditions, and smelting (European coke at £13 per ton is to be used at first, and the ore requires much flux), amortization, etc., the difficulty of keeping costs within the present price of copper is seen. The next year should determine whether the Katanga is to become a factor in the copper market in the next two years or at some later date.

Elizabethville, the centre of the industry, is a Belgianized western boom town lying under the tropical sun, and with Belgian and English pioneers. In a year the white population sprang from less than 100 to 1500. The Belgians have laid out some thirteen miles of boulevards; cafés surround the 'Place Royale', and the town boasts not only of a Chamber of Commerce, but also a cinematograph show, and a local mineral water company. The establishment of drainage systems and water supply is in progress; a weekly newspaper (printed, by the way, in both French and English) is being eagerly subscribed for at $7.50 per year. Fresh meat and vegetables are in such demand that upon the arrival of trains from the South the whole cargo is auctioned off at the station. Farmers and cattlemen are settling around the town, and a refrigerating plant and flour mill have been erected. Town lots are procured through the Katanga Special Committee, the price within the business district being from $4 to $8 per square metre, or from $9000 to $12,000 per lot (about 100 by 160 ft.). Residential lots cost about $1600. Brick buildings must be put up on these lots, and subleasing is not permitted without the Committee's permission; providentially, no one individual can acquire more than two lots. The sudden increase of population and the large shipments of machinery and supplies has naturally somewhat overtaxed the railroad, and consignments of goods are received six or seven weeks after the invoices. Native labor is difficult, not only to procure, but to keep, and at present it is almost impossible for prospectors to get enough porters to leave for the bush. This condition will presumably be partly righted by the foundation of a Katanga Labor Bureau under Government auspices.

Gold

The State budget for 1911 for prospecting and mining was about $310,000. The State operates in the northeastern part of the colony, its chief placer being at Kilo, to the west of Lake Albert. The product in 1910 was 876 kg. of gold, valued at about $525,000. The product for the first months of 1911 exceeded that of the corresponding months of 1910, but to September the product is reported to have been but a little over 448 kg., indicating an output for 1911 of less than 700 kg., or perhaps $420,000. This falling off is due to the fact that some of the richest streams have been exhausted, and to labor and food shortages. The placer ground at Kilo is of considerable extent, and, although rich pieces of float quartz have been picked up, no exploitable vein has yet been found. About $7,300,000 of gravel, ranging in value from $1.80 to $13.20 per yard, is reported to have been blocked out. The country rock is granite gneiss and granite. Hydraulic mining is being done in some of the more favorable streams, but the greater recovery is from sluices. A dredge, ordered some years ago, is still in Uganda, due to the difficulties of transport of the heavier parts. Thirty to forty whites are employed, but the black personnel, once 3000, has fallen off markedly. Supplies arrive by way of Mombasa, whence they are shipped by the Uganda railroad to Port Florence, thence by boat across Lake Victoria Nyanza to Entebbe, and from there are carried on blacks' backs some 200 miles. Considering this method of transport, the reported cost of sluicing (40c. per yard) does not seem excessive. The importance of the alluvial deposit at Nebula, about 110 miles N.N.E. of Stanleyville, was apparently overestimated. The State worked this mine in the current year, but presumably it will be abandoned in 1912, with perhaps a total output of $20,000 to $50,000 gold. Operations were started by the State in 1911 on the gold placer situated at Moto, about 325 miles northeast of Stanleyville. This deposit is stated to be rich.

The Société Internationale Forestière et Minière du Congo (a Belgian-American company) has during the year bent its efforts largely to prospecting, with satisfactory results. About thirty American and English engineers and prospectors and 700 blacks are employed. Toward the middle of 1911 it began to operate a rich, though rather small, placer at Kanwa, 3 miles from Nebula. An unusual dearth of water for sluicing kept the product down for the half-year of 1911, but it should be largely increased in 1912. The total gold production of the colony for 1911 will be from $500,000 to $600,000.

Diamonds

One of the most surprising developments of Central African mining in the past five years has been the finding of diamonds at widely separated points; in Bechuanaland, German East Africa, German Southwest Africa, several points in the Congo, and in Liberia. The 1910 production of German Southwest Africa was 798,865½ carats, valued at $5,154,859.* Pipes of rock, similar to that in which diamonds occur in South Africa, have been found in the Kundulungu plateau (southeastern part of Belgian Congo) and some 35 diamonds have been washed from sands of creeks in that general vicinity. As yet, however, it is believed that no pipes have been found to be diamond bearing. A company (Kundulungu-Lualaba Co.) has been formed to prospect these pipes, erecting machinery to wash the ground in considerable quantities. This company, of which the stock is owned by the Katanga Special Committee and the Tanganyika Concessions, Ltd., has a concession of some 12,000 square miles for diamond prospecting. In 1907 prospectors of the Société Internationale Forestière et Minière du Congo (a Belgian-American company in which Thomas F. Ryan and other Americans are interested) found one diamond on the Kasai river at Mai Munene. In the past summer a prospector for the same company picked up, in a couple of weeks, on the Kambambaie river near its junction with the Kasai, 240 diamonds, weighing in toto about 39 carats, the largest stones being about a carat. Many of these stones are of excellent water-white color, others are fancy colors, deep yellows, greens, and hyacinth; comparatively few are off-color stones. The crystallization is interesting, twins being comparatively common. These stones were washed either from pot-holes in the stream beds or from sands along the shores. Since then ten diamonds have been found at another locality and several at still another. As a result, diamonds have been found in the bed of the Kasai river and in the lower courses of its tributaries for a distance of 75 miles. Search is now being carried on for the rock source. In passing, it may be stated that the Kasai river in this region has locally cut its bed, down through the flat-lying Jura-Triassic sandstone which covers such large areas in Central Africa, into the older folded and

*George F. Kunz, 'The Mineral Industry,' Vol. XIX, p. 9.

metamorphosed rocks of sedimentary and igneous origin which resemble pre-Cambrian rocks in other parts of the world. The sandstone is equivalent to the Stormberg rocks of Kimberley, South Africa, in which the diamond-bearing igneous rocks occur as 'pipes', and in this Kasai locality the diamonds may be either associated with similar chimneys or with one of the basic rocks making up the pre-Cambrian like basement complex.

Tin

The Elizabethville-Bukama railroad, when completed, will tap the tinfield to the north of the Katanga copper belt. The tin rights over some 5000 square miles are held by the Tanganyika Concessions, Ltd. Another company has located a supposed extension of this field.

Other Operations

The Grand Lakes railroad is continuing its search for bituminous schists in the vicinity of Ponthierville with some success, and a drilling crew was despatched in 1910 to try for oil. Its other prospectors have found numerous gold-bearing streams, none of which, however, it is believed are exploitable. Its prospecting concession upon the augmentation of its capital from 50 to 75 million francs, was increased by 4,000,000 hectares (15,500 square miles). Prospecting by the Lower Congo-Katanga railroad has not apparently been successful; some low-grade lead and copper deposits have been found, also auriferous streams. Since the Katanga has been opened to general prospecting a considerable number of companies have been formed to search for minerals in the country outside of the area reserved by the Tanganyika Concessions, Ltd. These companies have located 30 blocks, including copper, iron, gold, tin, coal, and lead, of more or less problematical value. These companies were in June 1911 represented by some 60 prospectors, there being in addition some 10 independent prospectors.

Mining Laws

The mining laws published in December 1910 (decrees of December 16, 23, and 30) are of interest, as they not only open up to prospecting companies and to individual prospectors those parts of the Katanga not reserved by the Tanganyika Concessions, Ltd., but also as they will presumably form models for the mining laws of other parts of the colony, when within the next twenty years the various existing concessions lapse. In the Katanga the area reserved by the Tanganyika Concessions, Ltd., in

RHODESIA AND ADJACENT CONGO TERRITORY.

large blocks for one or more metals, is roughly 23,400 square miles. This is about 40% of the area covered by the older rocks which are most favorable to metallic deposits. The reservation of these blocks is the result of prospecting by the company in the whole Katanga during some ten years.

The companies already formed to further prospect the Katanga give to the Katanga Special Committee, the representatives of the Belgian Government in that part of the colony, 33% of their stock, and the same percentage of any future augmentation of capital. The committee also has the right to subscribe for 20% of the shares. In return the companies can prospect for two years over considerable areas. Prior to or upon the expiration of the two years they can take up an area, in one or several blocks, for exclusive prospecting, containing from 750 to 3500 square miles, according to the statutes of the company. They pay a yearly tax of $200 per prospector employed. Later they can take up for mining purposes claims, none of which can surpass 38.61 square miles, nor can any one company take, in all, over 386.1 square miles. Their right to exploit expires in 1990, at which time the

mine and machinery pass to the colonial government. A royalty of 1% of gross production in the case of base metals and 5% in the case of gold, silver, or precious stones, is paid to the State, but it must, however, equal in the former case at least 4c. per acre, and in the latter $4 per acre.

The decree of December 16, 1910, also threw open to prospecting companies and to individual prospectors those parts of the Katanga not already ceded as mentioned above. The companies (or individual prospectors) first obtain from the colonial officers for each man a general permit to prospect, at a cost of $20, good for two years and renewable indefinitely upon new payments. Upon finding mineral indications, a paper can be obtained giving exclusive prospecting rights (cost $40) over a circular area which in the case of precious metals or stones is 1000 metres in diameter, and in the case of the ordinary metals and non-metallic products is 5000 metres in diameter (area respectively of about 200 and 4900 acres). A discovery post must, however, first be placed at the centre of the circle with the information usually required in other countries (locality, date, name, number of license, character of discovery, and residence of prospector). The metals sought should all be listed, as only those mentioned in the location notice can later be mined. This notice is good for two years and can be renewed once upon a second payment. This permit, however, can only be delivered or renewed provisionally by the representatives of the Katanga Special Committee in the Congo, and must be passed on by the colonial legislative body, requiring the permit to go from Katanga to Brussels and *vice versa*. If this body refuses its approval the $40 is returned, but the prospector loses his discovery, his time, and the money expended during his work. Ten per cent of the product obtained while working under this special license goes to the State. Later, a third paper, giving the right to exploit within a rectangular area, containing in the case of precious metals or stones 50 hectares (about 125 acres), and in the case of the commoner metals of 1250 hectares (about 3125 acres), can be taken out, provided the land is vacant, is a certain distance from private and public improvements, and provided, further, that the State officials are satisfied that the company (or prospector) is financially able to exploit the deposit satisfactorily. The right of exploitation expires in 1990, at which period mine and machinery pass to the State. Thirty-three per cent of the profits go to the State. In finally locating, claim-posts must be placed at the four corners, and side-lines are to be marked by posts, each of which is to be within sight of another. Each corner-post must bear the date of the request for land, the number of the special permit, and the name in full and residence of the prospector. Payment of royalty is made quarterly, and upon receiving a permit of exploitation the prospector or company must pay the minimum tax for a quarter in advance (as above, 4c. or $4 per acre, according to the character of the substance sought). The 33% of the profits must be paid within a month of the closing of the fiscal year of the mine. Forfeiture of the right to exploitation follows the non-payment of royalty or the stopping of exploitation, and the land reverts to the colony. If a prospector or a company wishes to cancel a claim, it can be done by first paying all royalty due and putting up a sum sufficient to cover damages which may have resulted from the mining carried on.

The best feature of the law is that no extralateral rights exist, the company or individual controlling only the ground perpendicularly beneath the side-lines of the claim. The law, considering the fact that the ground has already been prospected, and that a prospector's expenses in Central Africa are in the neighborhood of $2000 per year, is, to say the least, not liberal to the real prospector who has developed the principal mining countries. On many points the law is obscure and, further, offers little assurance to the prospector that he will eventually get a deposit after having found it. The clause requiring sufficient capital to exploit, practically shuts out a poor man, or one with but a small grubstake, from the country, as even in case a rich placer were discovered, he is not assured permission to work it.

Iron Ore in 1911

Preliminary estimates of iron ore sold in 1911 were sent to the U. S. Geological Survey by 26 of the largest iron-mining companies in the United States at the close of the year. The combined output of these companies represents more than 80% of the total production of the United States. From these returns it is estimated by E. F. Burchard that the total quantity of iron ore marketed in the United States in 1911, not including stocks left at the mines, was between 43,000,000 and 46,000,000 long tons. This quantity represents a decrease of 22 to 24% of the sales for 1910, which aggregated 56,889,734 long tons.

Imports and Exports of Gold

According to estimates made by the Bureau of Statistics, the imports in 1911 comprised gold valued at $11,150,000 in foreign ore, $29,300,000 in foreign bullion, $5,750,000 in United States coin, and $10,050,000 in foreign coin—a total of $56,250,000. The gold exported in 1911 was valued at $500,000 in domestic ore, $8,050,000 in domestic bullion, $30,000,000 in United States coin, and $2,250,000 in foreign coin—a total of $40,800,000. The excess of imports over exports was about $15,500,000, indicating a marked change from the conditions in 1910, when the excess of imports over exports was $447,696, and also from those in 1909, when the excess of exports was $88,793,855.

The gold imported in 1911 was mainly in the form of ore and bullion, and came chiefly from Mexico, although considerable gold is received from Canada every year and smaller amounts from the Central and South American countries, and in 1911 a large quantity of gold was imported from Japan. The exports consisted largely of gold coin and went chiefly to Canada, although smaller shipments were also made to France, South America, the West Indies, and Japan.

World's Coal Output

The following table shows the coal production, in short tons, of the principal countries of the world, the figures being for 1910, except as indicated:

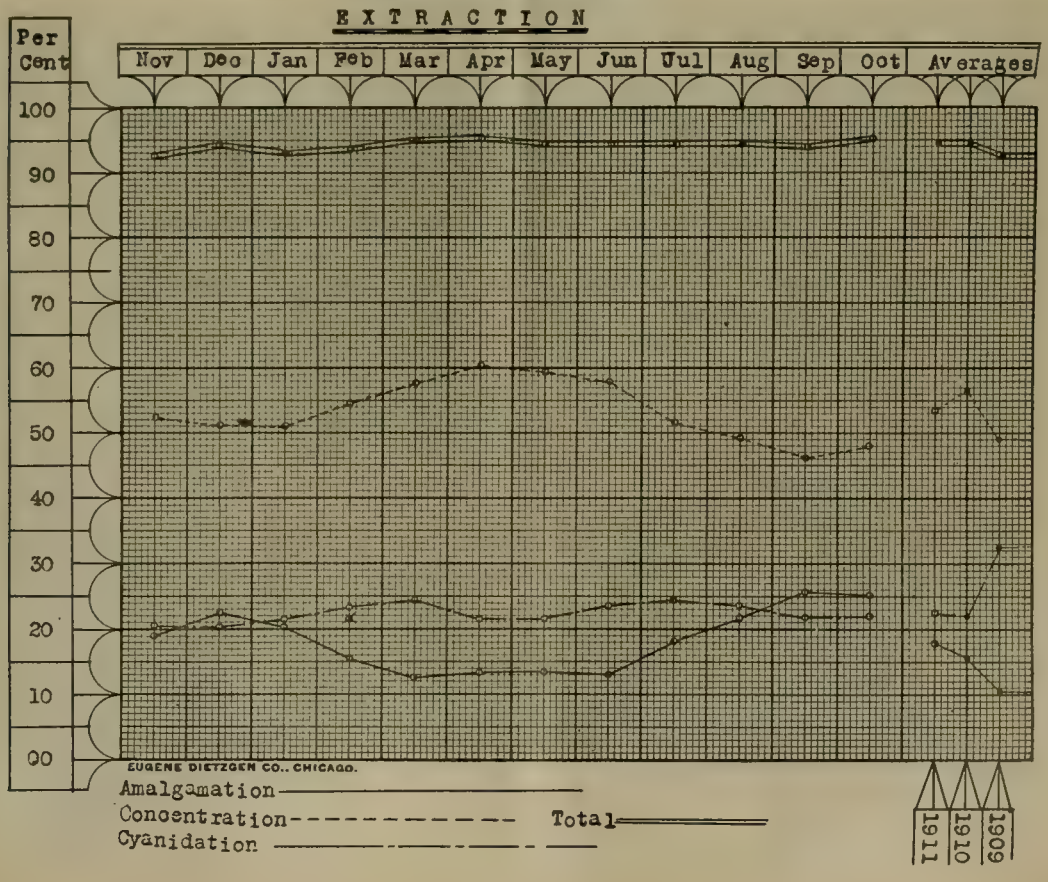
United States (1911)	490,000,000
Great Britain	296,007,699
Germany	245,043,120
Austria-Hungary (1909)	54,573,788
France	42,516,232
Belgium	26,374,986
Russia and Finland	24,967,095
Japan (1909)	16,505,418
India (1909)	13,294,528
China (1909)	13,227,600
Canada	12,796,512
New South Wales (1909)	7,862,264
Spain (1909)	4,546,713
Transvaal	4,446,477
Natal	2,572,012
New Zealand (1909)	2,140,597
Mexico (1909)	1,432,990
Holland (1909)	1,235,515
Queensland and Victoria	1,119,708
Italy (1909)	611,857
Sweden (1909)	272,056
Cape Colony (1909)	103,519
Tasmania (1909)	93,845
Other countries	5,236,903
Total	1,266,981,434
Percentage mined by the United States	39

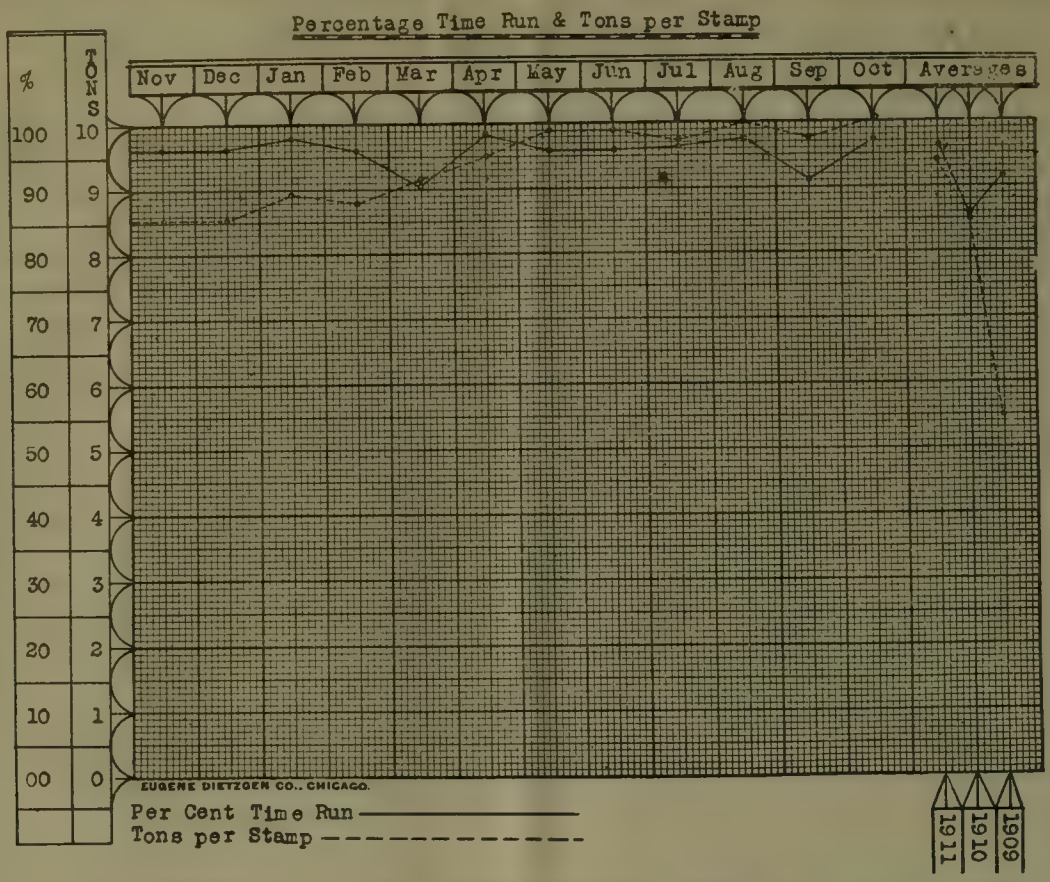
Operating Costs at the Goldfield Consolidated Mill

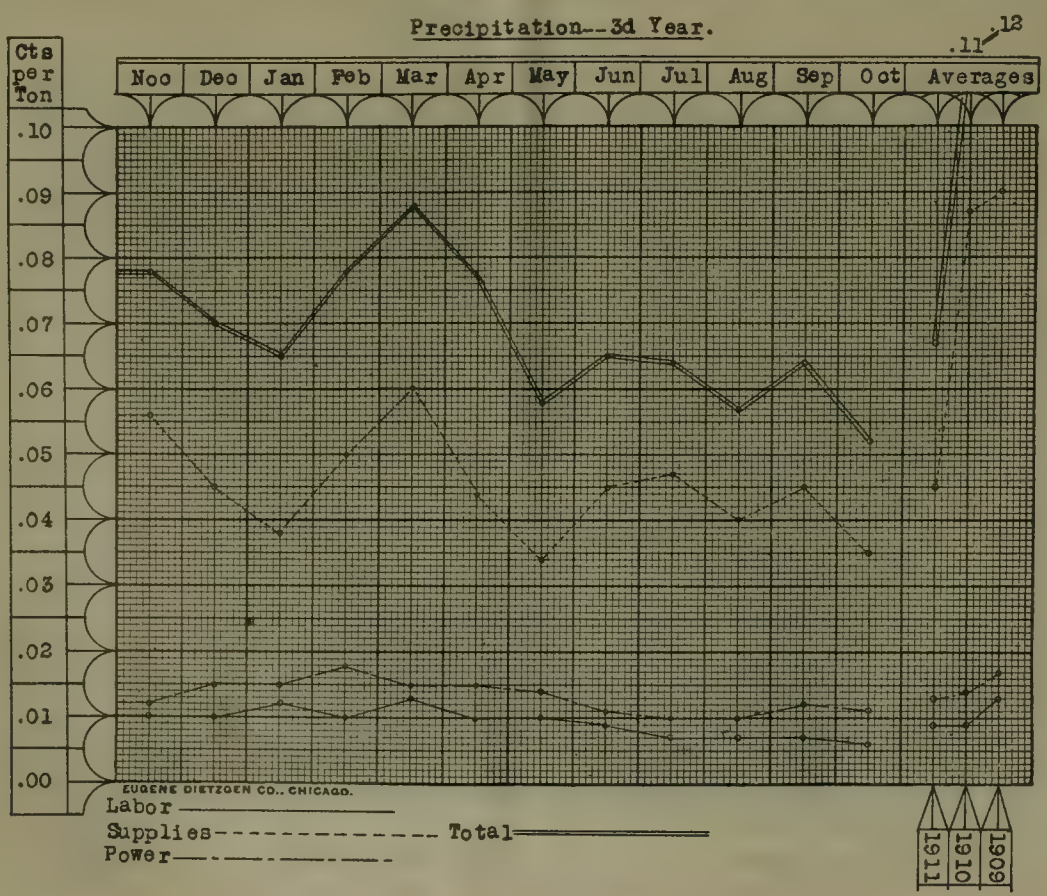
A detailed description of the mill used for treating the ores of the Goldfield Consolidated Mines Co., at Goldfield, Nevada, was published in the *Mining and Scientific Press* early in 1911.* In brief, the process involves three-stage reduction by means of stamps, Chilean mills, and tube-mills, followed by concentration and cyanidation, using Pachuca agitators, Butters vacuum filters, and Merrill zinc-dust precipitation. The concentrate is treated by amalgamation and a special cyanide, or bromo-cyanide, process. Detailed figures covering operating costs for the year ended October 30, 1911, are given below, being taken from an admirable general statement of costs at the property, compiled by the superintendent, J. W. Hutchinson, and generously furnished by him to his brother cyanidists. Owing to limitations of space, only a few of the 32 charts furnished by Mr. Hutchinson have been reproduced. The figures are perhaps self-explanatory, though in considering them it is well to recall that Goldfield is a district of high wages, $3.50 to $5 for 8 hours work, and of high power costs, since electricity must be brought from the mountains. The cost in fact is $6 per horse-power-month, based upon 90% of the peak load. When these figures are compared with the $15 per year rate obtaining at some plants in Norway, or even the rates in certain American mining districts, it will be recognized that the total must inevitably be high at Goldfield. Water amounts to 220 gal. per ton of ore milled and costs 50c. per thousand gallons. It should also be noted that the ore milled is high in grade, averaging approximately $40 per ton through two years, and the amount treated is large, about 28,000 tons per month. The actual amount treated in any month may be calculated from one of figures below, remembering that the mill includes 100 stamps. All the figures are based upon total tons treated. For example, the Chilean mill costs, as will be noted, ranged from 8 to 12½c. per ton, but to get a figure for comparison with costs elsewhere it is necessary to remember that only a part of the total tonnage goes through the Chilean mills. For the actual amount, and other data, readers are referred to Mr. Hutchinson's own account of the mill, already cited. Figures for 1909 to 1911 inclusive are reproduced below.

*"Goldfield Consolidated Mill Operation," by J. W. Hutchinson, *Mining and Scientific Press*, May 6, 13, 20, 27, June 10, 1911.

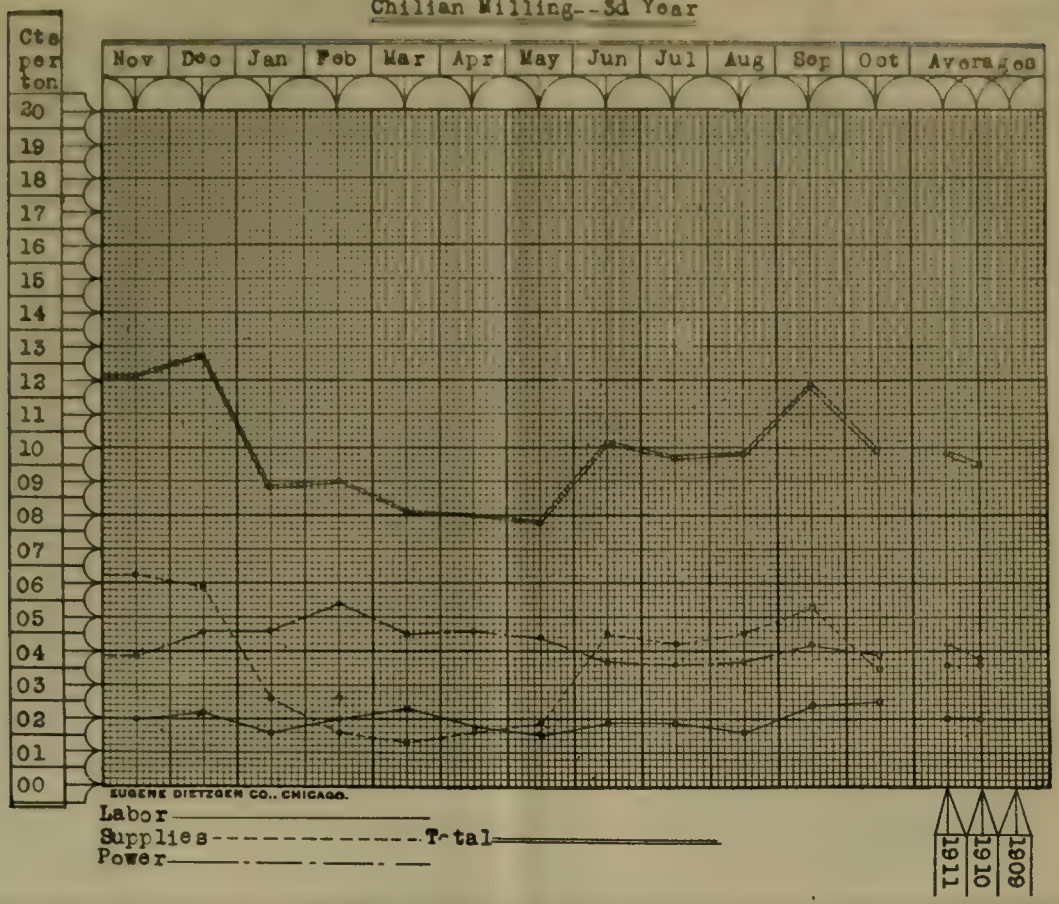
Cost per ton milled	1911 ¢	1910 ¢	1909 ¢
Crushing-conveying	0.040	0.071	0.053
Sampling	....	0.003	0.004
Stamping	0.134	0.174	0.195
Elevating-separating	0.022	0.023	0.021
Chilean milling	0.097	0.095	....
Tube-milling	0.177	0.187	0.206
Concentrating	0.057	0.059	0.062
Amalgamating	0.025	0.033	0.058
Neutralizing	0.045	0.046	0.046
Settling	0.053	0.055	0.055
Agitating	0.604	0.561	0.503
Experimental	0.102	....	....
Filtering-discharging	0.068	0.084	0.093
Assaying	0.046	0.045	0.063
Precipitating	0.074	0.110	0.120
Refining	0.098	0.183	0.203
Water service	0.098	0.112	0.110
Surface and plant	0.007	0.011	0.015
Steam heating	0.056	0.032	0.023
Watchmen	0.042	0.049	0.031
Storehouse and office	0.022	0.028	0.027
Stable	0.004	0.004	0.005
Lighting	0.021	0.018	0.019
Superintendence	0.062	0.067	0.082
General expense	0.012	0.012	0.009
Mill tools	0.002	0.003	0.005
Mechanical department	0.001	0.004	0.008
Electrical department	0.034	0.026	0.007
Return water service	0.010	....	....
Fire loss (machine-shop)	....	0.026	....
Mill total	2.013	2.131	2.040
Concentrate plant total	0.381	0.312	0.276
Total mill and conc. plant	2.394	2.433	2.316



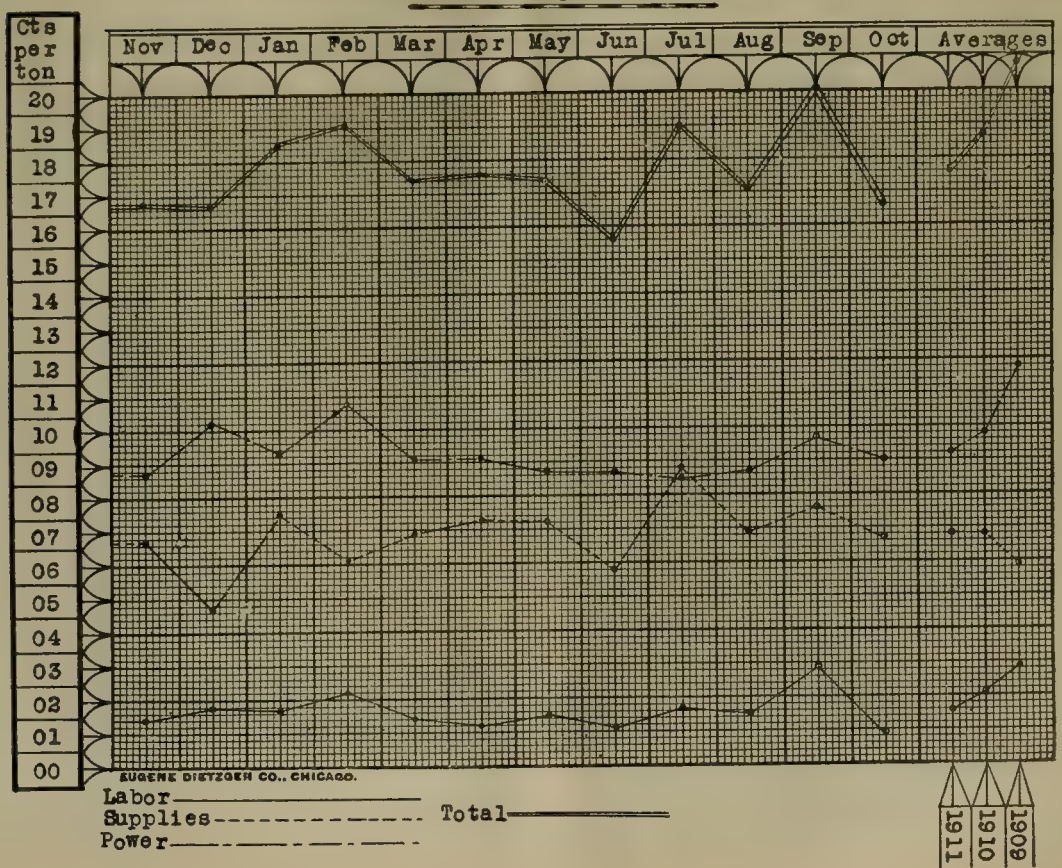

Percentage Time Run & Tons per Stamp
%
TONS
100
90
80
70
60
50
40
30
20
10
00
10
9
8
7
6
5
4
3
2
1
0
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Averages
EUGENE DIETZGEN CO., CHICAGO.
Per Cent Time Run
Tons per Stamp
1911
1910
1909

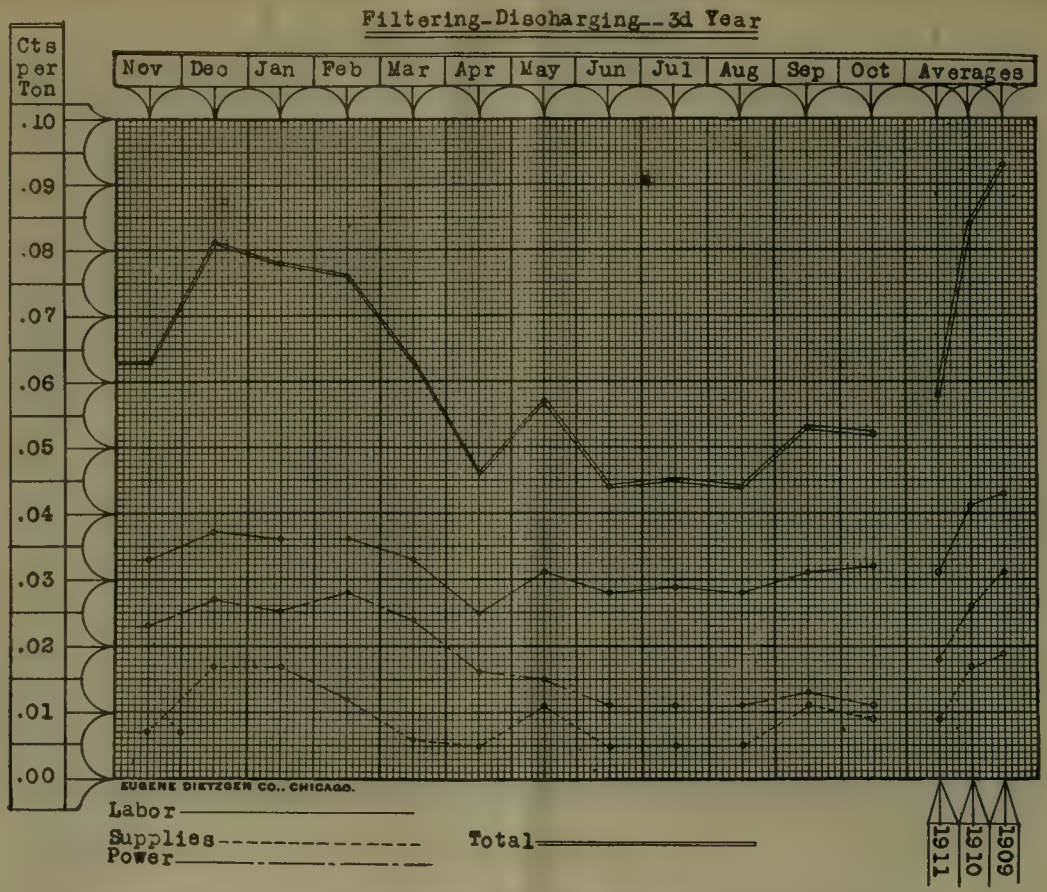

Precipitation--3d Year.
.13
.11
Cts per Ton
.10
.09
.08
.07
.06
.05
.04
.03
.02
.01
.00
Noo
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Averages
EUGENE DIETZGEN CO., CHICAGO.
Labor
Supplies
Total
Power
1911
1910
1909

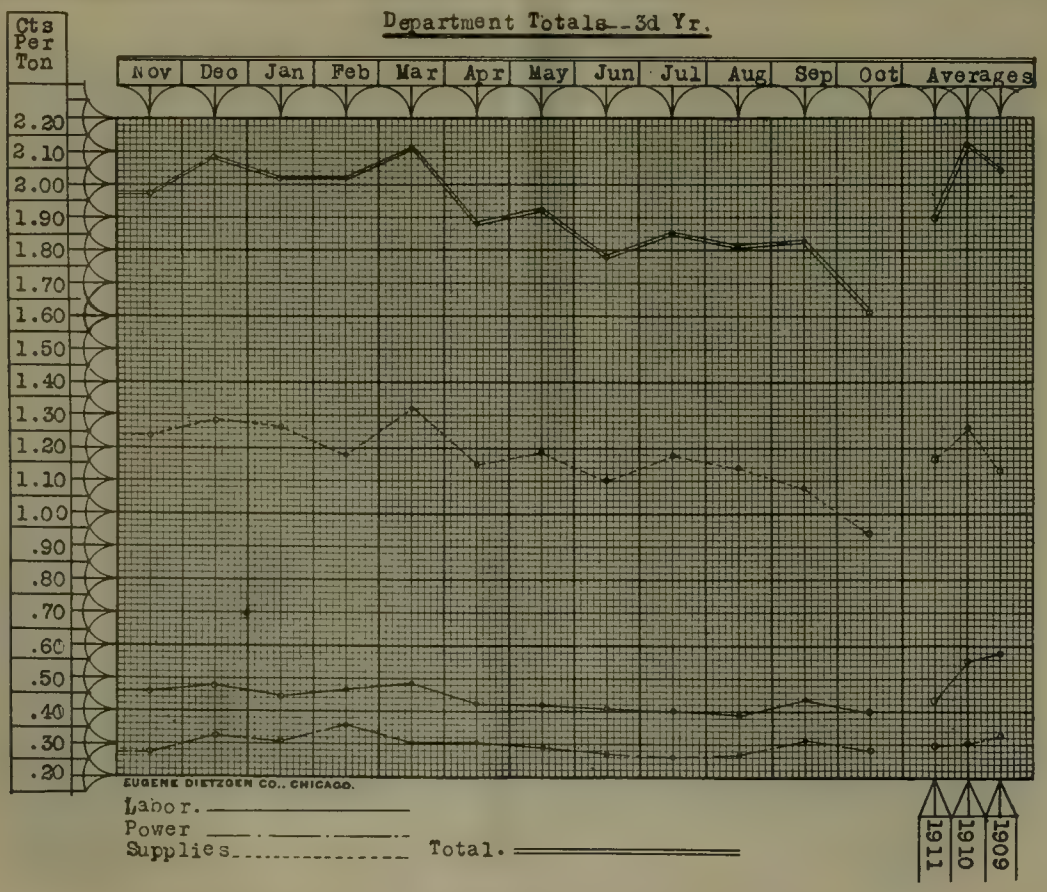
Chilian Milling--3d Year



Tube Milling -- 3d Year




Filtering-Discharging--3d Year
Cts per Ton
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Averages
.10
.09
.08
.07
.06
.05
.04
.03
.02
.01
.00
EUGENE DIETZGEN CO., CHICAGO.
Labor
Supplies
Power
Total
1911
1910
1909


Department Totals--3d Yr.
Cts Per Ton
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Averages
2.20
2.10
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
.90
.80
.70
.60
.50
.40
.30
.20
EUGENE DIETZGEN CO., CHICAGO.
Labor.
Power
Supplies
Total.
1911
1910
1909

Solution of Placer Gold and Silver

By Will H. Coghill.

It has been recognized for decades that the gold in placers is of a higher grade than the gold in the vein from which the placer gold came. Oviedo, early in the sixteenth century, commented upon this by saying: "It may be considered certain that in proportion as some washers are lower down than others, the gold will be of more carats or of greater value and fineness because the more the gold travels, the higher and finer the alloy; on the contrary, the nearer the gold is found to its vein or birthplace, the lower is its carat value." Recent publications show that there is no question about the 'fining' power of the stream, and observations in several localities show that the amount of fining varies with the distance the gold is moved. The most recent mention of the dissolving power of the stream is by W. Lindgren in Professional Paper No. 73 of the U. S. Geological Survey, in which considerable data are given, but on account of the great variation in localities no average is given to determine the amount of 'fining'. W. R. Crane[1] gives the average fineness of 800 placers and 200 quartz mines in California as 899 and 820, respectively. A calculation upon this basis would show that 107 parts of silver[2] was dissolved for every 1000 parts of gold present. But this is not all, for while the silver has been dissolving, the gold has also been yielding to atmospheric agencies, and the above ratio simply indicates that the silver has dissolved in advance of the gold.

Authorities seem to be pretty well agreed that the vein is the source of the gold in the sea. L. De Launay[3] says: "The percentage of the gold in the sea, for the most part, must come, like all the other substances contained in the sea, from long washing to which the materials derived from terrestrial erosion carried down by the water-courses to this 'universal sewer' have been subject." Lindgren says that silver has been dissolved, and it is understood, of course, that it was carried to the sea, else he would have suggested instituting a search for silver at some point along the river. De Launay assumes that the gold in the sea comes from the vein, but may I not go one step farther and assume that the silver in the sea comes also from the same vein, and expect to find the ratio of gold to silver in sea-water the same as the relative dissolving rate? The question now arises: What is this relative dissolving rate? It is known only that the silver dissolves in advance of the gold, as shown in data mentioned above. Let us assume that this alloy is 800 gold and 200 silver. Now if this relative dissolving rate were 8 to 2, there would be neither enrichment nor impoverishment in the placer; but since there has been an enrichment, it is plain that the ratio of gold to silver in sea-water must be less than 8 to 2, providing no precipitation has taken place. This introduces a subject upon which geologists have written much—that is, the origin of gold and silver in sedimentary deposits. F. Posepny[4] says: "As to primitive ore contained in marine sediments and precipitates, innumerable chemical analyses, especially of limestone, have failed to show the metallic traces which, according to the above hypothesis (showing that others take a different view) should be present." On the other hand, Bischof is inclined to consider hydrogen sulphide the precipitating agent resulting in the formation of lead and silver sulphides in the sedimentary rocks of the kupferschiefer, and says: "Since it cannot be doubted that the rivers flowing into the ocean bring with them metallic salts, though in very dilute solution, it seems a wise arrangement that in the hydrogen sulphide of sea-water a precipitant is presented to throw down the small minima, and thus to prevent a gradual accumulation of substances." Many discussions can be cited in which the possibility of the segregation of gold and silver on the floor of the sea is the theme, and they go to show that an unsolved problem in ore deposits is involved. After so many discussions regarding the possibility of an enrichment due to precipitation taking place in sea-water, it indeed comes as a great surprise to learn that, according to the 'Encyclopedia Britannica',[5] no officially authorized determination of gold in sea-water has ever been made. The statement there made by H. R. Mill and Otto Krummel is as follows: "No quantitative determination of gold in solution in sea water is available. Sonnstadt detected gold by means of a color test and roughly estimated the amount as 1 grain (65 mg.) per ton, and on this estimation all the projects for extracting gold from sea-water have been founded." This statement is not entirely correct, because it is said that Liversidge made numerous tests off the coast of New South Wales and found between 30 and 65 mg. gold per ton. Some Frenchmen, about fifty years ago, estimated the silver at 10 mg. per ton. It would, of course, be ridiculous to assay sea-water to determine how many million tons of gold there are in the sea, or how many gold dollars will be put in circulation by the propeller of a boat while going from San Francisco to Japan, but the determination of the ratio of gold to silver would be an advance along scientific lines. For instance, the development of an abnormal amount of hydrogen sulphide in the Black Sea has been noted. Is there any indication that it has precipitated either gold or silver? If their ratio does not approximate that in which they exist, where there is an absence of sulphuretted waters, or better yet, if the ratio does not approximate the relative dissolving rate, which is between 0 to 2 and 8 to 2, then apparently there has been a precipitation.

It seems more than strange that the assay for gold has not been made when one considers what a simple matter it is. Assuming that Sonnstadt's estimate of 65 mg. per ton is correct, 0.005 tons of solution, or 10 lb. tested, would be ample, as it would give a gold bead weighing 0.32 mg. The solids precipitated by evaporating 10 lb. would amount to 3.5% or 0.35 lb., equal to 158 gm., which could be fluxed with perfect ease, since it consists principally of sodium chloride. Such an investigation would be purely scientific, and one would not dare to predict that it would be of aid to the taxpayer, but our own Government has conducted many investigations of such nature—for instance, 'the force of gravity'—and also has carried on very expensive 'precise leveling', and is establishing bench marks in the farmers' fence-corners.

The voyage of the *Challenger* was without parallel in the history of scientific research. The staff of investigators contained specialists of every branch of science. Dittmar analyzed 77 of their samples and only mentions gold and silver, having made no quantitative test. He states that silver has been found on the copper bottoms of ocean ships; that Sonnstadt has identified caesium, rubidium, and gold in sea-water, and that C. Schmidt succeeded in determining rubidium quantitatively. One would infer from the last statement that the quantity of gold was too small for a quantitative test; this is radically different from Sonnstadt's determination. Such discrepancies or absolute lack of data indicate recklessness on the part of De Launay in his 'World's Gold' where he estimates the thousand million pounds of gold in the whole seas. If the data for which I ask are valueless, I say, then, that those who have used the figures now available as a basis of calculation and conclusions have played with figures and theories that are probably untrue, and of no value if true.

In summing up, I can state three good reasons for a series of accurate assays of sea-water: (1) It would help to give some idea as to the relative dissolving rate of gold and silver in placers; (2) comparing the data from one sea with those of another might shed some light on the theory of ore deposits; (3)—and possibly not least—it would likely put a quietus on the wily promoter who bobs up at regular intervals altogether too often, and sells stock on a new process for extracting gold from sea-water.

[1] 'Treatise on Gold and Silver,' p. 162.

[2] This is not exactly correct, as it is known that about 4% of the dissolved material consists of base metals.

[3] 'The World's Gold,' p. 76.

[4] 'Genesis of Ore Deposits,' p. 122.

[5] Eleventh Edition, Vol. XIX, p. 977.

Gold Mining in 1911

By H. D. McCaskey

The gold-mining industry was generally active in 1911, but early figures indicate a total production for the United States and Alaska slightly below the output of 1910. The most notable features of the industry in 1911 were the resumption of normal labor conditions in the Black Hills of South Dakota, the increased dredge output in California, development of production in the new Innoko-Iditarod placer region of Alaska and the Republic district of Washington, continued development and prosperity of the great Goldfield (Nevada) and Treadwell (Alaska) mines, normal conditions also on the Mother Lode in California, improvement in metallurgical methods, and general increase in activity at many small deep and placer mines. Renewed interest in prospecting was shown in Colorado, although the gold output of the State decreased, owing to the gradual exhaustion of several large orebodies and to continued small decrease in production from the great Cripple Creek camp.

In addition to the yields from placers and silicious and pyritic gold ores, notable contributions to the gold production were made from copper, lead, and mixed ores, particularly in Utah and Arizona, the mining of which was also generally prosperous in 1911. Notwithstanding a decreased output of copper in some States, due in part, as in Montana, to prearranged curtailment, the total production of copper was greater in 1911 than in any previous year except 1909. The output of lead and of mixed ores was also notably heavy in 1911.

Preliminary figures of the Director of the Mint* indicate a total domestic gold output of $96,233,528 in 1911, against $96,269,100 in 1910. Information from the mines, however, indicates that final figures of production and of exports of ore smelted in British Columbia and Mexico will show increases in gold output from Alaska, Arizona, and Washington.

The great bulk of the gold production from deep mines is derived from ore treated at gold and silver amalgamation mills and cyanide plants, a much smaller quantity being produced by smelting crude ore and concentrate. Nearly a quarter of the total output is still coming from gravels of placer mines, mainly by dredging in California and drifting in Alaska.—U. S. Geol. Survey *Press Bulletin.*

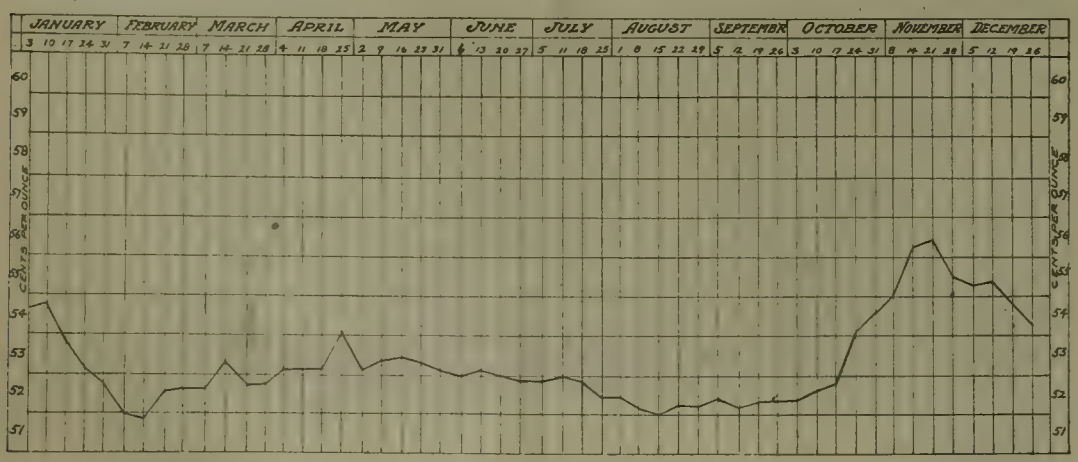
*Published in *Mining and Scientific Press*, January 6.

Silver Production in 1911

The silver-mining industry as such is of relatively small importance in the United States, according to H. D. McCaskey, of the U. S. Geological Survey, but the domestic silver production, depending largely on the output of gold, silver-gold, copper, and lead ores, is equal in value to that of lead or zinc. Owing largely to the prosperity of the gold, copper, and lead-mining industries, there was an output of silver in 1911 estimated at 57,796,117 fine ounces, which is 2,182,997 ounces more than the average annual output of 55,613,120 oz. of the preceding decade, and 658,217 oz. more than the output of 1910. Aside from the important production from the milling of the silver-gold ores of the mines at Tonopah, Nevada, the bulk of the silver output is derived from the smelting of crude copper, lead, and mixed ores and concentrates, chiefly from Montana, Utah, Colorado, Idaho, and Arizona and California. According to the Mint figures, the production increased from all these States except Montana, Arizona, and Colorado. In Colorado the production of all metals except zinc decreased. Increased copper production in Alaska added notably to the silver output of that Territory. Final figures will probably show increased production of silver from Arizona instead of a decrease, and possibly little change in California. Preliminary figures compiled by the Director of the Mint, and published in the *Mining and Scientific Press* January 6, indicate a total domestic production of silver of 57,796,117 fine ounces in 1911.

The average price of silver in 1911 was 53c. per fine ounce, a decrease of 1c. from that of 1910. The year began with silver near 54c., but the price declined to 52c. in February and fluctuated between 52 and 54c. until November, when it rose sharply to about 56c., declining to an average of 55c. for the closing month of the year. The course of silver prices through the year is shown in the accompanying figure. Speculation, chiefly in the Indian and Chinese markets, was the cause of the rise, and with the present disturbed conditions in the Far East the market may remain uncertain for some time.

According to estimates made by the Bureau of Statistics, the imports of silver in 1911 were valued at $27,450,000 in foreign ore, $12,850,000 in foreign bullion, $2,150,000 in United States coin, and $1,350,000 in foreign coin—a total of $43,800,000. The exports of silver during the same year were valued at $135,000 in domestic ore, $65,000 in foreign ore, $59,000,000 in domestic bullion, $4,750,000 in foreign bullion, $100,000 in United States coin, and $600,000 in foreign coin—a total of $64,650,000, or $20,850,000 in excess of the value of the imports. In 1910 the value of the excess of exports over imports of silver was $11,482,805; in 1909 it was $11,404,607, and in 1908 it was $9,613,541. Previous to 1908 it had not been below $15,000,000 for several years. The imports of silver in 1911 were, as usual, chiefly in ore and bullion and came mainly from Mexico and Canada. The exports were almost wholly in ore and bullion, and went as usual chiefly to the United Kingdom and in smaller amounts to Hongkong and France.



SILVER PRICES IN 1911.

The Nevada Hills Mill

By W. A. Scott

The new concentrating mill and cyanide plant of the Nevada Hills M. Co., at Fairview, Nevada, was put in operation September 15, 1911. It has a rated capacity of 150 tons per day and is gradually being brought up to the tonnage. There is a descent of 120 ft. from the crusher floor to the sump floor, there being eight levels, occupied as follows: (1) crusher and elevator; (2) mill-bin and stamp batteries; (3) classifiers and concentrators; (4) tube mills; (5) collecting and thickening tanks; (6) dilution and decantation tanks; (7) treatment tanks and filters; (8) heating plant and sump. The building, set on foundation and retaining walls of reinforced concrete, is constructed of steel, and has a covering of asbestos-lined corrugated iron, making it practically fireproof. The ore is drawn from the mine-bins over grizzlies to a 12 by 20-in. Hercules crusher, by which a sufficient tonnage is crushed in 8 hours to supply the mill for 24 hours. The crushed ore is raised to the top of the mill by a 12-in. bucket elevator, and it passes thence by gravity through an automatic sampling plant and automatic weigher into a 600-ton steel-frame ore-bin immediately above the stamp batteries. It is drawn from the bin through four Hutchinson automatic feeders, by which it is fed to the four 5-stamp batteries of 1250-lb. stamps, and these are operated in two 10-stamp sections,

NEVADA HILLS MILL.

each driven by a 35-hp. motor, belted to a cam-pulley at the centre of the section. The four mortars, weighing 12,000 lb. each, are made with narrow boxes, and designed for rapid discharge. Each mortar is anchored to a concrete foundation by seven $1\frac{3}{4}$-in. bolts of Norway iron. Each battery as a unit is designed for heavy duty, the pulp being discharged through 20-mesh screens. The present method is to pass the crushed ore from the batteries to classifiers, the fine going to 14 Deister tables, and the coarse to two 18-ft. tube-mills, 5 ft. diam.; but it is now understood that a Chilean mill is to be provided for regrinding the coarse from the classifiers, and the product of the Chilean mills is to pass through an Akins classifier, the fine from which is to be concentrated over Deister slime-tables, the coarse to be reground in the tube-mills. The tube-mill product is then to be classified by an Akins machine, the slime from which is to pass to two Dorr thickening tanks, the sand to be returned to the tube-mills for further pulverization, making a closed circuit that will permit no material to pass to the thickening tanks till it has been reduced to the requisite degree of fineness. The thickening tanks, which are 34 ft. diam., 12 ft. high, are supplied with overflow launders and heavy Dorr thickeners; the thickened pulp flows to a mixing-box, where lime-water is added, and it passes thence to nine agitating treatment tanks, each 12 ft. diam. and 32 ft. high, the clear overflow from the thickening tanks being returned by a 6 by 8-in. triplex pump to a 50,000-gal. tank near the mill. The standardized solution is put in the first treatment tank, the nine tanks being arranged in series for continuous agitation. The pulp undergoes 42 hours treatment from the time it enters the first tank until it is discharged from the last. A 10 by 12-in. duplex low-pressure Ingersoll-Rand air compressor is in use for supplying air for agitation and aeration. The pulp passes from the last treatment tank through three dilution tanks, 34 ft. diam. and 12 ft. high. These are provided with overflow launders and Dorr thickeners, so arranged that the overflow from one tank passes into the next tank below it. Barren solution from the zinc presses is added in the first tank and mixed through it by the Dorr thickeners, by which the solution is diluted. The overflow, after passing to the succeeding tank, is given treatment similar to that in the first, the treatment being automatic and continuous through the three tanks; the thickened pulp is drawn off at the bottom of the last tank and transferred to the stock tank, 30 ft. diam. and 12 ft. high, equipped with a Trent agitator.

The rich solution overflowing from the last tank is passed through two 36-in. 40-frame Perrin clarifying presses to three precipitating tanks, into which zinc-dust is added by a Merrill zinc-dust feeder; the solution is then delivered by two triplex pumps to two Merrill precipitating presses, each of 300 tons capacity, situated in the refinery building. The barren solution from these presses flows to two solution tanks, from which it is drawn off and standardized.

The pulp in the stock tank, above mentioned, is drawn to two Oliver continuous filters, each 11 ft. 6 in. diam. and 12-ft. face, the filtered and washed residues discharging upon a 14-in. belt tailing-stacker 200 ft. long, running at an inclination of 20°. Vacuum for the filters is maintained by two 14 by 14-in. belt-driven vacuum pumps.

The late John B. Fleming, who designed and directed the construction of the plant, made the following statement in his report to the company: "Inasmuch as concentration, when preceding cyanidation of silver ores, is being abandoned in many cases, it should be stated that there is in this mine a large tonnage of oxidized ore containing manganese dioxide so combined with silver as to make a combination that does not yield to cyanide treatment, and concentration must be adopted to remove this mineral. When the oxidized ore is exhausted concentration probably can be abandoned."

The water supplied for mill work is pumped from the mine by two Gould's triplex pumps, each having the capacity of 100 gal. per minute, and each of which is driven by a 40-hp. electric motor. The property is being operated under the management of E. A. Julian, with J. W. Hutchinson as consulting engineer.

Paragenesis of Zeolites

By J. Volney Lewis

*Zeolites and other secondary minerals occur in the Newark igneous rocks of New Jersey: (1) in cavernous spaces in the ropy pahoehoe of the extrusive Watchung basalts; (2) in fault fissures and fault-breccia of both the basalts and the great intrusive sill (Palisades, Rocky Hill, and Sourland mountains); (3) less commonly in the ordinary joint cracks of both the extrusive and the intrusive types. The rocks are practically the same in both chemical and mineral composition, consisting essentially of pyroxene and plagioclase feldspars, with quartz-bearing and olivine-bearing facies. The zeolites and related silicates are essentially combinations of the feldspathic elements and water, with the addition of fluorine in apophyllite and boron in datolite; the accompanying amphibolite, biotite, chlorite, epidote, serpentine, and talc are derivatives of the pyroxenes. Hypotheses of origin dependent on the action of meteoric waters are inapplicable on account of difficulties of circulation, deoxygenation, and sources of fluorine and boron; on the other hand, contact metamorphism by the intrusives has produced in the adjacent shales minerals into which fluorine and boron enter, presumably by emanation from the magma. Hence magmatic waters are regarded as the most probable agent in the formation of the zeolites and accompanying minerals.

*Abstract of paper read before the Geological Society of America.

A Nickel Deposit in the San Poil Mining District, Washington

By Howland Bancroft

General Statement

*A reconnaissance survey of the ore deposits of northeastern Washington was being carried on by myself during the field seasons of 1909 and 1910, during which time a great many of the properties in this part of the State were examined. The following notes on an ore deposit in the San Poil mining district are presented prior to the publication by the U. S. Geological Survey of the bulletin on the ore deposits of this part of the State because of repeated requests for information on this particular locality.

Nickel ore occurring in a deposit in the San Poil mining district has been exposed by the various workings on the Congress property. This prospect is situated on the north side of Bridge creek, 3½ miles east of the San Poil river, the camp being at an elevation of 2500 ft. A rough wagon-road has been built from the main San Poil road to the deposit. Republic and Wilbur are about equidistant from the property, the former being a little west of north of the camp, and the latter a little west of due south, the distance by wagon-road from either railroad station being about 30 to 35 miles. The building of a railroad down the San Poil has been talked of for some time, and if completed will make the deposits much more accessible. Timber and water are plentiful in the immediate vicinity of the prospect.

Developments on the property consist of five adits, together with drifts and cross-cuts on and to the vein, and a shallow discovery-hole, totaling about 1500 ft. of underground workings. The levels are separated from each other by vertical distances of from 50 to 100 ft., and the deposit has been explored through a vertical range of approximately 300 ft. The work has been done by hand, no machinery having been installed. Shipments are not reported from the prospect. The workings are on a northeast trending offshoot of a ridge which projects southeasterly from the principal mountain mass, and slopes rather precipitously down to Bridge creek, about 1000 ft. below the crest of the ridge.

Geology

Schistose rocks of both sedimentary and igneous origin, showing considerable dynamometamorphism, constitute the principal part of the geologic section exposed in this locality. These rocks are believed to be of Paleozoic age and have been intruded by a large dike of quartz monzonite porphyry, which is exposed on the southern slope of the main ridge at an elevation of 2900 ft. This intrusive is thought to be of Mesozoic age, although it is impossible to prove that it is. Lava flows, probably of Tertiary age, cap some of the ridges, and in places extend down to the level of the valleys in the Bridge creek vicinity.

The schistose rocks have a general northeast strike, and they dip northwest at angles varying from 45 to 90°, and are composed of apparently conformable strata of amphibolitic schists with interlaminated lime shale, quartz mica schist, and a rock which resembles sheared granite. Strata of limestone and quartzite are also included in the series. As the soil covering and underbrush do not permit continuous observations of the geologic section, it is impossible to give the thickness of the various formations which, taken as a unit, probably exceed several thousand feet. Faulting is pronounced in the schistose series, and shear zones of some magnitude were seen in the workings of the Congress property. The principal faults appear to have taken place in a direction parallel to the lines of foliation in the schists, that is, in a northeast-southwest direction.

The amphibolite has probably resulted from the dynamometamorphism of a basic rock having the composition of a gabbro or related rock magma, intruded into the sedimentary series of limestone, shale, and quartzite prior to the metamorphism of the area. The amphibolite is light green in color and is composed essentially of tremolite. The lime shale and limestone are fine grained and of a dark-gray color, the former representing a more or less impure platy limestone. Veinlets of siderite are present in the limestone. The quartzite is a fine-grained, grayish white rock showing distinct schistose structure. The rock, which now resembles sheared granite, is of a yellowish brown color and is locally distinctly schistose, especially so where it forms the foot-wall of the deposit in the Congress workings. This rock contains phenocrysts of white mica with some biotite and much talc. Magnetite, barite, and epidote are present in the rock near its contact with the schists. The intrusive quartz monzonite porphyry probably extends over a large territory and offshoots from the main dike are no doubt present in various parts of the schistose series. This rock has typical porphyritic texture, is of a general gray color, and contains phenocrysts of andesine and orthoclase feldspar with some biotite and quartz in a cryptocrystalline groundmass. Epidotization has accompanied the porphyry intrusion, and the limestones contain large quantities of epidote with which is associated magnetite and tremolite, the latter in places along shear zones being asbestiform.

Ore Deposit

The deposit occupies a shear zone or fault plane in the schistose series, and consists of a quartz vein varying in width from 6 to 23 ft., which has a strike varying from N.50°E. to N.70°E., and a dip of 45 to 90° northwest. The strike and dip of the vein conform to the planes of schistosity of the enclosing walls. The quartz vein filling is of a bluish white color, is fine grained and compact, and has been so jointed that cubical and rectangular blocks measuring from a fraction of an inch up to a foot or more have resulted. The portion of the vein explored by the Congress workings is somewhat cellular, the small vugs present being filled with quartz crystals and some malachite. Talc and barite are present and form a small part of the vein filling. Sparsely scattered through the quartz are small veinlets and aggregates of pyrite associated with some chalcopyrite. These veinlets of pyrite vary in width from a fraction of an inch up to an inch or more in places, and the quartz impregnated with sparsely scattered aggregates of pyrite may extend over a larger portion of the vein. The pyrite is nickeliferous, and where oxidation has been active the sulphides have been altered and their oxidation products have been deposited as a thin film along the joint planes and fractures, and in fact along all the openings in the quartz veins. Limonite, malachite, and a carbonate of nickel are present as thin films with the result that the whole vein is discolored, the predominant color being reddish brown with scattered patches of light and dark green.

The following samples were taken by myself to determine the approximate average tenor of parts of the vein and the results of assays in this material should not be taken as indicative of a thorough sampling of the property, such sampling being quite beyond the scope of the work of the U. S. Geological Survey. A sample of a cross-cut of the vein in the lowest or No. 1 level, 390 ft. from the portal of the adit and taken 90 ft. beyond the intersection of the adit with the vein (at this place 23 ft. wide) contained[1] 0.170% nickel and 0.013% cobalt. On the No. 2 level, where the vein is cut 40 ft. from

*Published by permission of the Director of the U. S. Geological Survey.

[1]Analyses for nickel and cobalt were made by J. F. Fairchild of the U. S. Geological Survey. The determinations for gold and silver were made by Ledoux & Co. of New York City.

the portal of the adit and then driven on for a distance of 160 ft. or more, a sample of 14 ft. of the vein was taken along the drift. The sample contained 0.246% nickel and 0.034% cobalt. A cross cut at the end of this drift shows the vein to be approximately 32 ft. wide at that place. A third sample was taken in No. 3 level in a crosscut on the vein 90 ft. from the portal, where the vein is encountered. This sample extended across 20 ft. of the vein from the hanging wall toward the foot wall, and contained 0.120% nickel and 0.016% cobalt. The silver and gold content of the three samples was determined from a composite sample of the three. The results of this assay[2] show the presence of 5.5 oz. of silver to the ton and a trace of gold. A picked specimen of sulphide ore containing chiefly pyrite was analyzed for nickel and cobalt by J. F. Fairchild and was found to contain 5.71% nickel and 0.35% cobalt.

In the oxidized ores the nickel content is low, while the picked specimen of sulphide ore revealed the presence of over 5% of nickel. In view of these facts, there seems to be some possibility that this deposit may be profitably worked below water-level where oxidized material would be practically absent and where sulphides should predominate. Because of the scanty distribution of the nickel-bearing sulphide ores in the quartz vein, the ore would of necessity have to be concentrated for successful and profitable operations. The ore deposit has probably been formed by solutions accompanying the intrusion of the quartz monzonite porphyry, which intrusion has caused more or less contact metamorphism in the adjacent rocks, the evidence of which is the presence of magnetite, epidote, and barite, in the contiguous strata.

Smelter Charges in Utah

The bulk of the silver-lead ores shipped from Tintic district, Utah, to the smelters in Salt Lake valley pay a treatment charge of about $1.50 to $2.50 per ton, based on a certain content of lead, usually 10%. If the lead content is below 10% there is an additional charge of 8c. per unit, and if above 10% there is a credit of 5c. per unit. A charge of 12c. per unit is made on all silica, of which Tintic ores carry 60 to 80%. The shipper is debited with 25c. per unit for sulphur, 30c. per unit on all zinc over 8%, and 50c. for speiss, consisting mostly of arsenic and antimony. Iron is paid for at 10c. per unit, and in settling for the copper in lead ores the smelters first deduct 1.3% from the assay value, and about 5c. per pound from the market price on cathode copper; that is, copper in lead ore running less than 1.3% is not paid for. The producer is paid for 90% of the lead content, less 1¼ to 1½c. per pound deducted from the market price for transportation and refining of bullion. He is paid for 95% of the silver at New York prices. Based on the foregoing figures it is apparent that producers of Tintic ores pay a treatment charge of $8 to $10 per ton.

Most of the Park City operators pay the smelters a flat rate of $10 to $12 per ton, the transportation charge being $2 per ton on crude ore and concentrate. Settlements for lead, silver, and gold in the ore are the same as those applicable to Tintic ores. Copper in Park City silver-lead ores is paid for at 5c. per pound less than the New York price, after deducting the difference between the wet and dry assay. Zinc is an important factor in the lead-silver ores of Park City, and the entire product shipped is in the form of concentrate. Most of it is shipped to Colorado and Kansas plants. Apparently the zinc situation has undergone some changes within the past seven months, and some of the zinc producers complain of exacting conditions under which zincblende concentrate is now marketed. Such a product, sampling 40% zinc, 4 to 5% lead, and 8 to 10 oz. silver, with spelter at 5c. per pound in St. Louis, is sold f.o.b. Park City at $10 to $12 per ton. A penalty on lime is charged, and there is also a penalty if 50% of the concentrate runs finer than a certain mesh. There are no credits for zinc, nor gold, of which there is a small amount. The only mine in Park City district the ores of which are not treated on the flat rate basis is the Daly Judge. Its lead silver ore, both crude and concentrated, is hence shipped to the International plant, the treatment charges being figured on the silica and iron basis.

A considerable tonnage of silver-lead-zinc ore is received at the Midvale mill of the United States S. R. & M. Co. In settlement for this the producer is paid $20 per ounce for 90% of the gold; he is paid market price for 80% of the silver, 80% of the lead, less 1½c. per pound; 60% of the iron at 6c. per unit, and 30% of the zinc content at 2c. per pound. He pays a treatment charge of $3 per ton, a roasting charge of $1.50 per ton, and is charged for 10% of the silica at 12c. per unit.

[2]See previous footnote.

Power Development in Mexico

In 10 months of 1911 the Mexican Light & Power Company, owning the big Necaxa power-plant and supplying El Oro and Pachuca, had gross earnings of ₱5,793,852, and net earnings of ₱3,892,412. Its subsidiary, the Pachuca Light & Power Company, in the same period had gross earnings of ₱962,009, and net earnings of ₱597,452. The power-furnishing capacity of the Guanajuato Power & Electric Company has been doubled by the completion of a third hydro-electric plant, on the Angulo river in Michoacan. The company has just closed a contract for the building of a 50-mile transmission line from Guanajuato to the Pozos district of that State to supply the important Angustias Mining Company. The Chapala Hydro-Electric & Irrigation Company has completed, at a cost of over ₱3,000,000, a 12,000-horsepower plant at Puente Grande, on the Santiago river, 15 miles from Guadalajara. This plant will now supply the transmission line extending to the Etzatlan and Hostotipaquillo mining districts of Jalisco, and any other lines that may be built. Notwithstanding a scarcity of labor during a part of the year as a result of the revolution, the Mexican Northern Power Company has made good progress in its important power project on the Conchos river in the State of Chihuahua. For several months, more than 1000 men have been at work. The company is already ascertaining power needs in the Parral, Santa Barbara, Naica, Santa Eulalia, and other mining districts. The first half of the year saw the completion of a transmission line from the Copper Queen smelter at Douglas, Arizona, to the Lucky Tiger mine in Sonora, a distance of 72 miles. A concession for a hydro-electric plant to supply power in the Zimapan mining district of Hidalgo has been granted Mr. Andrew Mackenzie, representing Canadian capital.

Natural and Portland Cements

Natural cements differ from portland cements in the following important particulars, according to E. F. Burchard, of the U. S. Geological Survey.

Natural cements are not made from carefully prepared and finely ground artificial mixtures, but from natural limestone rock. They are burned at a lower temperature than is portland, the mass in the kiln never being heated high enough even to approach the fusing or clinkering point. Natural cements, after burning and grinding, are usually yellow to brown in color and light in weight, having a specific gravity of 2.7 to 3.1—that is, the cements weigh 2.7 to 3.1 times an equal volume of water. Portland cement is commonly blue to gray in color and heavier, its specific gravity ranging from 3 to 3.2. Natural cements set more rapidly than portland cement, but do not attain so high tensile strength. Portland cement is a definite product, its percentages of lime, silica, alumina, and iron oxide varying only between narrow limits, while brands of natural cements vary greatly in composition.

New Placer Districts in Alaska

By A. H. Brooks

*In the summer of 1911, some placer gold was found near Red mountain, on the headwaters of the Indian river, which is in the Koyukuk River drainage basin. There are said to be about 50 men prospecting in this region, and a little placer gold was mined. The auriferous gravels of the Nowitna River region also excited some interest in 1911, though no important discoveries are reported.

The Ruby Creek region of the Yukon attracted renewed interest in 1911. Ruby creek is a small stream flowing into the Yukon from the south opposite the mouth of Melozitna river, about 200 miles below the Tanana. Gold was found in the Ruby creek gravels in 1907, and since then there has been a little productive mining each year. Considerable excitement was caused among the Yukon miners by the reported discoveries during the summer of 1911 of rich placer in some creeks located in this general region and 20 to 30 miles from the Yukon. As a consequence, there was a general movement toward the new find from the Yukon camps. These discoveries of placer gold were made in the headwater regions of Solatna river, which heads on the south side of the Ruby Creek divide and flows northeastward to join the Nowitna, a southerly tributary of the Yukon. The creeks reported to carry gold are Glenn and Birch, both tributaries of Flint creek, and Long creek. No detailed information regarding the extent or value of these placers is at hand, but it is certain that there has been as yet no production of gold which warranted the large influx of population. On the other hand, it is known that there is a considerable area lying south of the Yukon, in which the bedrock is the schist and intrusive granite typical of most of the Yukon placer district, and that alluvial gold has been found at a number of places within this area.

Stage Milling and Fine Grinding

Double-stage milling continues as popular as ever on the Rand, and all the new mills include it, although it has been claimed that the New Kleinfontein single-stage ore reduction costs are about a shilling per ton less than those of the East Rand Proprietary and Crown Mines, where enormous sums have been spent on capital account in order to increase the percentage of extraction. It is urged in various quarters, that this extra expenditure and outlay are not in all cases compensated by the slight resulting improvement in the total recovery. Mr. Stadler, who is connected with the Mines Trials Committee of the Chamber of Mines, has during the year also expressed the opinion that the extended use of tube-mills on the Rand seems to have unconsciously led in a few instances to fine grinding, quite beyond the economic or payable limit. Any grinding beyond a certain point, he points out is unnecessary, because it not only fails to assist, but may tend to impede the recovery of the gold, and at all events it is urged that naturally a high total extraction alone should not be aimed at without paying full attention to the cost incurred in obtaining such increased extraction.

Western Coal Production

According to E. W. Parker of the U. S. Geological Survey, the production of coal in most of the Rocky Mountain States decreased in 1911 about 10%, compared with 1910. The reduction was due primarily, first, to an unusually mild winter in 1910-11; second, drought in the agricultural States west of the Mississippi river, which caused large reduction in the demand for domestic purposes in South Dakota, Nebraska, Kansas, Texas, and Colorado; third, a decreased consumption of coal in locomotives on account of the reduced traffic on practically all the Western railroads; and, fourth, the resumption of coal-mining operations in the Central and Southwestern States which had been suspended during the strike of 1910. This strike in the Middle West had created an abnormal demand upon the coal mines of the Rocky Mountain States, particularly in Colorado and New Mexico. The car supply was satisfactory throughout the year, as was also the labor situation, except in the district north of Denver, in Boulder county, where a strike has been in progress since April 1, 1910. The mines of this district are being operated with non-union labor.

On the Pacific Coast conditions were not materially different in 1911 from what they were in 1910. The production of oil in California continued to be the dominating factor and probably will remain so for some years to come. The enormous production of this cheap and desirable fuel will probably have the effect of retarding the development of the Alaskan coalfields, as well as of other fields along the Pacific Coast.

*From preliminary review of the year published in U. S. Geol. Surv. *Press Bulletin*.

Siberian Mining Outlook

Owing to lack of rain in several parts of Siberia, not only has there been a failure of crops that will result in severe famine during the coming winter, but placer-mining operations were curtailed to a considerable degree in the Lena, Nerchinsk, and upper Amur regions. While the shortage of water did not seriously affect the large producers, small-scale operators depending upon seasonal rainfall to wash alluvium were much hindered, and the lessened output of gold in aggregate is considerable.

According to recent reports from the Anadir district, which is in northeast Siberia opposite Nome, some rich placers have been worked, but on a small scale, and only by hand. Much of this work has been done by *khischniki*, Russian bar 'snipers' or 'fossickers', who have mined in territory not open to location. There have been several arrests for illegal mining, and three *khischniki* were convicted and sentenced, at Vladivostok, to one year's imprisonment. The circumstance that men will not only take the chances inevitable to mining in such inaccessible region, but will also risk imprisonment, may be taken to denote either the belief in rich placers, or perhaps is an instance of the lure of gold, particularly when occurring in distant and difficult places.

Jafet Lindeberg and his associates attempted to exploit this region under concession from the Russian Government, but through difficulties seemingly due to the terms of the concession, discontinued their work.

Mining in Western Nicaragua

The Los Angeles mine, under option to Bewick, Moreing & Co., has been returned to the owner, F. Kaufman, of Libertad. The Javali mine, I. O'Reardon, manager, is installing 9 or 10 more stamps and additional cyanide plant. The San Juan, Ignacio Suarez owner, is erecting a 22-ton capacity (leaching) cyanide plant. The Cedro mine, owned by Porter Bros., still continues in rich ore. The Costa Rica, which was to be examined by Messrs. Proctor and J. M. Nicol still continues operation under the owner, as the former became ill while at Juigalpa and returned to the Pacific Coast. H. F. Lefevre, assisted by Mr. Hood, spent several weeks in the district in September, looking over properties for New York interests. The Esmeralda mine, Alfonso Hurtado owner, is producing steadily. In rank of importance the chief producing mines are Babilonia, Pedro, Esmeralda, San Juan, Costa Rica, El Carmen, Chamorro, and others.

L. Vogelstein & Co. report the following figures of German consumption of foreign copper for the months of January to November, 1911: Imports of copper, 176,524 tons; exports, 8429 tons; consumption, 168,095 tons. Consumption during the same period in 1910 was 157,087 tons. Of the above quantity 155,677 tons was imported from the United States.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

When Initial Profits Guide Wrongly

The Editor:

Sir—The greatest mistake made by many mining companies is the disbursement of big dividends when ore reserves are inadequate. Scores of companies have been ruined by such a policy, often encouraged thereto by the insistent clamors of stockholders for early profits. To pay big initial dividends, many managers have depleted their ore reserves, juggled with clean-ups, and otherwise damaged the property. It has not always been the fault of the manager the directors demand early profits and force the hand of the manager. In other instances, unscrupulous companies have encouraged such tactics in order to promote heavy stock sales. When the company had disposed of its stock to a gullible public, the promoters retire from its affairs - leaving the shell of a once prosperous property in the hands of the new owners. This feature of the industry is one most difficult to guard against, particularly when investors happen to be of small means. The interested people, living widely apart, are not in a position to obtain any information apart from that given out by the manager—and too late they realize the deception practised upon them. The greatest safeguard appears to be the examination of the property by competent engineers, and publication of reports sufficiently comprehensive to cover completely the all-important question of future sources of revenue.

Too often have rigorously honest mining companies wrought their own ruin by the desire to disburse immense profits at an early period of their career. Such dividends could not be long maintained, and with the inevitable crash a still good mine was condemned beyond hopes of redemption, as far as the owners were concerned. Had the directorate kept a surplus on hand, and been content to disburse only fairly good profits, a complete failure would have been transformed into a profitable enterprise. One of the most striking examples of the evils attending the disbursement of early profits is the East Rand Proprietary Mines, Ltd., operating one of the largest properties in the Witwatersrand field, South Africa. This company started out with predictions of great profits, and herculean efforts were made to fulfill expectations. For a while everything went along in seeming satisfaction. Then came the news that dividends had been cut, coupled with an alleged loss of 13,462 oz. of gold. The Union of South Africa government at once appointed a Commission of Inquiry, composed largely of prominent mining engineers, and the result is now known. The necessary reduction in the dividend rate and other unfavorable features of the incident not only injured the affected company, but has doubtless reacted against others in the district. Much the same thing has happened in other fields. Not only has the erring company suffered, but other meritorious enterprises have been victims of the distrust engendered. It is one thing to lose money in a prospect where the risks are understood, but quite another to be deceived when capital is placed in a proved gold producer. In the latter it is believed the investment is sound, and such failures work incalculable harm to the industry.

In California many companies have exhausted their funds by paying premature dividends, leaving nothing with which to finance subsequent developments. The practice is less common than formerly, and most managers have adopted the wise policy of maintaining a good surplus in the treasury. Some Mother Lode companies are in a position to pay a higher dividend rate than prevails at present, but a safe reserve is added to the treasury each month. In the history of all enterprises, mining and otherwise, comes lean periods when expenses absorb receipts and clamor wolfishly for more funds. The company having a large surplus is in a position to meet the demand, while the concern paying its entire earnings to stockholders speedily finds itself on the rocks. The result is the closing of a property that, under more competent management, might still produce with profit. The impatience of the stockholders for large and early dividends is the principal cause of the unwise policy. Many managers realize the bad features involved, but are compelled to follow the wishes of the directors. Many engineers have resigned positions rather than carry out such plans, but there is no trouble in finding men to steer the enterprise upon the rocks. The stockholders do not realize the danger, otherwise they would be content with the receipt of lower profits and the assurance of longer life for the mine.

When the ordinary investor desires to purchase stock in a company, two prime factors command particular attention, ore reserves and management. Poor managers ruin the best mines, and a mine without reserves is simply a dent on the face of Mother Earth—neither attractive to look upon nor pleasant to contemplate. But with extensive reserves, capable, honest management, and a good surplus in the treasury, the compass points to the success that proper conditions insure.

A. H. MARTIN.

Grass Valley, California, January 12.

Professional Ethics

The Editor:

Sir—In reading the second part of the article 'Two Famous Mines,' by T. A. Rickard, in your issue of December 30, I was quite forcibly impressed by the statements relative to the purchase of the Santa Gertrudis mine by the Camp Bird company. According to Mr. Rickard, at the time of purchasing, as also before and after, Mr. Hammond was consulting engineer for the Camp Bird company and in all probability under a heavy salary. While acting in this capacity he personally obtained an option on the Santa Gertrudis property and turned it to the Camp Bird company, obtaining a large commission on the sale, an even larger commission than the regular promoter usually asks. In this region promoters are usually satisfied with 10% or less on the sale price. Asking for information, I wish to inquire if this sort of a deal is considered good ethics in the engineering profession. If Mr. Hammond was employed by the Camp Bird company as consulting engineer at a large salary, is it considered strictly legitimate for him to have charged his own company a commission that would be regarded as excessive even for an outside promoter? Is that giving the stockholders a fair and square deal? Would such a commission have been paid to any other promoter of less attainments than Mr. Hammond without comment by the stockholders? Was Mr. Hammond acting as a promoter or as consulting engineer for the company? As a mining engineer, I am simply asking for information as to the ethics of the matter.

H. C. CUTLER.

Reno, Nevada, January 4.

[The Mining and Metallurgical Society of America, of which it happens Mr. Hammond is not a member, is the only organization that has attempted to define a code of professional ethics for mining engineers. In the preliminary draft adopted by the Philadelphia and San Francisco sections of that Society, section 12 reads as follows: "It is unprofessional to accept presents, fees, commissions, or compensation of any kind from those with whom the engineer transacts business for an employer or client."—EDITOR.]

DURING the month of December the Elmore vacuum plant at the mines of the Sulitjelma company, Norway, produced 630 tons of copper concentrate, although this was a short month owing to holidays.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting

NEVADA now contains 85 reduction plants, having 1489 stamps, including those temporarily idle. The daily capacity of plants not using stamps is 14,530 tons.

DURING the past fiscal year areas aggregating over 650,000 acres not previously examined were investigated by the engineers of the United States Geological Survey in connection with the withdrawals of water-power sites.

RUSSIA proposes to subsidize shipping at the rate of 75 rubles per ton of gross capacity and 135 rubles per indicated horse-power for steel ships constructed in Russian yards of Russian raw material. The law, if passed, is to remain in force for 15 years.

THE ATMOSPHERE is equal in weight to 1,268,000 cubic miles of water, which, however, is only $^1/_{325}$ of the volume of the ocean; yet this would be sufficient to raise the level of the ocean 45 ft. on all shores and to submerge an important part of the continents.

ACCORDING to estimates, the world's annual consumption of asbestos is not over 100,000 tons of all grades. Since 1877, when the Canadian industry was founded, the province of Quebec has supplied at least 75% of this, and asbestos mining is without doubt the most important mineral industry in the province.

THE BALOPTICON is an instrument that permits photographs, ore specimens, or like objects to be shown on a screen in their native colors. It is particularly valuable for use in lecture-rooms. A cheap form is available for parlor use in throwing on a screen the views on picture postal cards. For this use a smooth-surfaced card is essential.

SWEDISH iron ore now comes to America regularly. Recently the *Tellus*, a British built boat owned in Norway, brought into Philadelphia 11,600 tons of this ore for the Philadelphia & Reading Railway Co., the pioneers in its use. The *Tellus* is built of steel, 445 ft. long, 60-ft. beam, and 31½ ft. in depth. There is one 32 by 30-ft. and four 36 by 30-ft. hatchways. There are derrick hoists and 11 steam winches.

PULP from a battery, when the plates are set at proper angle and the amount of water is correct, travels down the plate in a series of waves, the lower edge of each wave rolling over and over and bringing each particle into contact with the amalgamating surface several times. The more sulphides there are in the ore, the steeper must be the slope of the plates to clear them and not interfere with subsequent concentration.

ASPHALT is a material that passes under many names, as is well indicated by the number with which the various sorts are labeled, such as tabbyite, wiedgerite, aeonite, grahamite, gilsonite, and a host of other names, which show the different varieties. There are ways of identifying these varieties, and a report recently issued by the U. S. Geological Survey contains a table showing the chief characteristics of each kind.

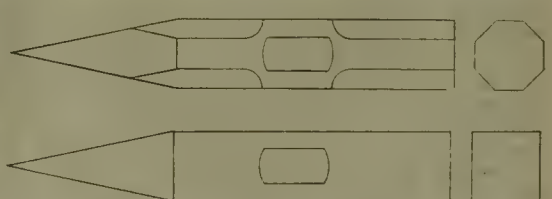
WATER-WHEELS, called *mangano-pygano*, are familiar objects on most Turkish farms. The common type is modeled on the Spanish *nooria*, with clumsy wooden buckets running on cogwheels, worked by horse or buffalo, the water being distributed by wood or zinc troughs, and the whole system being most primitive. Suction pumps, formed of hollowed tree trunks and fitted with piston and handle of the same material, are the common means of water supply of many a Turkish village; but the whole of Turkey is not so backward. On several estates mechanical pumps imported from America are at work.

ZINC-DUST is extensively used in indigo dyeing, the effect of the zinc-dust in this connection being that with milk of lime it produces hydrogen, and thereby reduces indigo blue to indigo white. The latter, being a soluble compound, is, consequently, easily absorbed by the textile fibre, and then again changed into indigo blue by atmospheric oxidation. Zinc-dust is also very extensively used for the reduction of nitrobenzol, which is the initial product of many combinations used in the production of analine dyes. Owing to the fact that zinc precipitates the majority of ductile heavy metals from their solutions, it is often used, in the form of zinc-dust, for cleansing lyes of zinc vitriol in lithopone works, and for similar purposes.

ELECTROLYTIC apparatus and processes use or utilize the separating or decomposing power of the electric current. When an electric current is sent through a liquid material which is compound in its nature, a chemical compound, the current tends to decompose the compound into two constituents, appearing respectively at the two points of contact of the electric conducting circuit with the liquid in question, that is, at the surface or face of contact of the undecomposable conducting part of the circuit with the decomposable part. Since the current has a definite direction the constituents appear at definite electrodes. The action is simply the result of the current extracting (or tending to extract) from the electrolyte one of its constituents at each of the two electrode surfaces.

PETROLEUM was used by the Incas long before Pizarro landed in Peru at Comendador creek, where he reported the discovery of a natural spring of oil. This spring was in what is now known as the Zorritos district, in the department of Piura, province of Tumbes, northern Peru, and for generations the product was gathered in the most primitive manner by the natives. In 1864 the attention of prospectors was attracted to this district, and a small refinery was subsequently built at Tumbes; but no important development occurred in the district until 1883. Since then, however, over 300 producing wells have been sunk, and for many years these were the only fields in Peru developed to any extent. A refinery was erected at Zorritos and satisfactory refined products furnished to the home trade.

CUTTING SAMPLES in a mine is hard work under any circumstances, but must be done accurately if it is to be of value. The best tool is a moil, but when cutting overhead its use is both awkward and laborious. As a substitute, a tool such as figured below may sometimes be employed. It is essentially a moil, with an eye so that it may be mounted on a wooden handle of any convenient length. One man holds and guides the moil while another strikes on its head with an ordinary hammer. The point should be sharpened to accord with the character of the material to be sampled. For catching the sample cut with this tool, a candle box may be used, but, except when fine gold is present, a more convenient method is to use a canvas bag strung on an iron loop and mounted on a pole, exactly as an entomologist mounts a net for catching butterflies. This bag may be held with one hand so as to catch the cuttings, while the moil is held with the other. After each sample is cut the bag should be turned inside out and cleaned by beating or brushing.



Special Correspondence

RHODESIA

GLOBE & PHOENIX.—FOOD REGULATIONS.—COMPETITION OF BRITISH SOUTH AFRICA CO.—COAL.

A statement has just been issued by the Board of Directors of the Globe & Phoenix G. M. Co., owning the premier mine of Rhodesia, as to the position there regarding ore reserves. The statement brings the matter down to September 30 last, and in comparison with the figures published in the interim report for June 30, there is practically no change. The gross value of the tonnage standing developed in the mine today, is placed at £1,332,592, the ore blocked amounting to 177,606 tons, and this compares with 179,040 tons of an average value of 36 dwt. per ton, at the end of June last. The Globe & Phoenix is not only the largest profit earner in Rhodesia—it is, what is most important to bear in mind, the deepest mine in the country, and the fact that good widths and valuable ore are being disclosed in the lowest levels of the property, disabuses Rhodesia of a condemnation that has been often directed against it; that is, that not one really enduring ore-shoot has so far been discovered in the country.

New regulations concerning the feeding, etc., of natives in Rhodesia have just been promulgated in the *Government Gazette*. The regulations provide that natives employed both at surface and underground, on coming off night shift, shall be given one pint of hot soup, coffee, or cocoa. A minimum scale of rations (they are, 1½ lb. of meal per day, 2 lb. of beans per week, 2 lb. of meat per week, 2 lb. of vegetables, 1 lb. peanuts, and 3½ oz. salt per week) is required, and various other foodstuffs such as molasses, manioc or cassava, fruits, etc., are recommended. In regard to native huts, it is required that air space per head shall not be less than 250 cu. ft., and that no hut shall have a lesser height than 8 ft., measuring from the centre of the floor to the apex of the roof. Under the new regulations there will have to be 15 ft. between each hut, reckoning from eaves to eaves. These regulations are typical of the endeavors now being made all over South Africa to better the lot of the native workers at the mines, to lower native sickness and death rates, and generally to improve the efficiency of the unskilled laborers. Similar motives induced the Transvaal Chamber of Mines to engage the services of Sir Almroth Wright, the eminent English bacteriologist, to investigate the causes of, and remedy for pneumonia on the Rand, and if possible to discover a vaccine for a disease which yearly carries off hundreds and hundreds of valuable mine laborers, especially those hailing from tropical and sub-tropical areas. The Rhodesian mining authorities have been endeavoring to secure the cooperation of the Chartered Company Government, with a view to obtaining the services of Sir Almroth Wright for Rhodesia, as well as the Rand. The Government, however, has taken the attitude that Rhodesia, in common with the rest of the world, will benefit by Sir Almroth's Transvaal researches, and that in consequence the Government does not see fit to go to the expense of engaging the eminent scientist specially for Rhodesia. To this, the Rhodesia Chamber of Mines replies that conditions in Matabeleland and Mashonaland are vastly different to those obtaining in the southern Transvaal, and urges the Government to reconsider its decision in the matter.

The Rhodesia Chamber of Mines, like similar institutions in other countries, seldom appears to find its members in fairly complete agreement with the Government on any particularly important new laws or new policy. The action of the British South Africa Co., in floating a Mines Development Co., to promote mining, assist prospecting, and form subsidiary companies, has drawn forth a loud cry of protest from the larger and more important mining corporations operating in the country. The mining corporations urge that the flotation, under Government auspices, of such a concern should be postponed until the administrative and commercial departments of the British South Africa Co are more clearly divorced, than at present. They also point out that the British South Africa Co's venture will be in a position to compete, under exceptionally favorable terms, with companies floated in Europe on European capital. Apparently, the Chartered company's latest flotation scheme, while it may be considered good business by the 'small man' mining element, is not looked upon with grave concern by the large and influential limited liability companies.

Much importance attaches itself to the exploitation of coalfields in Mashonaland by the Consolidated Gold Fields of South Africa. Hitherto the only working colliery in southern Rhodesia has been at Wankie, in northern Matabeleland. The more important gold-belts are situated at a considerable distance from the Wankie pit, and in consequence the cost of transport on fuel has been very large; in fact, to many mines it has been prohibitive, and wood has been consumed. Especially have the properties most distant from Wankie, that is, mines situated in eastern Mashonaland, suffered. The area selected by the Consolidated Gold Fields company is situated about 75 miles west

TYPICAL SMALL MINE IN RHODESIA.

of Gatooma, and in extent amounts to 200 square miles. Work has been proceeding there for about six months, and the latest reports received from the property are highly encouraging.

LONDON

CLAIMS OF THE TANGANYIKA CONCESSIONS.

A few weeks ago I wrote about the present position of the Tanganyika Concessions, the great organization controlling the copper deposits of Katanga, in Congo Territory, in the very centre of Africa. The venture has been strongly criticized in this country, in your pages, and in other publications from America. Of the latter I may mention particularly the comments in Stevens' 'Copper Handbook.' Mr. Stevens, while admitting the existence of wonderful deposits, postpones their profitableness for a century or two, on account of the difficulties of metallurgical treatment and the lack of transport. It is a rather exaggerated view, but is based on sound enough sense. There are, however, many shrewd men of fine character in this country who have faith in the deposit and in the capability of Robert Williams, the man at the head of affairs. Moved by their urgent pleadings, I am inclined to give some space this week to an outline of the statement made by Mr. Williams to the shareholders. The property is in Congo near the Rhodesian border, and the ownership and control is divided between the Belgian company, the Société Minière de Haut Katanga, and the English company, the Tanganyika Concessions. In addition, there are many affiliated companies engaged in mining and railway construction, the exact relation between all in the group being too complicated for description here. The adverse critics have made much of the scarcity of instructive detail and the disinclination of the controllers to engage experts of the highest standing. One of their strongest arguments

was that R. J. Frecheville's clients never took any financial interest after he had carefully examined the deposit and presented an elaborate report. Nor was the nature of the report ever divulged. This leads me to the most interesting of all the statements made at the recent meeting, a remark, really quite incidental, to the effect that Mr. Frecheville had vouched for 1,800,000 tons of 12% ore. This publication of his view has greatly cleared the air, and it is now permissible to presume that it was the want of communications with the outside that made him cautious in recommending his clients to invest their capital. He evidently felt that conditions, though ultimately promising, would be worse before they were better. Therefore the shares would be in danger of assessment; and in any case, were offered at too high a price. For a finance company that does not care for an undetermined lock-up, the speculation was not entirely inviting. Another interesting announcement related to the cost of coke. No African fuel was available, either as to quality or cost, when smelting was first contemplated, so it was decided to take the bold course of importing coke from Europe. A few months' experience has shown that this coke has cost £12 delivered, and that much more has been used per ton of copper produced than was originally announced, owing to the necessity of adding fluxes to the aluminous ore. Smelting started at the end of last June with one furnace, and after several trial runs, a continuous run was made of nine weeks, from the middle of September to November 20. During this time 1000 tons of copper was produced, and the recovery was 87% of the content. The operations were successful and a second furnace is being built. As regards the coke question, recent negotiations have provided for the supply of coke made at Wankie colliery in Rhodesia to be delivered at £5 per ton. The fuel outlook has also been improved by the discovery of good coking coal in Luano valley, a deposit under the control of the Tanganyika Concessions. It is possible to mix some charcoal with the charge, and as this costs less than £2 per ton the reduction in cost thereby effected is appreciable. Mr. Williams was not quite so convincing when he referred to the nature of the ore deposit, for he still trusts that sulphides will be found in depth. Those who have been on the spot or who have seen the ore are inclined to the view that the deposit is shallow, and has not been derived from ascending waters of igneous origin, but has been formed from the erosion, solution, and transport of earlier deposits elsewhere. As regards the railway position, good progress is being made with the Benguella railway to Lobito Bay on the west coast of Africa. When completed this road will work wonders in the development of Central Africa, for it will bring it into much closer connection with Europe. For the past year or so the Katanga district has been connected with the Rhodesian railways, thus permitting through communication to Cape Town or Beira; but of course these lines are in the wrong direction and their rates are appalling. I have given the above outline of the present position in a spirit friendly to the enterprise. I trust your readers will understand my motive, as I do not withdraw anything that I have written previously.

SILVERTON, COLORADO

New Zinc Separator at Sunnyside.—Cyanide Plant for Gold Bug.—Iowa Tiger Developing.—Silver Lake Increases Force.—Hercules Again Idle.—Silver Ledge Changes Management.—Congress Developing.—Agitation for Cyanide Plants.

The new zinc separator plant at the Sunnyside mill is nearing completion and will probably be in operation within the next 60 days. The Gold King lessees made a mill-run during December with excellent results. The mine will be developed during the winter by sub-lessees, and a large tonnage will be available for the mill next summer. It is reported that the Gold Bug M. Co. has ordered a 50-ton cyanide mill for the Gold Bug mine, and that the machinery is now in transit and will be erected this spring. The Intersection is hauling supplies for an increase of five stamps in its battery capacity, and the new battery will be set up and ready for operation during the spring. The Iowa Tiger mill was run for several days in December, and the lessees shipped six cars of concentrate. A force of 25 men is employed on development, but no new orebodies have been discovered. The Silver Lake has increased its force at mine and mill and is now operating two shifts and milling more than 100 tons per day. The force will be increased to three shifts when the Durango smelter is again blown in. The Hercules is again idle, and Mr. Kane, the manager, is East in conference with the stockholders as to future operations. The Silver Ledge mine and mill are operating at full capacity and producing two cars of concentrate per day. W. Z. Kinney has resigned as manager, and the mine is now under the control of Karl Knupfer, secretary, pending the arrival of Mr. Arnold, recently in charge of the Casa Diablo mine, California, who has accepted the position of manager for the Ledge. The mine is making a very favorable showing at present and seems in position to become a steady producer. The Southern E. & M. Co. is developing the Congress mine and expects to ship this year. An ample supply of coal and all necessities of life are now on hand, and the railroad has reduced its train service to normal. There is a good deal of agitation at present for cyanide plants, and it is probable that several will be erected during the coming season. Much of the agitation has been carried on by men inexperienced and poorly informed in the art of cyanidation, and many failures and much discouragement will no doubt result. These can, of course, be avoided by the enlistment of expert advice as to the adaptation of cyanidation to San Juan ores and proper methods of procedure in each case. The danger lies in proceeding without such help and in thinking that cyanidation is a simple panacea for all the metallurgical troubles of this district.

GOLDFIELD, NEVADA

Consolidated Mines Co. Shipping to Denver Mint.—Roasting Plant About Finished.—Field Notes of the District.

The Consolidated Mines Co. now ships all its bullion to the U. S. Mint at Denver, instead of to the Selby company at San Francisco, as formerly. The latest shipment was valued at about $220,000. The company's new roasting plant, designed for the final treatment of residue from the present concentrate-treatment plant, is practically completed. It has cost the company about $72,000 and is expected to effect a saving of at least $80,000 per year. Lateral development is now in progress from the Grizzly Bear shaft at a depth of 1300 ft., this being the deepest shaft in the Goldfield district. It is near the Clermont shaft, which is nearly 1100 ft. deep. The Hazel shaft, on the Miss Jessie claim of the Laguna group, has been sunk to nearly 900 ft. and from this point a cross-cut is being driven to a point under the main Laguna shaft, which will be sunk to greater depth and will be the main point from which the Red Top vein will be explored.

On the Florence Goldfield property development continues on the lines planned prior to the destruction of the company's mill. Lateral work is in progress on the 350, 530, and 650-ft. levels, and the shaft is nearing a depth of 1000 ft. At this depth a sump will be sunk 60 ft., and drifts and cross-cuts will be started in the direction of the veins that have produced on upper levels. Lessees have begun work on the Gold Coin claim of the Jumbo Extension, in the Diamondfield part of the district, and adjoining the Goldfield Daisy. Six leases in all are now working on the claims of the C. O. D. Consolidated, and are, for the greater part, exploring virgin ground, extending to the boundary of the Atlanta. An important announcement, involving the early development of the Atlanta on a large scale and at great depth, is expected soon. It is announced by officials of the Silver Pick Consolidated that active development will begin on the company's claims during the present month and that a working shaft

will be sunk to great depth at a point 250 ft. distant from the boundaries of the Combination and Mohawk claims of the Consolidated.

In the Diamondfield part of the district seams of high-grade ore have lately been found by lessees on the Black Butte, near the 100-ft. level, and this shaft will be unwatered and a drift will be driven on the vein at greater depth.

On the Goldfield Belmont the rich ore-shoot exposed on the 300-ft. level and later followed a long distance in a drift from the winze on the 350-ft. level, is said to have been followed to a point near the boundary line of the Daisy, and miners believe the ore-shoots of this large vein pitch to the south, toward the latter property. The Belmont has produced some rich ore recently, and the winze will at once be sunk another level.

Old workings of the Daisy mine are being cleaned out and repaired in preparation for development at the hands of the Daisy-Belmont Ledge company, which has acquired a long-term lease on the greater part of Daisy territory and will proceed to explore for the southern extension of the Belmont vein. It is the plan of F. A. de Costa, manager for the company, to sink the main or No. 2 shaft, now down 530 ft., to penetrate the Belmont vein, which, according to the dip indicated on upper levels, it should cut at about 700 feet.

NEW YORK

EQUITABLE FIRE.—RIVAL INTERESTS JOINED IN INSPIRATION CONSOLIDATED.—UNITED VERDE EXTENSION REORGANIZATION.—GENERAL MARKET NOTES.

New York has stood this week to watch the destruction of one of the most important of its monuments in the financial district. Fire destroyed the old fashioned eight-story Equitable building, originally built by the elder Hyde, the founder of the Equitable Life Assurance Society, at an expense of some eighteen million dollars. It was the first structure in New York to be equipped with passenger elevators. It contained the offices of the Harriman roads, the Union Pacific and the Southern Pacific, and its safe deposit vaults were the most important in the city. Many securities were lodged in the vaults, which were so covered by piles of débris and many feet of ice that not until the afternoon of the third day were they partly uncovered. In the meantime the regular deliveries on the New York Stock Exchange were temporarily suspended and the various banks which were housed in the burned building and in the adjacent structures were obliged to open temporary offices wherever accommodations could be found. Market operations were therefore much interrupted.

Perhaps the most significant development of the week in mining affairs is the formation of the board of directors of the new Inspiration Con. Copper Co. The members of the new board include some of the most important figures in the financial world and bring together some interests which have for many months been looked upon as antagonistic. A study of the various names and the connections of the individuals is worth while, distinctly so, in view of the much discussed copper merger. With the world's greatest industrial combinations, either in the throes of dissolution, or under fire of investigation, the banking interests have hesitated to apply the trust principle to copper. From the roster of the board of directors under discussion it might be suspected that the activity of the Federal authorities and the uncomfortable features of the Sherman anti-trust law are to be evaded and avoided, or at least circumvented, by the older device of co-operation and community of interests.

The president of the newly consolidated company is William B. Thompson, a special partner in the house of Thompson, Towle & Co., of New York and Boston. Mr. Thompson is interested in many mining ventures, among them Nevada Consolidated. Mr. Thompson was one of the original promoters of the old Cumberland Ely Copper Co., which was merged with the Nevada Consolidated; the Mason Valley, at Yerington, Nevada, which has recently entered the producing ranks, and others.

The vice president is William D. Thornton, president of the Greene Consolidated Copper Co. The connection with the Cole Ryan is close and complete, as both Thomas F. Cole and John D. Ryan are directors, and the Standard Oil, Amalgamated connection is further evidenced by the name of William G. Rockefeller. The names which carry a peculiar significance by their presence are those of E. C. Converse, president of the Bankers Trust Co., a Morgan institution, and by reason of recent absorptions of other banking houses, the most important trust company in New York, and that of Eugene Meyer Jr. Eugene Meyer, Jr. & Co. is looked upon as a distinctly Morgan factor, and has always been credited with being the connecting link between J. P. Morgan & Co. and the Guggenheims. The joining of these names in this way may or may not carry any particular meaning, but in view of the recent action of the copper metal market and the very evident strength of the pools behind the recent upward movement, it certainly justifies the inquiry as to whether the two recognized leading factors in the production, refining, and marketing of copper have abandoned al' idea of competition and whether the copper merger may not become a reality in this form, so tangible for all working purposes, but impalpable as to any outside attack. To be sure, the Inspiration-Live Oak properties are not in themselves of any overwhelming importance, but the bringing together around the directors' table of the various banking interests described is important and future moves in the like direction will be intently watched.

Other members of the Inspiration board are W. E. Corey, former head of the U. S. Steel Corporation; Philip L. Foster, of the London Exploration Co.; and Henry B. Hovland, who represents the Live Oak people and who primarily is affiliated with people of the Lake Michigan copper country.

A reorganization of the United Verde Extension is being planned and the stockholders are informed that some important mining interests are to be brought into the company, under an agreement, by which the present company sells 25,000 shares of its present treasury reserve to the new investors coming in, at $1 per share, which purchaser shall then have the right to form a new company and in exchange for two-fifths of the stock of the new company shall receive all the property of the present corporation. A like amount is to go to the purchaser in consideration of $200,000 to be placed in the treasury of the proposed company, which shall also receive the balance of one-fifth of the stock. It is reported, and denied, that the "important mining interest" referred to is the Phelps-Dodge company. The camp of Jerome is something of an anomaly. W. A. Clark has drawn enormous revenue from the United Verde for many years and has been singularly fortunate in having no strong encroaching neighbors, such as have made so many stormy chapters in the history of Butte, Montana. There are several developments adjacent to the United Verde besides the United Verde Extension. The Hull Copper M. Co. and the Cleopatra Copper M. Co. are both said to have prospects of some promise, but are each capitalized for some ten millions of dollars and without efficient management, so that Mr. Clark has been able to build his mansion in Fifth avenue, New York, for the delight of the strollers in the avenue and park opposite without fear of anything worse happening at the mines than the caving under the old smelter. The entrance into Jerome of any such powerful factor in copper as the Phelps-Dodge company would undoubtedly start Mr. Clark to building a fence at home, a labor which he has so far been spared in Arizona, though his experience in Montana made him one of the most far famed of expert fence builders. The Clark campaigns in Montana are history—most exceedingly interesting history when one can lure some ex-member of the Montana legislature of those days into a reminiscent mood.

The report of the Copper Producers' Association shows a steady improvement in the copper situation, and 15c. copper is looked upon as an assured fact. There still remains

some skepticism as to the real foundation for the boom in copper; it is pointed out that there has been no marked revival of business at home, in fact, domestic deliveries decreased in December something over 2,000,000 lb., production increased some 11,000,000 lb., while exports ran up some 12,000,000 lb. over the preceding month, reaching a total of 79,238,716 lb., breaking all records for foreign deliveries for any one month since the Producers' Association was formed. According to the association's figures the accumulated stock of copper in this country is smaller than at any time within the past three years, having been cut down in the past eighteen months from a high mark of 168,276,017 lb. in July 1910 to 89,454,695 lb. on January 1, 1912. During the same period the world's visible supply has decreased from 401,139,697 lb. to 217,768,615 lb. It is idle to speculate as to the genuineness of the rise in copper metal. The situation has not been a healthy one, foreign manufacturers seemed destined to accumulate large profits from cheap copper furnished by mines in this country, while domestic consumers could neither buy for future use with prudence nor otherwise take advantage of the low prices prevailing. One thing is certain—producers, smeltermen, refiners, and selling agents are getting closer together, and undoubtedly it will not be long before prices are maintained, if, indeed, the present level cannot be held without undue reaction.

The Nevada-Utah reorganization has developed into something of a scrimmage for the support of the stockholders by various committees. Theodore Gross, of the Hirsch Syndicate and long identified with the Venture Corporation of London, is working with the present officers of the company to float a bond issue with the shareholders. In any event it is quite certain that further complications will be added to the organization, which is already involved past any reasonable comprehension. There may be those in the company who understand or claim to understand thoroughly the corporate organization of Nevada-Utah, but to prove such understanding would take a long time and much argument. There are now some ten thousand shareholders, who are asking whether they shall or shall not throw good money after bad, and so long as they will donate sums small or large, there will not be any great difficulty in finding reorganization committees to administer the funds so collected.

BLACK HILLS, SOUTH DAKOTA

STATE CONDUCTS PROSPECTORS' SCHOOL.—WINTER UNUSUALLY SEVERE.—WASP NO. 2 PRODUCTION.—DEADWOOD ASSAY OFFICE BREAKS RECORD.—NEW DEVELOPMENT.

For the benefit of men who cannot attend a full year, the South Dakota State School of Mines, at Rapid City, is this winter giving a short course in mining and metallurgy. The classes began on January 4 and will continue for six weeks.

The Black Hills has been experiencing an unusually severe winter, and train service has been maintained only by heroic work. The mills depending upon railroad haulage of ore from mine to mill have been hampered somewhat by delayed trains, and outside work has been almost entirely suspended. Construction work has been suspended at one or two properties, and work at the Wasp No. 2, where the ore is mined in an open cut, has been entirely suspended until better weather comes. This step was finally decided upon after strenuous efforts had been made for a number of weeks to keep the operations up to normal. This proved too expensive, and it was decided to suspend until the weather gets warmer. During the year 1911 the Wasp No. 2 produced $286,000 and paid $60,000 in dividends, while other profits of operation were devoted to liquidating indebtedness incurred during the construction of the new mill, which plant was built in 1910 to replace one destroyed by fire early in that year.

During the quarter ended December 31 the United States Assay Office at Deadwood purchased South Dakota bullion to the value of $2,042,000, which was the largest quarter's business in the history of the office.

In 1911 three new gold producers of substantial size were added to the Black Hills list. These were the Castle Creek dredge, and the Trojan and New Reliance cyanide mills. The Richmond-Sitting Bull mine, at Galena, was reopened during the year, and steady shipments of silver-lead ore were made to smelters. Among the new producers which will start during the present year are the Black Hills smelter at Galena, the Evans Consolidated in Spruce gulch, and the Bismarck Consolidated at Flatiron, adjoining the Wasp No. 2. The smelter people are interested in mines at Galena and Two Bit, and the plant will offer a market for the product of a number of mines which are preparing to commence shipments when the plant is ready for ore. The Bismarck Consolidated is constructing a dry-crushing cyanide plant which will have a capacity of 300 tons per day. The cold weather has seriously interfered with construction work, but it is expected that the plant will be ready for operation early in the spring. The Evans Consolidated is repairing the Lexington Hill 20-stamp cyanide plant, in Spruce gulch, near Deadwood.

Wood Brothers, of Montreal, have secured an option on the bonds of the Hidden Fortune and Columbus companies, at favorable terms, and are having a thorough examination made of the property of the companies. There are two shafts, one 300 and the other 500 ft. deep, to be unwatered, and a large amount of other workings to be sampled. It is estimated that this work will cost in the neighborhood of $25,000. It will be started at once. Should the results prove satisfactory, a company will be incorporated to take over the property of both companies and work undertaken on a scale second only in importance to the Homestake.

Eastern investors are interested in the Kicking Horse and Carrol ground, in Blacktail gulch. This property is known to contain a large amount of medium-grade ore, which could be handled by cyaniding, and the new company plans erecting a plant at the property. Articles of incorporation of the company are being filed in Illinois. The moving spirit of the enterprise is Fred G. Jones, of Chicago.

The Golden Reward company is shipping ore to its mill from the Wells Fargo ground, in Blacktail gulch, after allowing the property to lie idle for a number of years.

The Iron Creek Placer G. M. Co. is to start, early in the spring, hydraulic mining on Iron creek, in western Lawrence county. The company secured nearly two miles of the creek. E. Bright, of Columbus, Ohio, and associates are financing the company.

Boston capitalists have purchased the Gladiator ground, in upper Deadwood gulch, from the owner, Burt Rogers, of Deadwood, and have made a substantial first payment on the purchase price.

The Gold King M. Co. has been incorporated, as a subsidiary of R. Bunce's Black Hills Development & Financial Corporation. The capital of the Gold King is $500,000, in shares of $1 each. Of this amount the B. H. D. & F. corporation proposes to retain 251,000 shares, and to offer the rest to the public. The company will undertake the development of the Gordelia property, near Rochford, which is equipped with a mill. It is proposed to equip the mill with a cyanide department.

O. N. Brown, of Deadwood, is working on plans for transporting ore from the Victoria Extension property to the Victoria mill, a distance of about a mile and a half. It is proposed to construct a tramway around the hill, over which the ore will be hauled to the loading terminal of the aerial tram at the Victoria mine, and thence taken to the mill. During the past few months the Victoria Extension has been opened up in good shape under A. J. Malterner, general manager, and a large amount of ore is blocked out ready for treatment. The Victoria owns a first-class dry-crushing cyanide plant.

Canfield & McLeod, of Hill City, owners of the Golden Summit mine, near that place, are developing a rich ore-shoot, and as soon as the weather permits of easy working, will start the mill. Many other companies will be glad of the advent of warmer weather, as the winter time is especially disadvantageous for new construction.

General Mining News

ALASKA

Ketchikan

A 12-ft. vein of copper ore has been discovered on the Redwing property, of which R. W. Dwyer is superintendent. Richard Nuckles recently found rich gold ore while doing assessment work on the Goo Goo group on Thorne Arm, near Sea Level, says a newspaper report.

Prince William Sound

The adit on the Errieson copper property, on Glacier creek, has been driven more than 60 ft. and is in high grade ore. Mr. Errieson is mining blacksmith coal a few miles from Glacier creek. The copper property is financed by an English company.

ARIZONA

Cochise County

The Phelps-Dodge Mercantile Co. has been incorporated to take over the mercantile interests of the Copper Queen, Detroit Copper, and the Southwestern mining companies, the last having its property at Dawson, New Mexico. The headquarters of the new company, which is capitalized at $4,000,000, will be at Bisbee.

The Calumet & Arizona M. Co. has accepted plans for its new smelter, state recent newspaper reports, and construction will start in the immediate future. The plant is to be completed in eighteen months, and will cost nearly $2,000,000. It will be built at Douglas.

Gila County

It is reported that the Duquesne M. Co. has started shipping ore to the El Paso smelter. J. F. Shaw is manager for the company. T. C. Hendricks, president of the Douglas Copper Co., owning 25 claims in the Kay district, says a report from Miami, is about to go East to purchase a churn-drill. The Gibson Copper Co. has resumed work at the Gibson, formerly under option to the Summit Copper Co. T. Henderson is superintendent. It is rumored that A. A. McKinsey has sold his five claims adjoining the Live Oak property to the Inspiration Consolidated.

The Miami Copper Co. continues to produce at the rate of 2,500,000 lb. of copper per month from the milling of 2500 tons of ore per day. The Hardinge mills for the sixth unit have been shipped, and this unit should be in operation by February 1. The third 1200-kw. generator set has been erected in the power-house, and the installation of the duplicate Nordberg compressor is well advanced.

Mohave County

Press despatches state that the mines of the county during 1911 produced $2,052,071. Of this, the Gold Road Mines Co., a subsidiary of the United States S. R. & M. Co., produced in its nine months of life, $673,540 in gold and silver, and the Tom Reed mine $747,680 in bullion.

CALIFORNIA

Amador County

It is rumored that the Central Eureka mill will resume operation in the near future on ore from the 2700-ft. level of the company's mine.

Butte County

Newspaper despatches state that a new dredging company has been organized at Chico to operate a dredge below Oroville, on the Feather river.

Kern County

Reports from Randsburg state that the new hoist of the Good Hope mine, owned by the Consolidated Mines company, has been erected. The mine has 50 tons of ore ready for milling.

Ed Cook and Ernest Peden have secured a lease on the Magpie claim of the King Solomon property. James Rice, a lessee on the same property, has found good ore at a depth of 100 ft. The International Mfg. & M. Co. has moved its dry washer to the Baltic placer property. George W. Cordes, of Portland, Oregon, a director of the company, is supervising a demonstration of the washer. T. W. Peck and associates, of New York and Los Angeles, have a force of men at work on the property claimed by the California Trona Co. at Borax lake. W. A. Austin, receiver for the property, has warned them off, but no action has been brought in court. J. G. White & Co., of San Francisco, have purchased from the National Tube Co. 124 miles of 12-in. steel pipe for a natural-gas line for the Midway Gas Company.

Modoc County

Renewed interest is reported in the High Grade district, a few miles from both Oregon and Nevada. The shipping point for the district now is New Pine Creek, on the N. C. & O. railroad, eight miles distant. An 8-in. vein of ore assaying about $1000 per ton is reported to have been found on the Sunshine property at High Grade.

Sierra County

A large shipment of machinery for the Sierra M. Co.'s plant at Pike City, which is being rebuilt, is now at

CALIFORNIA, BY COUNTIES.

Nevada City. It is reported that probably the machinery cannot be delivered this winter. George St. John, superintendent for the company, has returned from an Eastern trip.

Siskiyou County

Joseph Detro, who has a lease on a placer mine owned by George Simmons, recently discovered valuable ore at bedrock. The deposit is over a foot in depth, and the width has not been ascertained. The property is near Hawkinsville.

Tuolumne County

(Special Correspondence.)—Rich ore has been uncovered in the south drift on the 1100-ft. level of the Harvard mine, which is situated near Jamestown. The quartz exposed is flecked with gold. The Harvard has been operated continuously during the past several years, employing at times as many as 125 men. It was a heavy producer in the early days when it was known as the Whiskey Hill mine.

A few men are working at the Gold Crater, in the Knights Creek district, and in a short time active operations will be resumed. A Burleigh drill has been purchased.

Development since the finding of the new orebody on

the 400-ft. level in the Providence supports the belief that the shoot is large as well as rich. The rock contains considerable free gold. The work of cleaning out and retimbering the shaft, which had progressed to a point below the fourth station when the crew was removed to do some development work, is about to be resumed.

Articles of incorporation of the Long Gulch Mining & Development Co., organized under the laws of California, have been filed in this county. The capital stock is $250,000. The directors are Thomas G. Winwood and Andy Matijawich of Oakland and Ernest Harrison, J. J. Morrisey, and A. C. Broadfield of San Francisco.

Tuolumne, January 13.

VENTURA COUNTY

(Special Correspondence.)—The National Borax Co. is planning to purchase motor trucks to transport its product from the mine, near Stauffer, to Bakersfield, in Kern county. The distance is about 60 miles. A 2-compartment shaft is to be sunk in the near future. The property at present is developed on four levels. The company, which is capitalized at $1,000,000, acquired its property from the United States Borax Co., and has a calciner at the mine and a refinery in Jersey City, New Jersey. About 5000 tons of material is ready for transportation, it is reported. The property has not been operated for four years, but was well developed before then. The new company will start operating within 45 days, according to a recent announcement. Max P. Fries of Los Angeles is president of the company.

Stauffer, January 14.

YUBA COUNTY

The property of the Northern California Gold Mines Co. is to be sold at private sale, January 20, at the office of Richard Belcher, referee in bankruptcy, at Marysville.

C. H. Campbell, owner of the Branborough mine at Browns Valley, has found a vein of rich ore, believed to be a continuation of the old Pennsylvania. He has sunk a shaft about 20 ft. from the first drill-hole with encouraging results.

COLORADO

CLEAR CREEK COUNTY

Tentative development will be started soon at the Pulaski mine, which has not been operated for several years. B. F. Kelly will have charge of the work. If a test shipment of a carload of ore gives satisfactory returns, a compressor and mill will be erected, and development started through the Hall adit. George Bergen and Jeff Richards, lessees on the Sunset property, Covode mountain, recently discovered ore assaying more than $20 per ton in gold.

DOLORES COUNTY

The Rico M. Co. is planning to lease the Phoenix, Nigger Baby group, Laura, Power House, Golden Age, and other properties on Newman hill, states a recent newspaper despatch, as the company's holdings cover too much ground to permit adequate exploration in any reasonable length of time. The company reserves for its own development the Shamrock mine and some of the property on the southeastern part of Newman hill, south of the Group adit.

OURAY COUNTY

The annual meeting of the Gold Trio Mines Co. was held January 5 at Ouray. The company's holdings include the Grizzly Bear group, the Nordica group, a one-third interest in the Senator Beck group, and other properties. The Grizzly Bear group, the principal property of the company, is stated to have about 3000 ft. of development, all in ore, and during the summer of 1911 a number of cross-cuts were driven, proving the orebodies extend from end to end of the property. The past production of the group is given at $335,700. More than 100,000 tons of broken ore is stored. No. 5 level has 15,200 tons of ore averaging about $10 per ton, it is claimed. Samples from the Nordica, it is asserted, have assayed in high figures. Paul J. Simones, as president of the company, heads the list of officers elected at the meeting.

The Arps-Krisher M. Co. is reported to be planning an adit under the Pony Express contact from the Lenore side. Its last car averaged close to 400 oz. silver per ton.

TELLER COUNTY (CRIPPLE CREEK)

To provide water for the Argall mill, the first low-grade plant of its kind in the State, the Golden Cycle, Vindicator, and Independence companies have combined to unwater the Cycle shaft, which has filled to the 1100-ft. level. The Argall mill has been closed for some time, as its usual water-supply, from springs, has been frozen. The agreement was announced by Joe Carr, superintendent for the Golden Cycle company.

The Mable M. Co., operating on Beacon hill, in December produced 1186 tons of ore averaging over $17 per ton. Receipts from royalties and the sale of its own ore amounted to about $6000. Shaft-sinking has been stopped for the present owing to water.

The Blue Bird, E. S. Johnson manager, is working with a full force of 40 men. The old employees were not taken back, owing to their objection to the discharge of a foreman.

Three shifts are developing the lower levels of the W. P. H. mine, Ironclad hill. Oscar Fogleman has a lease on the property.

J. B. Giroux, lessee in the Deadwood mine, Bull hill, has opened a shoot of ore from which grab samples assayed $120 per ton.

It is reported that the Jerry Johnson mill may be put in operation. A recent decision of the district court awarded title to it to Edwin Gaylord. The mill uses the cyanide process.

The annual meeting of the Elkton Con. M. & M. Co. will be held February 12 at Colorado Springs.

IDAHO

LEMHI COUNTY

Newspaper despatches state that an independent company will drive an adit from the town of Gilmore to meet the Allie M. Co. and Pittsburg-Idaho company's mines at the 500-ft. levels. A spur track will be built from the railroad to the portal of the adit so that ore can be delivered from the mines to the bins or cars direct. It is estimated that the adit will cost about $75,000 and will require nine months for construction. It is believed that the economy it will afford in transportation will mean a saving of nearly $100,000 per year. A. S. Ross, president of the Pittsburg-Idaho company, and Maurice M. Johnson, consulting engineer to the same company, head the party which will select the route. Prominent mining investors of the district are said to be interested in the proposed company.

SHOSHONE COUNTY

The Amazon Development Co., Ltd., has been organized under the laws of South Dakota to take over the Amazon-Manhattan property on Sunset peak. General offices will be at Galesburg, Illinois, and the mine office at Wallace. C. C. Barth will be in charge of the property.

According to recent reports, the Tuscumbia mine has been purchased by Butte capitalists, who will increase the capitalization of the company to $1,000,000. A mill may be erected in the spring. The main office will remain at Wallace, although a branch office will be established at Butte.

The Mammoth mill has been shut down, owing to the lack of water, and it is rumored that several other mills may be closed for the same reason. There has been less water this season than for the past 13 years. The lack of water is caused by the continued cold.

The Bunker Hill & Sullivan M. & C. Co. last week paid dividend No. 172, making a disbursement of $65,400. The total in dividends paid is now $13,225,050.

The Success M. Co. has paid a dividend of $15,000, making the total disbursements for the past six months $45,000. The output of the mine is being steadily increased and sinking commenced from the lower adit.

MONTANA

LINCOLN COUNTY

(Special Correspondence.)—John H. Town, principal

owner of the Shaughnessy hill mining property, has resumed operation there with a double shift. The lower adit will be driven to crosscut the vein at a depth of 300 ft. This adit is now in 900 ft. and it is thought that the ore will be reached within thirty days. In the upper adit, which intersects the vein at a depth of 115 ft., there is a good showing of silver-lead ore, much of which is rich enough to ship without concentration.

Libby, January 16.

SILVERBOW COUNTY

A stockholders' meeting of the Butte Coalition M. Co. will be held January 20 in Jersey City, New Jersey, to consider dissolving the company.

NEVADA

CLARK COUNTY

Theodore Park and William Kerwin recently discovered a 10-ft. vein, four feet of which assays about $100 pre ton, in the Chiquita district, adjoining the Chiquita mine, states a report from Searchlight. Development is active in the Lost Basin district, just south of the Chiquita district.

During 1911 Clark county mines produced 11,317 tons of ore, valued at $66,723, according to recent newspaper estimates.

It is reported that a stamp-mill is to be erected at the Crystal Ledge property, near Barnwell. The mine is owned by Mrs. C. E. Barringer, formerly a hotel manager of Seachlight. There is 115 tons of ore ready for milling.

ELKO COUNTY

Ed Benane and Thomas Beadle have secured an option on the Alphas property near Jarbidge.

ESMERALDA COUNTY

The Daisy-Belmont Ledge M. Co. in the near future will sink the No. 1 shaft on the Goldfield Daisy property to a depth of 300 ft. where connection with the No. 2 workings will be made. Other development of the property also will be started to tap the Belmont vein.

To permit commercial tests of the coal in the recently developed fields at Coaldale, mentioned in this department in previous issues, the Tonopah & Goldfield railroad recently distributed gratis a carload shipped from the Nevada Coal & Fuel Co.'s property.

One item included in the Goldfield Con. company's December preliminary report, already published, was $42,000 expended for new construction. Development is making normal progress, and it is said that ore of excellent grade has been exposed in new workings. The new roasting-plant, designed to treat the residue from the present concentrate-treatment process, is practically completed, at a cost of $72,000, and it is expected to effect a saving of at least $80,000 per year.

The work of enlarging the St. Ives shaft, 480 ft. deep, of the Goldfield Merger Mines Co. has been completed, and sinking is in progress. This stage has been reached earlier than was anticipated. The shaft is now of three compartments, with the timbers so framed that those for the fourth can be adjusted readily. The compartments are 4½ by 5 ft. in the clear. Timbers are 10 by 10 in. from surface to the water-line, and below this point are 12 by 12 inches.

HUMBOLDT COUNTY

A new crew of men has been engaged at the Mayflower National main workings, and sinking on the vein has been started. It is reported that last month's production of the National mine was valued at more than $489,000. F. M. Stewart and Frank Christenson are developing the Platora group, near Rebel Creek. The claims formerly owned by M. Atkinson and W. Trengoe, near National, reputed to be unusually rich, were re-located January 1 by Stanley Chapman and associates. Rich ore recently was found in an adit on the Ormous property, owned by J. F. Nenzel, at Limerick.

The annual report of the Seven Troughs Coalition M. Co. shows that during the year of 1911 a total of 4260 ft. of development work was done. The ore production amounted to [illegible] tons. The ore [illegible] and [illegible] in December. During the year a tailing dam, giving a storage capacity of [illegible] tons, was erected, the cyanide plant reconstructed, and some new machinery placed in both mine and stamp-mill. The company has acquired 80% of the holdings of the Kindergarten Extension M. Co., adjoining its property, and the Fair Gold claim, on which the cyanide plant and tailing dam are situated.

STOREY COUNTY

The new 2460-ft. level pump station in the C. & C. shaft was completed last week. Measurements taken last Saturday show that the water has been held below the 2650-ft. level. The second drill-hole from the Ward raise in the Julia shaft cut into the old workings on the 2150-ft. level of the Bullion incline. When the ventilation equipment is completed, the pumping association will work south to a point where bulkhead No. 1 was constructed in 1882.

In the Union mine the north drift, 2500-ft. level, has reached quartz sampling about $35 per ton. The Ophir company last week produced 329 tons of ore averaging $42 per ton. The Ophir is the only company approaching normal production, as the Mexican is waiting for the mill to start treating ore, repairs to the Union shaft have not been completed, and the Crown Point is delayed by changes and repairs to the Yellow Jacket hoist.

C. & C. SHAFT.

NEW MEXICO

OTERO COUNTY

The Eureka Mines Co., Con., has almost completed its annual work on its property. S. Howard Leech supervised the work. The Orogrande Smelting Co. also has about completed its work, but has a few men engaged at the By Chance property: C. K. Hartley has a small force working at the old Monte Carlo Con. Copper Co.'s property, which is now owned by another corporation. Messrs. Fink, Burnheiser, and Baker, all of Oklahoma, are reported to have found gold ore on their recently purchased property, formerly known as the Knocker. George E. Moffett and associates, leasing the Monarch, near Lucky Flat, are mining good ore. George Creamer is doing annual work on his claim, near Cuprite, known as the Battle Axe.

SOCORRO COUNTY

(Special Correspondence.)—The Socorro Mines mill handled between 5000 and 6000 tons of ore during December, yielding 33,000 oz. of gold and silver bullion and 10 tons of high-grade concentrate. The heavy snows have somewhat delayed the arrival of parts of the oil-engines for the new power equipment, which, however, will soon be in commission.

The Ernestine M. Co.'s clean-up for the last ten days of December resulted in 10,150 oz. of gold and silver bullion, with a concentrate product of 9000 lb. for the period. The past week's ore treatment was 525 tons. The crude-oil engines are being tested out prior to giving them the regular mill and mine load. Seventy tons of the Oaks Co.'s ore was treated the past two weeks in the Deadwood

mill, taken from development on the Pacific mine. At the Deep Down lessees are timbering the stopes preparatory to starting production.

Mogollon, January 12.

OREGON

Jackson County

The Southern Oregon and Northern California Mining Congress will be held at Medford, February 2 and 3. An exhibit of ore and machinery will be one of the features of the meeting. Among other papers on the program will be one on 'The Public Land Question' by J. F. Callbreath, secretary of the American Mining Congress.

Josephine County

A shipment of gold recently was made from the Horsehead mine at Williams through J. H. Miller, a merchant of that place.

UTAH

Beaver County

An assessment of ½c. per share has been levied on the stock of King David M. Co. to pay off the indebtedness of the company. The mine will not be opened before spring. Stock becomes delinquent February 13 and sales day will be March 6.

Juab County

The Iron Blossom Con. M. Co. has declared a dividend of 7c. per share, payable January 25 to stockholders of record January 18. The dividend, which is the first to be declared by any Tintic property this year, will require the disbursement of $70,000, a total to date of $1,070,000.

Sinking the main shaft of the Eagle & Blue Bell mine was started under William Owens, superintendent of the property. Three shifts are working. Ore will be shipped as usual while the shaft is sunk.

Salt Lake County

(Special Correspondence.)—Kirk & Leavell, of Salt Lake City, have taken a lease on that part of the Utah-Apex mine, Bingham district, above the 400-ft. level, which they will operate through the Phoenix and Andy adits. The lessees have a force of about 40 men employed. The ores carry lead, silver, gold, and copper, the first two and the last two named metals being in separate veins. Their low-grade ore is to be concentrated at the Winnemucca mill, operated by W. Ziegler. The Utah-Apex company is mining and milling ore from the levels below the 400-ft. level, taking the ore out through the Parvenu adit, which is on the level of the Phoenix mill. Kirk & Leavell are also working the Last Chance and Horace Greeley mines, situated farther up Carr fork in Bingham district. The Last Chance is noted as a producer of high-grade silver ore.

Salt Lake City, January 15.

The Utah Copper Co. is preparing to redeem $2,778,050 of the bonds of the Bingham & Garfield railroad, converting them into Utah Copper stock at $50 per share. This will increase the issued stock to 55,561 shares. The bonds are drawing 6%, and the Utah Coppr Co. is paying 6% on its stock at $50 per share.

The third section of the Ohio Copper Co.'s mill will be in operation by the end of the month. It is thought that the Wall crushers, 18 sets of which have been placed, will be sufficient to handle the ore for the third section, which will bring the capacity of the plant to about 3000 tons of ore per day.

The Utah-Apex M. Co., according to a recent report, is about to develop a much larger portion of its holdings in Bingham canyon through an extension of the Parvenu adit. The company is said to have been earning $20,000 per month from its Bingham operations, and to have paid its floating indebtedness of about $90,000. There is outstanding a bonded indebtedness of $289,000, of which the convertible clause expired January 1. The 71,800 shares held for possible conversion, and $70,000 more of authorized bonds never issued, are free for treasury use. It is said that the company is to increase its production by 50 per cent.

Summit County

Press reports state that a new orebody has been found at the 1550-ft. level of the Silver King Consolidated mine at Park City. James Mara is superintendent of the property. During December 9118 tons of ore was shipped from Park City.

Uinta County

Samples from a deposit of phosphate discovered six months ago about 16 miles north of Vernal, have assayed about 80% phosphate, it is reported.

Utah County

Operation has been resumed on the Santaquin King M. Co.'s property, in the Santaquin district, says a recent newspaper report.

CANADA

British Columbia

The Nickel Plate mine in December established a new record for itself with a production for the month of 5514 tons of ore, against 5340 tons in November. The press report does not give figures regarding the recovery, but states that it was higher than ever before.

Officers of the British Columbia Platinum Co., Ltd., state that large deposits of platinum ore have been discovered on the company's property, Tulameen river, Similkameen district. Gilbert Blair, of Tulameen, is secretary-treasurer of the company.

George Clothier, general manager for the Indian Mines, Ltd., Portland Canal district, has denied rumors to the effect that the property had been sold.

Ontario

Returns from a car of ore from the 500-ft. level of the Temiskaming M. Co., Ltd., show 31 tons yielded 200,723 oz. silver, valued at $110,000. This is one of the richest cars ever shipped from Cobalt and is regarded as significant, as it came from one of the lowest levels in the district.

During the year 1911, 24,831 tons of ore was shipped from the Cobalt district, according to newspaper reports. The amount is about 8000 tons less than for the preceding year. The decrease is accounted for by the fact that many mines have built concentrators for treating their own ores, assert the press despatches.

Yukon

(Special Correspondence.)—The recent discovery on Sixty-Mile river was made by a Swede named Matson, popularly known as the 'Lone Swede', at a point about 80 miles south of Dawson and 30 miles west of the Yukon river on an east-west line. He secured about $40 from a hole which he drifted, cleaning up about 55 sq. ft. of bedrock. The whole district has been staked during the past two weeks. The valley is wide, and the ground is generally believed to be about 25 ft. deep. Matson drilled four holes, but found 'pay' in only one of them, and as he filled this hole, no one has been able to verify his find. It is certain at the present time that there is nothing to excite anyone.

Dawson, January 2.

Messrs. Butler, Nazarino, Vaglio, and Braga are reported to have found the second channel on the bench just off No. 20 on Barker creek. Equipment will be purchased to handle the deposit on a large scale.

MEXICO

Chihuahua

The strike at the Santa Eulalia has been settled and the agitators, at the instance of the Government, have left the district. About 1500 miners returned to work after holding out for a 25% increase in pay, an eight-hour day, half-pay in case of injury and during incapacitation, and in case of death a sum to be fixed by law. The men returned at practically the same wages and with the same hours as before the strike. The managers have agreed among themselves to provide a suitable amount for the families of those who are incapacitated or killed while at work in the mines.

Petroleum Production in 1911

The production of the various oilfields in 1911 is estimated by the U. S. Geological Survey as below, the revised figures for 1910 being also given for comparison

	1910. Barrels.	1911. Barrels.
Appalachian field	31,985,515	28,000,000
California	73,010,560	81,000,000
Kansas and Oklahoma	54,157,486	56,000,000
Louisiana	6,841,495	10,000,000
Texas	8,899,266	9,000,000
Miscellaneous	35,661,926	33,000,000
Totals	209,556,048	217,000,000

The total production for the United States is between 215,000,000 and 220,000,000 bbl. The gain in a single State -California -was greater than the net gain shown for the country as a whole, the usual decline in the older districts offsetting the increase in the Middle West and South. The most striking feature of the year in the petroleum industry was the development of the Electra oilfield in northern Texas.

The petroleum trade as a whole has suffered of late from two antagonistic conditions. First, there has been oversupply due to the sudden development of great fields, first in one part of the country and then in another, until confidence became shaken as to the possibility of maintaining a satisfactory price. This condition has had an unfavorable effect on production in the older settled districts which have passed the gusher stage and yet are capable with fair prices of maintaining a reasonable output for many years. Second, the trade has been constantly handicapped by the fear lest the big producing districts should wane as rapidly as they have waxed, and leave a supply far below the capacity of the huge industrial plants designed to utilize such veritable floods of oil as have characterized late years.

For two years, however, discoveries of oilfields of great size have followed one another so closely that doubt has become conviction that the supply is abundant for years. It cannot be denied that the quality of geologic deduction has so changed for the better, thanks to more exact and intelligent field investigations, that the geologist's estimates of the oil resources are now more than generally accepted by the oil producers and users.

The tendency to substitute oil for coal in many industrial establishments is growing rapidly. It is further encouraged by the possibilities of still greater economies by burning oil in internal-combustion engines. Its advantages long known in the manufacture of fine glass are being heeded. It has been adopted by the Navy, and its use increases on the railroads. Oil is being taken seriously.

During the year stocks in general have declined except in California. In the Appalachian field and in the Mid-Continent field they remained stationary. In Illinois there are about 21,000,000 bbl. in storage, compared with 27,000,000 in 1910. The stock on the Pacific Coast is estimated at 40,000,000 bbl., compared with only 33,000,000 at the close of 1910. In neither year is account taken of such producers' stored oil as has not been sold or even carefully measured, but is chiefly contained in open reservoirs.

According to the Bureau of Statistics of the Department of Commerce and Labor, the exports of crude oils increased from about 165,000,000 gal. for the first 11 months of 1910 to 183,000,000 gal. for the corresponding period of 1911; of naphthas, from about 92,000,000 to over 130,000,000 gal.; of illuminating oil, from 861,000,000 to 1,025,000,000 gal.; of lubricating oils, from 150,000,000 to 164,000,000 gal.; and of residuum, from 113,000,000 to 125,000,000 gal. In 1911 the Bureau of Statistics for the first time chronicled the importation of gasoline, 7,639,125 gal. being imported, principally from the Dutch East Indies. In 1911 the importation of other oils, chiefly crude oil from Mexico, amounted to 48,216,167 gal., worth $1,640,514, in the first 11 months. In the corresponding period in 1910 such importations amounted to 23,924,571 gallons.

Among the Copper Mines

The Ray Con. Copper Co's production for 1911 is estimated at 15,500,000 lb. of copper. The April production was 704,000 lb., and from then the monthly production increased steadily to 2,660,000 lb. of copper for December. As the fifth unit of the mill recently was placed in commission, it is thought that the January production will show another increase.

Work at the Inspiration mine, Gila county, Arizona, is at present confined almost entirely to the operation of the experimental mill and the construction of a temporary warehouse at the mouth of the main adit. Work has been started on the water-supply dam across Pinal creek, and a boiler, engine, and head-frame have been rigged up on the Inspiration ranch, about five miles from the mine, preparatory to sinking a 2-compartment shaft for developing additional water-supply. Development of the Live Oak orebody is now confined entirely to underground work, all churn-drilling having been discontinued.

The copper production in February by the mines of the Butte district will show an increase. The Anaconda company's properties are making larger production, but it will be about the first week in the coming month before such mines as the East Butte and Tuolumne commence to show any increase. The Tuolumne has a very large body of ore blocked out, but owing to the lack of facilities, it was not in a position to do any better than 100 tons per day and carry on its other work. However, the new surface plant is about ready for operation, and by February 1 the production will be increased to 400 tons per day, which will be the largest amount of ore ever taken out of the mine daily.

The Butte-Alex Scott, which has been producing about 50 tons per day, has increased its output to 100 tons per day, and sufficient ore has been blocked out and is in sight to continue this increase for an indefinite time. It would not be surprising that if by the close of next month the production of all the mines of the district would be increased so that the total production would be in the vicinity of 27,000,000 or 28,000,000 lb. per month. This would mean that the Anaconda properties would be turning out about 25,000,000 lb. per month, and that among the Tuolumne, North Butte, East Butte, Butte-Alex Scott, and one or two other small mines, the remainder would be made up.

The East Butte company will also start on a scale of increased production about the first of the month.

The Guaranty Trust Co. of New York and Kidder, Peabody & Co. of Boston offer, until January 29, $10 per share cash to stockholders of the Inspiration Copper Co., Gila county, Arizona, or an exchange of one share in the new Inspiration Con. Copper Co. for two shares of the older company. To the Live Oak Development Co. they offer $40 cash per share, or two shares of new for every share of old stock. Six million dollars, 10-year, 6% bonds, convertible into stock of the new company at $25 per share, will be offered to stockholders, February 1. The bonds are payable, 25% March 1, and 25% each six months thereafter, until paid. The bonds will be issued at par. The company will erect a concentrator of 7500 tons nominal daily capacity, but with an actual capacity probably considerably higher. To provide for bond conversion, the erection of the concentrator, and to bring the mine to a state of production, not over 1,000,000 shares of the authorized capitalization of 1,500,000, par value $20, will be issued. The annual production, according to recent estimates, will be 65,000,000 to 75,000,000 lb. of copper at a cost of about 8½c. per lb. The basis of consolidation was fixed by engineers, who estimated a total of 45,300,000 tons of ore averaging 2% copper.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

E. B. Yerington is here.

H. W. Turner is in London.

Joseph Errington is at the Palace.

W. A. Prichard is in San Francisco.

W. H. Storms has returned from Los Angeles.

Webb Smith was in San Francisco last Monday.

Charles R. Gregg, of Denver, is at the Fairmont.

A. M. Chamberlin was in San Francisco this week.

E. R. Schuley, of Reno, Nevada, is in San Francisco.

Charles E. Kenney is in San Francisco from Nevada.

E. V. Bray has gone to Goldfield on professional business.

H. H. Wilson, of Tonopah, Nevada, is in San Francisco.

Z. Kendall, of Manhattan, Nevada, is visiting San Francisco.

James Laidlaw, of Cranbrook, B. C., is at the Palace for the winter.

C. F. Nourse has returned to San Francisco from Nacozari, Sonora, Mexico.

Frederick G. Clapp is making a short visit to the oil and gas fields of Louisiana.

R. Gordon Walker is in Mexico City for the Oliver Continuous Filter Company.

Duncan MacVichie has been appointed general manager for the Yerington Copper Co., at Yerington, Nevada.

Ralph Arnold, who recently returned from Trinidad, was in San Francisco this week and has gone to New York.

Clifford G. Dennis has returned to Berlin, Nevada, where he is installing a plant for the production of quicksilver.

E. P. Rice, of Wickenburg, Arizona, has removed to Miami, where he is connected with the Miami Copper Company.

Paul W. Purtzman is visiting the California oilfields to complete the field work upon a bulletin of the State Mining Bureau.

A. A. Pare has gone to New Zealand and Australia to make an extensive study of mining and metallurgical methods.

The address is wanted of A. M. McDonald and Dan McDonald, twin brothers, who lived in Oakland about ten years ago.

R. B. Brinsmade has opened an office as consulting mining engineer and metallurgist at 7 Meson del Angel at Pueblo, Mexico.

Daniel Guggenheim, Murry Guggenheim, and Edward Brush have retired from the board of directors of the National Lead Company.

R. B. McGinnis left San Francisco on January 15 for Yuma county, Arizona, to examine properties; he expects to return in two weeks.

Howard R. Stewart was married to Miss Lena Beryl Ball, in London, on January 2, and expects to visit California during February.

W. H. Bruce is consulting engineer and manager for the Summit Hill Mining Co., at Dobbins, California, with head offices in San Francisco.

J. N. Hauser has accepted the position of superintendent of the properties at Carthage, Missouri, for the American Zinc, Lead & Smelting Company.

Oscar Wallace has resigned as manager of the Interstate mine, near Wallace, Idaho, and has taken charge of the Ruth property on Nine Mile creek, Idaho.

S. E. Bretherton will lecture on 'Modern Copper Smelting' before the Mining Association of the University of California, on January 24, at 8 p.m. in the Hearst Memorial building. Visitors are welcome.

Market Reports

LOCAL METAL PRICES.

San Francisco January 18.

Antimony	11—11½c	Quicksilver (flask)	43.50
Electrolytic Copper	15—16½c	Tin	47—48½c
Pig Lead	4.70—5.65c	Spelter	7½—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES.

(By wire from New York.)

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Jan. 11	14.25	4.45	6.58	55½
" 12	14.23	4.45	6.58	55½
" 13	14.23	4.45	6.58	55½
" 14	Sunday.	No market.		
" 15	14.13	4.45	6.58	55½
" 16	14.13	4.45	6.58	■
" 17	14.13	4.45	6.58	55½

COPPER SHARES—BOSTON.

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, Jan. 18.		Closing Prices Jan. 18.
Adventure	6	Mohawk	$ 55
Allouez	42	North Butte	26
Calumet & Arizona	61½	Old Dominion	46½
Calumet & Hecla	430	Osceola	108
Centennial	21½	Parrot	14
Copper Range	53½	Shannon	10
Daly West	5	Superior & Boston	4½
Franklin	11¾	Tamarack	29
Granby	37	Trinity	5¼
Greene Cananea, ctf.	8½	Utah Con	15½
Isle-Royale	21½	Victoria	4½
La Salle	5½	Winona	5½
Mass Copper	8	Wolverine	99½

NEVADA STOCKS.

(By courtesy of San Francisco Stock Exchange.)

San Francisco, January 18.

Atlanta	$ .18	Mayflower	$ .02
Belcher	.60	Mexican	4.15
Belmont	8.07	Midway	.23
B. & B.	.14	Montana-Tonopah	1 00
Booth	.06	Nevada Hills	2.40
Chollar	.18	Ophir	1.55
Combination Fraction	.13	Pittsburg Silver Peak	1.35
Con. Virgina	.90	Round Mountain	.51
Florence	.58	Savage	.17
Goldfield Con.	4.32	Tonopah Extension	1.37
Gould & Curry	.09	Tonopah of Nevada	6.95
Jim Butler	.34	Union	1.37
Jumbo Extension	.22	Vernal	.14
MacNamara	.26	West End	.71

OIL SHARES.

(By courtesy of San Francisco Stock Exchange.)

San Francisco, January 18.

Associated Oil	$43.75	Peerless	$ 4.50
Brookshire	.52	Pinal	2.90
Caribou (New Stock)	1.25	Premier	.55
Claremont	.84	P. S. Petroleum	.17
Coalinga National	.13	Republic	.45
Con. Midway	.03	Silver Tip	.95
Empire	1.05	Sterling	1.45
Enos	.14	S. W. & B.	.25
Maricopa National	.23	Turner	1.10
Midway Premier	.27	Union	99.00
Monte Cristo	1.25	United Oil	.31
Palmer	.73	W. K. Oil	2.55

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. Jan. 18.		Closing Prices. Jan. 18.
Amalgamated Copper	$ 65	La Rose	$ 3¾
A. S. & R. Co.	70	Mason Valley	11¾
Braden Copper	5⅝	Miami Copper	24½
B. C. Copper Co.	4½	Mines Co. of America	3¾
Butte Coalition	22¼	Nevada Con	19¼
Chino	25½	Nevada Utah	1/16
Davis Daly	1	Nipissing	6¼
Doble	¾	Ohio Copper	1
Dolores	4	Ray Central	1¾
First National	2¾	Ray Con	18
Foley O'Brien	¾	South Utah	¾
Giroux	4½	Superior & Pittsburg	18
Goldfield Con.	4¼	Tenn. Copper	38
Greene-Cananea	8½	Trinity	6¼
Guanajuato Con.	¾	Tuolumne Copper	3¼
Hollinger	13¾	United Copper	1¼
Inspiration	10½	Utah Copper	56¾
Kerr Lake	2¾	Yukon Gold	3¾

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EDITORIAL

STATISTICS regarding the iron trade in America are published fully by *The Iron Trade Review*. The iron industry has become so large and prompt knowledge so valuable that a daily edition is hereafter to be published.

CANADIAN and British mining engineers are to get together at Ottawa, March 6, 7, and 8, in a joint session of the Canadian Mining Institute and the Institution of Mining and Metallurgy. A number of Americans are planning to attend, professional knowledge, fortunately, being one of the things regarding which Canadians and Americans agree there shall be full reciprocity.

IT IS announced that Mr. William C. Hook, now circuit judge of the Eighth Judicial Circuit, will be appointed to the existing vacancy upon the bench of the Supreme Court of the United States. This puts an end to the widely expressed hope that a jurist especially versed in mining law might succeed to the vacancy. The Mining and Metallurgical Society of America has recently been in process of making a recommendation to that effect, but meanwhile the vacancy was filled.

STEADINESS and responsibility among employees is universally appreciated, and large companies are quick to utilize any factor that may tend to increase these desirable characteristics. The Anaconda Copper Mining Company has announced that henceforth it will employ only citizens of Butte, so long as a sufficient supply of laborers shall be locally available. This is a wise policy, for miners are too often Ishmaelitish in their characteristics, and anything which puts a premium upon steadiness, thrift, and sobriety will work to the advantage of the employer as well as of the community.

NEW producers of copper in the Southwest are making excellent progress. At the Chino two sections of the mill are in steady operation, and a third is expected to start early in February. At the Ray, which began production in April last, over 15,000,000 pounds of copper was produced during the nine months, the December output being 2,660,000 pounds. At the Miami the sixth unit of the mill is expected to start by February 1. The December output of this company was 3400 tons of concentrate, or approximately 2,500,000 pounds of copper, and about 2500 tons of 2.6 per cent copper is now being handled daily.

SUBSCRIPTIONS for the Emmons memorial fellowship in economic geology at Columbia University are being received from individuals in many lands. This is as it should be, since, aside from the fact that S. F. Emmons benefited men in many districts, the memorial is intended to be a tribute of mining men to the work of economic geologists. The men who brought science down into the mine and made it useful deserve well of their professional associates, and in honoring Emmons the whole rank of mining geologists is honored. If you have not already sent in your subscription, please do so. The treasurer is Mr. B. B. Lawrence, 60 Wall street, New York City.

FOREST fires are being better controlled, as is shown by the report of the district forester stationed at San Francisco, covering the year 1911. Although there were 797 fires, as against 553 the year before, the acreage burned was decreased 75 per cent. This is accounted for by the fact that 40 per cent of the fires were sighted, reported, reached, and controlled promptly, in place of 23 per cent the year before. More trails, telephones, and a better patrol service are accomplishing this result, and in this as in other matters prevention is proving better than the most vigorous attempts to cure.

AN unusual case was recently adjudicated by the Commonwealth High Court at Sydney, Australia. Thomas Johnson sued the English & Australian Copper Company, for which he had been manager, for wrongful dismissal. At the trial it appeared that the defendant company had bought a lot of copper ore, which was assayed as usual by both seller and buyer. The buyer's analysis, which was finished first, showed 36.24 per cent copper, the seller's analysis, when received, indicated 35.75 per cent. The manager thereupon instructed the buyer's assayer to make a new certificate for 35.85 per cent copper, which was then sent to the seller. When this was discovered by his company he was dismissed, and the suit followed. On the first trial damages of £1225 were awarded, but this was reversed on appeal. Corporations are commonly believed to have no souls; apparently the consciences of some companies are more tender than those of their officers.

THERE is a saying to the effect that anything that is worth doing is worth doing well, which may be adequately answered by asking, 'How well?' Accuracy is always desirable and frequently necessary; the same may be said of expedition. Often one can only be gained at the expense of the other, the securing of an adequate measure of both offers scope for the judgment and skill of the engineer. Elsewhere in this issue Mr. A. J. Sale discusses rapid methods for the determination of copper, in which accuracy is consonant with speed. Where the material to be thus assayed varies but little in character and copper content, it is often convenient to prepare a large sample of ore, approximating the average, which, after careful analysis by electrolysis, can be employed as a standard ore in place of copper foil, which is less convenient to weigh, and lacks the impurities present in the ore. Many such details of practice are everywhere being worked out as incidents of the day's work in the mining world, and the engineer who is quick to learn is also generous to share his knowledge with others and thus aid in keeping the wheel of progress steadily advancing.

Why Not Mine?

A visitor from abroad, when examining the mining districts of the United States, is likely to be impressed by the considerable areas on which but little exploratory work has been done, and may inquire if the small amount of work apparently performed has been sufficient to demonstrate the non-productive character of the ground. His mystification would be increased rather than lessened upon being informed that the ground in question had been located as mining claims, and in many cases patented, but no further development work had been performed. "But I understood that the purpose of your American mining law was to allow the individual citizen to freely develop mineral deposits upon the public domain; that any citizen might locate claims, if he proved their value as mineral-bearing land he might purchase them for a small sum, and if he was unable to prove their value they reverted to the public domain; how then can large areas exist which are not open to location, and have neither been proved valuable nor valueless as mineral land?" Most probably the person interrogated would at this point give up in despair of ever clearly explaining how the American mining law, intended to permit exploitation of the national resources upon the simplest terms, has succeeded in producing confusion of rights beyond the wildest ideas of its framers, merely through having been made too simple through a faulty conception of the nature of ore deposits. It is a curious fact that the attempt to apply a simple system to a complex matter always results in the compounding of complexities. Thus the American mining law, conceived with the idea of making the development of mineral deposits as easy as possible, has really acted as a powerful retarder in their exploitation.

To attempt a general criticism of our Federal mining law is much like shooting at a flock of ducks, and is likely to be similarly ineffective. Let us therefore single out a bird, and direct our aim at it. Perhaps the most obvious is the curious outcome of the attempt in the law to secure free scope for initiative and stable rights to the prospector and miner. This was to have been obtained by providing that all the mineral land of the public domain should be freely open to prospectors; that when a prospector found indisputable evidence of the occurrence of a deposit he might secure a temporary title to a sufficient area to protect him while he explored it sufficiently to demonstrate its probable valuable or valueless character; and that, finally, he might for a small sum secure an absolute title to the property when he should have convinced himself that its probable value would justify the expense. Apparently this is ideally simple, yet in practice it has proved woefully ineffective, not primarily from defects in the law, but from defective machinery provided for its execution.

One of the important factors in the devising of an experimental system of government for the Republic was a horror of conferring power on officials. Men familiar with the medieval abuse of power in Europe by nobility and officials who were responsible only to a king whom they often did not obey and a God whom they did not fear, not unnaturally hesitated to confer upon officials any powers which might be retained by the community, and thereby escaped known evils by falling into unknown ones. The New England town meeting represents the eighteenth century idea of satisfactory government in the United States, and it is perhaps only because no ordinary imagination could conceive the growth of the United States during the next century and a half, that we find a system that was excellent for a New England town so unsatisfactory when applied to a nation imperial in its extent and resources. In short, from a twentieth century viewpoint the system of government of the United States is unbusinesslike. If in the conduct of an ordinary business every question that arose in the course of daily operations had to be submitted to a committee of shareholders for prolonged investigation and decision, it is obvious that the number of decisions coming before the shareholders would be more than they could adequately attend to, thus creating great delay. Department heads, rather than be kept waiting for months and years to find whether apparently necessary courses of action would be sanctioned or not, would either devise irregular methods of conduct of affairs which would obviate the constant necessity of submitting oftentimes trivial matters for investigation and decision, or would restrict their activities as much as possible. Progress and initiative would be deadened, the business would tend toward a dull round of 'red tape' and would unquestionably fall into confusion. No business man would countenance this in the conduct of a private business, yet we all countenance it in our public system of

government. In the specific case which we are discussing, if a question arises as to the validity of a claim it must go before a court for decision, with the right of appeal almost indefinitely prolonged. The result of this is that when anyone has located a claim it is not really worth any other person's while to attempt to question that right unless the claim gives evidence of much value, when the slightest pretext will suffice for a prolonged controversy that too frequently leaves both sides in a position where nothing effective can be done for the development of the deposit. Disputes as to mineral rights on unpatented claims should be subject to the review and decision of a single official, who would immediately award the claim to one or the other of the disputants, thus releasing the energies of both from a fruitless controversy to engage in useful development. The rights involved are not ordinarily great enough to justify buttressing them with elaborate machinery. Even if now and then, through too hasty decision, a prospector lost a claim to which he was justly entitled, the pecuniary loss would commonly be less than a miner often incurs in an evening about the faro or poker table. On the other hand, he would be freed from a hampering quarrel and could put his best efforts into making fresh discoveries. The suggestion that 'graft' would be the result of putting such power into the hands of a single man is patently absurd. 'Graft' results when a little man is in a position to do a big favor to a corporation or an individual; there is clearly no chance for it where but little money is involved. If the general system remain as it is now what the prospector needs is more freedom and less protection in his right, then large areas of mineral land can not be held under questionable titles by those who are not developing them and who are unwilling to let them go. Let us be done with law-suits—why not mine?

Leasing Agricultural and Mineral Lands

Opponents of a leasing system as applied to the public mineral lands are accustomed to ask why the system, if it is to be applied to mines, should not also be extended to cover farms—why mineral lands only, and not all public lands, should be leased. The question is raised not in order to promote leasing of the agricultural lands, but to prove, or attempt to prove, that no leasing system is desirable in America. We have already expressed our favorable opinion of leasing when applied to coal, phosphate, and oil lands. We are by no means sure we would not favor a similar system for all mineral lands if a specific proposal that seemed sound should be urged. As to that, for the present, we reserve opinion. We do not, however, accept the dictum that advocacy of leasing as applied to certain lands necessarily commits us to advocacy of a similar system for all. Specifically, we do not favor the leasing of agricultural lands, and to our way of thinking there is a vast difference between the two proposals.

A farm is essentially a homestead; a mine is essentially a hole in the ground. The one is a place of habitation for all time to come; the other is a place temporarily occupied for a specific purpose. Farms, it is true, may, by reason of wrong methods of cultivation, 'run out' and be abandoned; but, even so, they may under changed conditions be brought again under cultivation, and there is no inherent reason why any farm should permanently cease to be of value. The farmer lives on the interest of his investment, and, if he be a wise farmer, his capital account, represented by the value of his land, increases as the years pass. The miner, on the other hand, acquires a piece of ground for the specific purpose of taking out and selling something which cannot be replaced. No matter how wisely he may plan, nor how carefully he may work, he draws on capital account from the day he first strikes a pick into the ground to that when he regretfully hoists out the last man and shuts off the steam. Many mines are temporarily closed, and all mines must ultimately be expected to be permanently closed. In the one case the worker builds a continuing business, in the other he tears down and takes away—and in most instances the more efficiently he does his work the quicker he mines out the ore and moves on. Granting freely that the best social system is that which most firmly attaches men to the soil, granting further and gladly that a system of permanent tenantry is unthinkable in America, it does not seem illogical to argue for different systems of control in the two cases depicted. Clearly, a man may buy things out of income that are unwarrantedly expensive when purchased out of capital. Giving men homes is one thing, and a thing that cannot be too greatly encouraged, but allowing them to lock up and keep from others capital which should be brought out and put into circulation is certainly different.

The wisdom or folly of introducing a leasing system for any lands will depend upon the particular plan adopted and the way in which it is administered. It is easy to imagine a system of leasing or a character of administration that would be fatal to all immediate development; but it is also possible to think out a system that would relieve many present difficulties, safeguard the future, and promote development. Whatever may be done should only be with full knowledge of conditions in the West, the territory to be mainly affected, and any changes made should not be radical. It is entirely possible to introduce a leasing system which will retain to the Government the right to alter conditions at some specified date in the future, and yet not unreasonably change the actual operating conditions now. If the results are satisfactory, further changes can be made as occasion arises. This is not possible under the present system of land tenure. A claim once patented belongs to the owner to do with as he likes; he may work it or not work it, he may make it useful or useless to the community. He may make it a centre of industry or he may hold it and block the way of others who would do so. The only remedy is taxation and possibly condemnation and repurchase by the public. Opponents of change too often blink present evils, which are in fact real and widespread. Their nature and effect has perhaps been sufficiently indicated. Some remedy must be found, and it will not do to dismiss without consideration one that is proposed, because of a fancied resemblance to the feudal system of farm tenure.

When Mr. Roosevelt began making land withdrawals, and when Congress took up the matter of validation of the withdrawals, a mighty storm of protest went up from the California oilfields. The net result, however, was undoubtedly good. No candid observer can doubt that the condition of the oil men there would today be the worse if public land was still open to unlimited staking. Furthermore, all legitimate explorers have, under the withdrawal act, protection they never had before, so long as their operations are conducted in good faith. Evidently the terms of the law are more important than its title. Recently a letter was sent to more than fifty representative mining men throughout the United States requesting an expression of opinion regarding the advisability of applying a leasing system to the public mineral lands. Four-fifths of the men replied, and all shades of opinion were expressed. It is interesting to note that nearly two-thirds favored some form of leasing. He is but a poor judge of public opinion who does not see that sentiment in favor of such a change is rapidly rising. It should be the part of mining men to inform themselves, to take a part, and to direct the framing of the new law when it is passed. Not leasing, but the particular form of leasing is important.

Copper Mining in the Caucasus

By Frederic W. Cauldwell

*American capital is largely interested in the Caucasus Copper Co., Ltd., which was formed in London in 1900 for the purpose of taking over and developing copper mines in Murgne Gorge district of Artoin, near Dzansul and about 50 miles from Batum, which had been worked in the time of the Genoese, several centuries ago.

Up to the present time the company has expended large sums on the property, but only recently has it been brought to a stage where the plant will pay operating expenses and yield a margin of profit. The development of the mining property has been slow because the ore is most difficult to treat, the copper being so finely disseminated through the rock that fine crushing is required. A magnetic plant was first erected, but was found unsatisfactory, partly because of the difficulty of cooling large quantities of hot ore to the temperature required by the magnetic machines, and partly because of the difficulty in separating the ore from the silica. Enough of the latter mineral remained attached to render the concentrate produced too silicious for economical smelting. Water concentration is now being used successfully. It yields a concentrate that can be smelted with less than 15% of oil and gives a recovery comparable to similar plants in Utah and Nevada.

At the present time an extensive campaign of development is about to start at the mine, and one plant extension is already under way. It is proposed to increase the crushing, concentrating, roasting, and smelting equipment to a capacity of treating 1500 and probably 2000 tons of ore per day. The plant now treats 500 tons of ore per day. In view of these intended extensions, a description of the equipment and operation of the present plant is given. The mines contain, so far as is known from development work already done, 5,000,000 tons of 3¼% copper ore. It is known that there are extensions to this body far beyond that tonnage which have never been developed, as the ore now known is sufficient for present needs.

The ore occurs on a steep mountain-side in a flat body varying in thickness from 80 to 120 ft. The overburden to be removed amounts to one-third of a ton for each ton of ore developed. The whole of the tonnage of ore thus far developed can be mined in open cuts. It is planned to remove the overburden, 80% of which is soft earth, by means of hydraulic giants, which will be cheaper than steam-shovel work. These conditions, in connection with the cheap labor, will permit of an exceptionally low cost for mining, which, with a tonnage of 1500 tons per day, would probably equal the lowest cost obtained at the large porphyry mines in Utah, Nevada, or Arizona. With the mines opened and the overburden removed, it is estimated 2000 or 3000 tons of ore can be supplied daily to a concentrator.

The ore is carried from the mine in 4-ton double-hopper cars by a short track to a crushing mill having a capacity of 1200 tons per day. This mill contains four 18 by 24-in. Blake crushers and eight sets of 15 by 36-in. rigid rolls. Automatic feeders supply the first pair of crushers, which crush to 2½-in. maximum size. The ore is then carried on a Robins belt-conveyor to a 500-ton bin, above the second pair of crushers, which crush to 1½ in. Automatic feeders are also employed here. From the Blake crushers the ore is carried on a belt-conveyor to a bucket elevator, at the top of which it is discharged to the two units comprising the eight sets of rolls. Each set of rolls is equipped with its own elevator and trommel, so that the material already fine enough to pass through the trommel is not sent through the corresponding set of rolls, thus decreasing the formation of slime. The first set of rolls has a ⅞-in. trommel, the medium roll a ⅝-in. trommel, and the two pairs of fine rolls each a 5-mm. (millimetre = .039 in.) trommel.

The ore, crushed to a 5-mm. size, is delivered to an aerial ropeway of the Pohlig system, similar to the Bleichert system in use in the United States, and carried to the concentrators at a level 2400 ft. lower. There it is divided between two concentrators, each having a capacity of 250 tons every 24 hours, and is fed from stock bins by automatic feeders to the boot of a vertical elevator, at the top of which a stream of water carries the ore to six jigs. In these all sizes of ore below 5 mm. are jigged. The tailing from the six jigs goes to revolving screens with 1½-mm. holes, from which the oversize goes to an Evans-Waddell Chilean mill, equipped with 1½-mm. screens. The product of this Chilean mill joins the undersize from the revolving screens and is elevated by a bucket elevator to a 3-compartment hydraulic classifier. The coarsest spigot from this classifier is sent to four jigs, and the tailing from these jigs goes to a second Chilean mill equipped with ¾-mm. screens.

The ore from the other compartments of the classifier is sent to a row of ten 6-ft. Frue vanners. The pulp is divided over the vanners in the proportion required by the tonnage produced in each of the sizes of the hydraulic classifiers. Each of these 10 vanners thus treats between 20 and 25 tons of ore per day. The tailing from each group of these first-treatment vanners goes to a bucket elevator attached to each group. After being elevated, the tailing is again classified and treated a second time, a group of 20 vanners re-treating the tailing from the first 10. A fourth row of 10 vanners is used to give a double treatment to the slime obtained from the overflow of the classifier. The slime is collected in eight wooden tanks, 10 ft. in diameter and 18 ft. high. The concentrate produced averages approximately 8½% copper, 37% silica, and 28% sulphur. It is sent to concentrate-storage bins and from there delivered to McDougall roasters, 18 ft. in diameter, and of the usual type used in the large copper mills of the United States. The red-hot calcine, mixed with limestone, is delivered to three reverberatory smelting furnaces, two of which are 35 ft. in length and one 50 ft. All are fired with oil.

The property is equipped with an excellent machine-shop and a foundry of a size usually found only in plants of several times the capacity of this. These large shops are found necessary, owing to the distance and time required to obtain spare parts. The mines and smelter use oil for fuel exclusively. The oil is brought 50 miles from Batum by the company's own pipe-line through 4-in. Mannesmann high-pressure pipes. The oil used is that produced in the Caspian oilfields and is brought from Baku to Batum in tank cars. The concentrators include the most up-to-date American machinery. In the smelter and the crushing mill the machinery is partly of English and partly of American manufacture of the most improved types. In extending the plant, the company will install equipment on the same general lines as that now in use.

At the present time over 1100 men are employed in the mines and the smelting work and in construction. The labor is cheap and fairly efficient. A great variety of nationalities is found at work in the different departments. The miners are chiefly Greeks and Turks, with Persians working in the crushing mill. At the concentrators the laborers are Russians, Turks, and Georgians. In the machine-shop and foundry Russians and Georgians are to be found almost exclusively, while at the smelter the labor is exclusively Persian.

The property is about 50 miles from the seaport of Batum. The Government macadamized military road covers 35 miles of this distance and the remaining 14 miles the company was obliged to construct at great expense. This road had to be built along the face of mountains through rock and sliding soil. During the 10 years of its existence the company has conveyed in wagons 100,000 tons of supplies, machinery, and product over this 50 miles of road. All the copper produced by the company is sold in Russia and commands a good price, as the duty on foreign copper imported into Russia is 5 rubles ($2.575) per pood (36.1 lb.). The property, in point of ore tonnage developed, is today one of the large mines of the world.

*Abstract from *Daily Consular and Trade Reports.*

The Spring Valley Oilfield in Southwestern Wyoming

By F. J. H. Merrill.

This field is in southern Uinta county, Wyoming, near the line of the Union Pacific railway. Its geologic structure was worked out with much care by A. C. Veatch and assistants in 1905 and 1906, and the results were published in Bulletin 285 and Professional Paper No. 56 of the U. S. Geological Survey. To these publications, especially the latter, the reader is referred for minute details. The general facts of importance to the present discussion are as follows.

In the vicinity of Spring Valley the members of the Cretaceous series, which carry coal at several levels, are folded in an anticline with northeasterly axial trend. This is succeeded on the west by a synclinal fold, the west limb of which is overturned to the east and adjoins on the west an extensive fault also trending northeasterly.

Near the base of the Cretaceous is a formation called the Aspen shale, 1800 to 2200 ft. thick, having intercalated beds of sandstone varying in thickness up to 60 ft. which, on the west dip of the anticline, carry nearly all the petroleum found in this region. At one point oil has been found in the underlying Bear River sandstones, which are about 2400 ft. thick and form the base of the Cretaceous, resting directly on the Jurassic red sandstones.

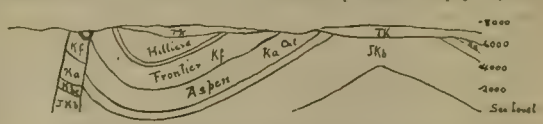
The productive oilfields lie on the west limb of the anticline between the outcrop of the Aspen shale and the axis of the syncline. But while a synclinal axis theoretically offers opportunity for the accumulation of oil, it happens that along the axis of this particular syncline, in the vicinity of Spring Valley, the top of the Aspen shale lies at depths of 2000 to 4000 ft. below the surface. As this formation is about 2000 ft. thick and the exact level of the oil-sand is not known, it will be seen that along this axis wells 3500 to 5500 ft. deep will be required to reach oil. Further, it is possible that the pressure of this great thickness of strata may have compacted the sandstones along the axis and reduced their porosity. If this be true, better opportunities may be found on the west dip of the anticline.

Along the axis of the anticline the Cretaceous beds have been eroded away, leaving exposed the underlying red beds of the Jurassic, and to the eastward, upon the axial exposure of Jurassic and the edges of the Cretaceous strata, has been laid down a great thickness of Eocene Tertiary beds included in the Wasatch group and known individually as the Almy, Fowkes, and Knight formations, having an aggregate thickness of 5000 to 6000 ft. These Eocene beds dip eastward about 20°, extending for miles in the same direction, in unbroken benches and plateaus.

No Cretaceous strata are exposed east of the anticlinal axis, and no information is available as to the level of the buried surface of the Cretaceous or the thickness of the Tertiary beds which overlie it. The accompanying section shows this structure in diagrammatic form.

VIEW ACROSS SPRING VALLEY ANTICLINE, NORTH OF LEROY STATION.

East of the anticlinal axis the eroded surface of the Cretaceous is covered unconformably and deeply by the



SECTION ACROSS SPRING VALLEY ANTICLINE.
(After A. C. Veatch.)

Eocene Tertiary beds, and the existence of oil in the Aspen shales has not been proved.

No wells have yet been sunk through these Tertiary beds to determine the line of outcrop of the Aspen formation on the old surface of the Cretaceous. Further, while the presence of oil in the Aspen formation on the east limb of the anticline is in every way probable, it cannot be regarded as certain, since there are geologic possibilities that might interfere with it. Therefore, concerning this territory east of the axis, information is lacking on the most important points. These are: (a) the thickness of the Tertiary deposits overlying the upturned edges of the Cretaceous beds; (b) the distance east of the anticlinal axis at which the Aspen shale outcropped on the old sur-

face, now buried—it is obvious that the deeper the erosion of the Cretaceous the greater would be the thickness of the overlying Tertiary below the present surface and the greater the distance of the buried Aspen outcrop to the east of the anticlinal axis; (c) the presence of oil east of the anticline in the Aspen shale or in any other formation.

On the last point, about all that can be said is, that oil will probably be found in this formation, but the number of wells that must be drilled on any particular section line across the strike, in order to find oil, or the depth at which it may be found, is wholly conjectural.

The region east of the anticline, therefore, offers possibilities as an oilfield, but will require extensive exploration.

There are but two seepages in the Spring Valley region. One, called the Brigham Young oil spring, was known to the Mormons in 1847, and is situated near Hilliard, on the N.E. ¼ of the N.W. ¼ of Section 4, T. 13 N, R. 119 W. The other, known as the White oil spring, is on the S.E. ¼ of the N.W. ¼ of Section 33, T. 14 N., R. 119 W. This was discovered in 1867. The Carter oil spring, on the S.W. ¼ of the N.E. ¼ of Section 31, T. 14 N., R. 119 W., was started in 1868 by opening a

SOUTHERN WYOMING OIL TERRITORY.
(Spring Valley field in black near railway.)

small adit for coal. This oil had a gravity of 21°B. In 1900 a well was sunk by the Union Pacific Railway Co. about one-half mile southwest of Spring Valley station, and yielded oil at three levels, 491 to 493 ft., 573 to 581 ft., and 1148 to 1170 ft. With the exception of the wells drilled through the Aspen shale into the Bear River formation, all the wells of the productive field take their oil from sandstone layers in the Aspen shales. These sands vary in thickness and in number, as shown by the table of well records. It is said that the wells at the north end of the developed field have thicker beds of oil-sand than those at the south end, and this seems to be the case.

An extensive and detailed set of well records from this field has been published in Professional Paper No. 56, pp. 139 to 159. Since the paper was issued, but few wells have been drilled, the most important being those of the Texas King Oil Co. and that of the Roberts Oil Co. In Texas King well No. 1, the top of the oil sand was reached at 758 ft. The bottom of the well is 20 ft. below. The Roberts well No. 1 met oil at 840 ft., with 20 ft. of oil-sand.

The oil of this field as it flows from the pumps, is free from sand. The oil-sands are evidently, therefore, more coherent than those in California and Texas, where the oil carries a considerable percentage of its bulk in fine sand. The earlier wells drilled in this field were cased to the bottom of the sand, and the casings, according to California practice, were perforated at the points where oil-sand was detected.

In all cases, while the wells when first brought in have yielded from 60 to 130 bbl., within a few months they have fallen off to a production of from 5 to 15 bbl. per day. The drillers explain the falling off of the flow by the suggestion that paraffine is deposited in the perforations through evaporation of the volatile constituents when the wells are pumped dry. This paraffine can be melted out by the use of steam or hot water. During the past year three wells were drilled, in which the casing stopped at the top of the oil-sand. In these also, the flow, while copious at the beginning, shrank very greatly; in one case from 124 bbl. per day at the outset to 16 bbl. Evidently, therefore, if deposition of paraffine is the cause of the decrease in flow, it must occur in the pores of the oil-sand. The suggestion is now made that the flow can be restored by shooting with nitroglycerine. This, however, has been tried, in one case, without permanent results. Until, therefore, some one succeeds in maintaining the flow of a well, it is not certain that this can be done, and the field may, at present, be regarded as one of uniformly small production. The Pittsburg-Salt Lake Oil Co. has five wells which were drilled some years ago, and the average production of these wells is about 4 bbl. each per day. The present output of the whole Spring Valley field is only 100 bbl. daily from a total of 16 producing wells, or an average of 6.6 bbl. per well per day. At a market price of $1.60 per bbl., this corresponds in income to a production of 35.2 bbl. per well per day of California fuel oil at 30c. Oil of high gravity and value, theoretically costs less to market, because the transportation charges are proportionally lower.

The oil of the Spring Valley field varies in gravity from 41 to 49°B. It is not always carefully handled and, when pumped into uncovered wooden tanks, loses 3 to 4°B. by evaporation. When it reaches the refinery its gravity is said to be from 41 to 45°B. As stated by the Utah Refining Co., the oil contains on an average: gasoline, 15%; kerosene, 45%; lubricating oil, 40 per cent.

An analysis made of one of these oils by a Boston chemist gave the following results:

	Per cent.
Light naphtha	10.67
Illuminating oils	34.67
Lubricating oils	41.16
Residue, largely paraffine	13.50

As all the Spring Valley oil is adapted to refining, its natural market is a refinery. At present all oil brought to the railroad at Spring Valley and Leroy goes to the refinery of the Utah Refining Co. at Salt Lake City. The same company controls a small refinery near Spring Valley station which is not now in operation. A refining plant brought to Leroy from a locality near San Francisco, California, is being erected, but has not yet begun systematic operations.

The Pittsburg-Salt Lake Oil Co. has pipe-lines from Spring Valley to all the producing properties except that of the Standard Reserve Oil Co. A gravity pipe-line has been laid from the wells of the latter company to Leroy, where at present this oil is loaded into tank-cars and shipped to Salt Lake City.

The Utah Refining Co., through its purchasing company, the Pittsburg-Salt Lake Oil Co., pays at the well $1.60 per bbl. for oil of 41°B. gravity or higher. For oil below 41°B., 5c. per degree is deducted from this price. The two refineries of the Utah Refining Co. are said to have a total capacity of 1000 bbl. daily, but the total supply is only 100 bbl. daily, which is all treated at the Salt Lake City refinery. The refinery at Leroy proposes to pay $1.75 per bbl. for 43°B. oil; adding or deducting 5c. per degree above or below. It has been suggested that the product of this field might be profitably shipped to the Standard Oil Co.'s refinery at Florence, Colorado, or to that at Boulder, but I have not had opportunity to verify the possibility of this.

The costs of operation in this region are difficult to ascertain, because there has been no systematic study of this detail by the operating corporations. Apparently con-

ditions are similar to those in California. Many of the wells furnish enough gas for making steam, and when this is lacking, good steam coal can be had in the vicinity for $1.75 per ton.

For drilling, as in California, the standard rig is found most substantial. To drill a first well 1000 ft. deep will cost about $10,000. If other similar wells are to be drilled nearby, they can be put down for about $6000 each.

The companies now operating are: Pittsburg Salt Lake Oil Co., Salt Lake City, 5 wells, 1200 to 1500 ft. deep; Texas King Oil Co., Evanston, Wyoming, 2 wells, 800 ft. deep (No. 1 well oil-sand 758 to 788 ft.); Roberts Oil Co., Evanston, Wyoming, 1 well, oil-sand 840 to 860 ft., two 5-ft. sands below; International Consolidated Oil Co., Boston, Massachusetts, 5 wells; Standard Reserve Oil Co., Chicago, Illinois, 4 wells. Those not producing are: Duchess Oil Co., Spring Valley, Wyoming; Manhattan Oil Co., Evanston, Wyoming; Alleghany Oil Co., Evanston, Wyoming; International Petroleum & Oil Development Company.

Accurate 'Slop-Coppers'

By A. J. Sale

The volume of work around large copper mines and mills, necessitating the employment of a system of assaying for mine or drill samples which is more rapid than the iodide or electrolytic methods, naturally forces the assayer to fall back on the so-called 'slop-coppers.' But the average chemist is apt to conceive the idea that slop-coppers means sloppy coppers, and works in accordance. The 'slop' method, if proper precautions are observed, will give accurate results even on low-grade refractory ores.

The first consideration for accurate work is that, with ore assaying from 1 to 3%, the amount of copper contained in the ore is relatively so small that from a 1 gm. assay the solution will be so dilute at the time of titration that it will be difficult to obtain an accurate end-point. By starting with 2 gm. I consider that the large bulk of material handled in the assay is more than compensated for by the advantages obtained. The next important consideration is that some portion of the copper is usually closely associated with the iron pyrite, which is far more soluble in aqua regia than in nitric acid. The course of operations that I have found to give best results is to put 2 gm. of pulp (through a 100-mesh screen) into a casserole and boil nearly to dryness with 15 c.c. of aqua regia. Then add 10 c.c. of nitric acid and boil until it becomes fairly syrupy. Then add about $\frac{1}{2}$ gm. of chlorate of potash and boil for five or six minutes. This will sometimes throw down a dark brown precipitate which is probably mostly manganese dioxide. I have found from a large number of results that the proper manipulation of chlorate will always prevent the yellow precipitate which sometimes forms when titrating, and causes difficulty in reading the end-point.

The assay is washed from the casserole into a small beaker with boiling water and allowed to cool until it will not 'spit' too violently when ammonia is added. The ammonia is put in, a little at a time with constant stirring, until the iron is completely precipitated. It is very poor practice to add ammonia directly in the casserole, as it is then difficult to see the precipitate, also to wash it out.

The assay is now filtered into a titrating flask and the precipitated iron washed with boiling water. This iron always contains some of the copper present and should be washed into a beaker and nitric acid added drop by drop until the precipitate is almost dissolved. It is usually better not to completely dissolve it, as this may again put the manganese into solution. Ammonia is now added until all of the iron is re-precipitated, and then the material is filtered through the same paper into the titration flask. The precipitate is washed with boiling water, and if the filter paper shows any signs of blue color the re-solution and re-precipitation is again repeated.

For standardizing, the best results are obtained when the amount of copper in the standard is approximately the same as in the assay, for instance, if the ore runs 3% the assay from 2 gm. will contain 60 mg. of copper, which should be approximated when weighing the standard. Also it is more accurate to add approximately the same amount of foreign elements to the standard as will occur in the ore and carry it through the same as if it were an assay. It is more rapid to find the exact weight of a piece of copper than to try to cut it to some exact weight, such as 40 or 50 mg., only, as before stated, it should be approximately of the same weight as the copper in the assay. If we start with 2 gm. of pulp, then each 20 mg. of copper is equivalent to 1%. It is much less confusing to divide the weight of the standard by 20 and record as an equivalent percentage than to keep its exact weight. For instance, if the weight is 44.6 mg., record as 2.32%. Two standards should be weighed and one titrated at the beginning of a set of assays and the other at the finish. In titrating, the solution should be at the temperature of the room and the same amount of time and agitation given to each. It is also better to stop at a light pink end-point than to take out all the color; the important thing is to have the same end-point for all assays and standards. To avoid errors in calculation, the results should be recorded in the form shown below:

	No.	Burette reading.	Net reading.	Percentage copper.
2.76%	standard.....	10.15	10.15	0.272 per c.c.
	1	21.0	10.85	2.96
	2	30.6	9.6	2.62
	3	41.35	10.75	2.94
	4	50.7	9.35	2.55
2.15%	standard.....	58.55	7.85	0.274 per c.c.

The mean strength will be 0.273% copper per c.c. In rapid work there is possibility of an error of subtraction or multiplication; a quick check on the arithmetic is obtained by adding the final assays. The sum of these should equal their total net burette reading, times the mean strength of solution. In the above table the sum of the assays from No. 1 to No. 4 is 11.07%, and the total net burette reading is $50.7 - 10.15 = 40.55$ c.c. Now, $40.55 \times 0.273 = 11.07$, which checks the calculations.

The water used in the analysis is an item of considerable importance. Most of the so-called 'distilled' water around a mine or mill is condensed steam, and frequently contains oil or boiler compounds which may seriously affect the results. The most satisfactory water that I have found, where pure distilled water is not obtainable, is secured by adding a little ammonia to ordinary spring or hydrant water and boiling until all of the excess of ammonia is gone. This, when decanted from the precipitated lime and other salts, will nearly always give a good end-point. The final precaution for good results is the use of pure potassium cyanide. I have found from a number of experiments with partly decomposed cyanide that its strength is liable to vary with the part of the burette from which it is drawn, being stronger at the bottom of the burette than at the top, or the reverse. These precautions may seem to be trivial, but on refractory low-grade ores they are virtually essential, and if carefully followed, I think, will give practically as good results as the average iodide or electrolytic assay.

Location Notice

Below is given verbatim a copy of a location notice found in California. It illustrates that in America one may know more of the rules of law than of language.

Notis:

i the under sined hav this day claimd & located this spring for millen & minen purpes on the golden rull min.

claim 5 ackers of land & runs 500 feet each way from this notis.

this spring is knoun es the iren Spring on cors gold gulch in town ship 9 fresno Co. Cal.

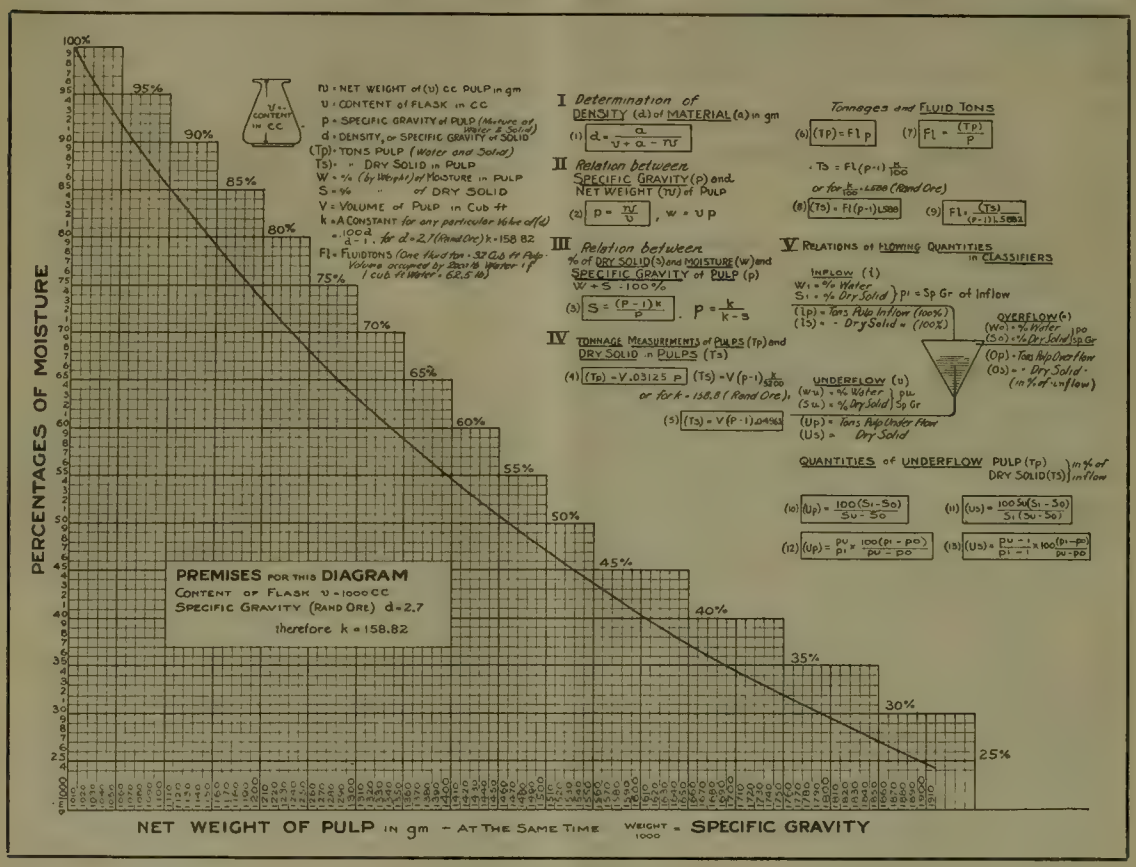
located on the groune this 29 day of June 1888.

locater Signed.

Practical Applications of the Specific Gravity Flask

By H. Stadler

*The principal objects of these notes is to show the great practical possibilities of the specific gravity flask, which in future should prove to be one of the most useful and indispensable instruments for efficient and reliable control of the condition of mill-pulp. W. J. Sharwood's admirable article on the measurement of pulp and tailing[1] is presumably familiar to all millmen who have to deal practically with the handling of pulp. The present notes do not pretend to add much that is really novel, but I trust that some practical conclusions drawn from the above and other papers on this subject[2] will be welcome to those whose daily duties leave very little spare time for a thorough study of technical literature.



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In practice it has been found that flasks having a large mouth ground true, the ground edge to be used as the mark of capacity, are more convenient for taking fair samples than the usual glasses with a mark below the mouth. In consequence of sand adhering to the glass above the mark, the latter are more difficult to fill accurately.

I. Determination of Density (Specific Gravity) of Solids

If the specific gravity of the solid ore under treatment be not taken at an accepted average value, it may be determined by any well known method. For instance, if the material is dry, a known weight (in grams) of the material under examination is placed in the flask, and water added to the mark (in the suggested flask to the top), the total weight of the contents is then taken. The density is obtained by the use of formula (1). Wet material, such as mill-pulp, is preferably dried and weighed after the determination of the specific gravity of the pulp.

II. Determination of Specific Gravity of Pulps

Almost all factors determining the nature of pulps, from the millman's point of view, are governed by the specific gravity of the pulp. If the metric system of weights be used, the specific gravity is at once obtained by dividing the net weight of the pulp by the volume occupied, or when a 1000-c.c. flask is used by cutting off the last three decimals of the net weight of the pulp (in grams). The specific gravity of slime pulp, in which all solids are freely suspended, may be measured by a hydrometer.

III. Determination of Percentage (by Weight) of Dry Solid and Water

Although the specific gravity is indicative of the constitution of pulps, the percentage of dry solid or moisture conveys a more definite impression to the average mind. The usual method of determining the percentage of solids and moisture, by drying and weighing, is very troublesome, and also, as done in practice, unreliable and inaccurate. Hence methods based on specific gravity, formula (3), are vastly quicker and more convenient.

Any alteration in the composition and in the rate of flow of pulps shows itself by a marked change in the percentage of moisture and this therefore gives a reliable, sensitive, and effective control in the uniform distribution of the pulp and the regular working of classifiers. For instance, at a mine where a set of eight similar classifiers

*Extract from the *Jour.* Chem., Met. and Min. Soc. of South Africa, November 1911.

[1] *The Mining Magazine*, Vol. I, Nov. and Dec. 1909.

[2] See F. B. Hyder's 'Specific Gravity Estimation of Pulp,' Colorado Scientific Society, Vol. IX, p. 417; and W. A. Caldecott, *Jour.* Chem., Met. and Min. Soc. of S. A., Vol. II, p. 375.

was fed with the same battery pulp, the moisture in the underflow of the different classifiers varied, at the same moment, from 45 to 75%, thus showing that the distribution of the pulp over the classifiers was very irregular. It is to be hoped that, with such a convenient means at hand, millmen will pay more attention to the control of individual units, as the total average always gives figures which are no help in detecting faulty work.

IV. Tonnage Measurements of Total Pulps (Tp) and of Dry Solid in Pulps (Ts)

Tonnage measurements of flowing quantities are generally made by running pulp for a measured time into a vessel of sufficient capacity to give fairly accurate results. Scales for weighing the large quantities collected are not practically available, and the drawing off of the water, drying and weighing of the solid portion in such quantities still less practicable. All these inconveniences are avoided by reckoning the tonnage from the volume occupied by the total pulp (in cubic feet) and its specific gravity, by formula (4) for the total pulp, and by formula (5) for the dry solid portion only.

The simplest manner to carry out these measurements is to run the pulp into a box of known capacity, large enough to take at least one minute's run of the stream. The exact time required for filling is taken by a stop-watch, the point of overflow being easily and exactly determinable. The specific gravity is determined from separate representative samples taken simultaneously, and the calculated weight of pulp or dry slime passing during the time (t in seconds) are then used to give the hourly or daily quantities. If, in all measurements, boxes of equal capacity are used, for instance, 16 cu. ft. (the volume of half a ton of water), all the constant factors may be condensed into one. For a box of the above capacity the formulæ for Rand ore are:

$$\text{Tons of total pulp in 24 hours: } (\text{Tp}) = \frac{43{,}200p}{t}$$

$$\text{Tons of dry solid only } (\text{Ts}) = \frac{(p-1)\ 68609}{t}$$

Since the capacities of launders, vats, pumps, and other machines, as well as the rates of overflow of classifiers are determined by the volume of the pulp, the fluid ton of 32 cu. ft. (equal to the volume of 2000 lb. water, on the assumption that 1 cu. ft. of water weighs 62.5 lb.) is frequently used as a unit in mining work. The tonnage of pulps of known specific gravities is readily converted into fluid tons by formula (7) for the total pulp and by formula (9) for the dry solid portion.

The same method is also applicable on a large scale to the tonnage measurement of vats, provided the consistence of the pulp is not changed by drawing off water or slime (as is the case with sand-collecting and slime-settling vat), or by adding cyanide solution (as happens with slime-treatment vats). For large measurements the practical utility of this method is therefore confined to agitation or circulating-vats, and in all other cases, for lack of better methods, resort must be had to the method commonly practised, inaccurate as it is, of estimating the dry solid by the established dry weight of the settlement volume. This varies considerably with the nature and the fineness of the ore, and should therefore be checked frequently and corrected if necessary by actual test. For such tests the method I describe is suitable, as no drawing off of water nor drying is necessary.

At the Knight Central G. M. Co. the daily tonnage measurements of the mill-pulp for several years past have been regularly taken by the gravity method, which, after careful investigation, was found to give most reliable results. In addition there is the advantage that it can be carried out without waiting for settlement of the slime. After filling the first transfer tank with solution and after circulation (the whole operation taking about four hours), two samples are taken, one at the delivery pipe, representing the pulp at the bottom of the tank, and one from the upper part, to get a representative average for the whole content.

V. Relations of Flowing Quantities in Classifiers

The relation of flowing quantities in classifiers may be calculated from the percentage of any of their components measured at the inflow, overflow, and underflow. No component can so quickly and reliably be measured as the percentage of dry solid taken with the specific gravity flask. From the percentages of dry solid so obtained, the tonnage of the total pulp underflow (as a percentage of the total pulp inflow) is calculated by formula (10) and the tonnage of dry solid underflow (as a percentage of dry solid inflow) by formula (11). In neither case is it first necessary to calculate the percentage of solid, since the flowing quantities of the underflow can directly be determined from the values of the specific gravity, by formula (12) to get the percentage of the total pulp, and by (13) to get that of the dry solid portion only. The accuracy obtainable by the specific gravity method is only limited in practice by the accuracy with which the means at our disposal determine the correct values of (1) the volumetric weight of the pulp (w), (2) the density of the solid (d), and (3) the specific gravity of the liquid (δ).

(1). *Accuracy of Volumetric Weight of Pulp.*—When using a 1000-c.c. flask an error in content or in weighing of even 10 c.c. or 10 gm. respectively, affects the specific gravity (p) of the pulp in the third decimal only. For a 1:1 pulp the error is 0.0007%, which increases with the dilution of the pulp. A variation in (p) of 0.01 in a 1:1 pulp (Rand ore) gives an absolute error of 0.74% in the calculation of the dry solid or moisture percentages, corresponding to 1.48% of the true value. With the dilution of the pulp the error increases progressively. The accuracy of the tonnage measurement of the total pulp varies as that of (p), while the tonnage of the dry portion shows an error of 2.17% which increases progressively with the dilution of the pulp. If we allow such rough work in actual mining practice, the annexed curve gives us the percentage of moisture or solid within ½ to 1 per cent.

(2) *Accuracy of Density of Solid.*—It seems that the average density of Rand ore is, at least for individual mines, fairly steady. The constant (k) in the formula varies with the density as follows:

Density .	2.4	2.5	2.6	2.7	2.8	2.9	3.0
k	171.4	166.6	162.5	158.8	155.5	152.6	150.0

A variation from the generally accepted average density of 2.7 for Rand ore to 2.8 affects the accuracy of the specific gravity (p) in a 1:1 pulp by 0.96%, which error decreases slowly with the dilution of the pulp. The tonnage of the total pulp is affected to the same extent as (p), while the dry solid portion shows a constant error of 2.8% independently of the consistence of the pulp. For the percentage of dry solid and moisture the error is 2.06%, which increases with the dilution of the pulp. When much concentration of the pyritic portion of the ore takes place the actual specific gravity must be ascertained in each case, as an increase from 5 to 10% pyrite causes the specific gravity of the solid to vary from 2.7 to about 2.8 per cent.

(3) *Accuracy of Specific Gravity of Liquid.*—All the formulæ are based on the specific gravity of pure water, but they are applicable to ordinary mixtures of cyanide solutions with enough accuracy for practical purposes, except in cases of excessively thin pulps, such as turbid water, overflow of classifying vats, etc. For exact scientific work or for much heavier liquids (sea water = 1.027) the true specific gravity (δ), corrected for temperatures, is taken into consideration in the following formulæ:

$$\text{Specific gravity of pulp} = \frac{100\ \delta p}{100d - \text{S}(d-\delta)}, \text{ and}$$

$$\text{Percentage of dry solid } \text{S} = \frac{100\ d(p-\delta)}{p(d-\delta)}$$

In stating that the extent of the error introduced by ignoring the higher specific gravity of cyanide solutions, is not generally appreciated, Mr. Hyder was misled by erroneous information (accepted by him with the reservation "assuming this to be correct") as to the average

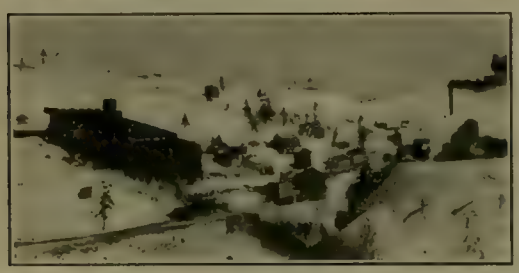
density of ordinary cyanide solutions. This strength does not generally exceed 0.18% for sand, 0.025% for slime, and 0.3% for black sand. I am indebted to M. T. Murray, lecturer of the South African School of Mines, for the exact determinations of the specific gravity of an ordinary cyanide solution, assaying 0.126% KCN and 0.01% alkalinity. He obtained a value of 1.0021, and from the data given above it will be seen that the small variation from the specific gravity of pure water is negligible. These results are published through the courtesy of the Mines Trial Committee though on my own responsibility.

The Colburn Mill

DENVER CORRESPONDENCE

The latest milling addition in the Cripple Creek district is the Colburn cyanide mill at the Ajax mine. The Clancy process forms the basis for the treatment system in this mill, which has been running two months and appears to be working successfully, although no actual figures as to costs and extraction can yet be given out, owing to its newness.

Statements made by local papers that $2 ore was being treated at a profit and that the cost was 75c. per ton, have been denied by E. A. Colburn, president of the Ajax company. It is certain, however, that a good saving is being made at low cost. It is claimed that when the mill is operated at full capacity the entire cost of treatment will not exceed $1 per ton. The control assays of the plant indicate



COLBURN MILL AND AJAX MINE, CRIPPLE CREEK, COLORADO.

a saving of 80% of the gold content of the ore. The ore treated at present is waste from the sorting-house, which would otherwise be sent to the dump, and low-grade ore obtained from development work. The ore milled averages $4 per ton.

In the operation of this mill the ore is crushed and automatically sampled. It is then classified and crushed in cyanide solution by tube-mills, to such a fineness that only 12 to 15% remains on a 150-mesh screen. The pulp has a specific gravity of 1.3, and is agitated for 24 to 36 hours; in the meantime a current of electricity is passed through the solution. The current has a strength of 300 amperes, at 8 to 10 volts. The electrodes are of iron and graphite. The solution contains cyanide, calcium cyanamide, sulphocyanide, and potassium iodide. The chemical consumption in cyanide and potassium iodide is low, about 0.01 lb. cyanide per ton of ore treated. The only chemicals lost are those mechanically carried away by the slime, owing to defects in washing. The solutions are separated from the solids by means of a Moore filter plant. The cycle of filtering operations require 60 to 70 minutes, and the filter plant has a capacity, per cycle, of 5 lb. per square foot of filtering surface. The plant has, therefore, a large capacity. Zinc-dust precipitation is used.

The Colburn mill has a proved capacity of 250 tons per 24 hours. It is a modern mill in every respect and appears well adapted to carry on a long campaign with a minimum cost for repairs, and without danger of serious breakdowns. At present the mill will work to about half capacity, until some necessary changes have been made in the mine so as to meet the demands of the plant. A. W. Warwick is at present in charge of the plant, in behalf of the Moore Filter Co., which is exploiting the Clancy patents.

Vanadium in Southwestern Colorado

BY KIRBY THOMAS

The vanadiferous sandstone deposits of San Miguel county, Colorado, have been known to the scientific world since 1899. They early attracted attention as a probably reliable source for vanadium, but only during about four years have methods of treatment been perfected which permitted their commercial utilization under the conditions of the comparatively low-grade ore and high freight costs. Small shipments of the higher-grade ore have been made intermittently to the Eastern States and to Europe for special treatment, and at the present time the Primos Chemical Co. is operating a plant at Newmire, treating about 25 tons per day.

These deposits occur in a horizontal bedded sandstone of the Jurassic period, known locally as the La Plata beds. They are found, practically continuous, as a bed or stratum in the lower sandstone bed and below a persistent and characteristic bed of dark limestone. This vanadium-bearing stratum is mainly parallel with the bedding of the sandstone, and usually has a regular bottom or floor, often marked by shale parting. This floor is from 10 to 25 ft. below the limestone. The vanadium-bearing material sometimes extends to the limestone and often expands upward, forming the 'rolls' as defined by the operators. The vanadium-bearing stratum is often a mere seam and in a short distance will expand to upward of 20 ft. in thickness. The thicker bodies are generally richer also. The La Plata beds are found continuous and undisturbed over a large area in western Colorado and Utah. They are exposed in the canyons of the San Miguel river and its tributaries and elsewhere. In the San Miguel region only, so far as is known, do these typical vanadium-bearing deposits occur. The deposits, as now disclosed by erosion, form roughly a zone, running west of north, more than fifteen miles long and two miles wide, assuming continuity through the hills or 'mesas' intervening between the exposures.

The mode of occurrence and this limitation of the vanadium-bearing stratum has suggested several theories as to its origin, a plausible theory assumes deposition contemporaneous with the containing sandstone from vanadium-charged water, presumably a river current or flow in a shallow sea. The theory of the origin is of importance as bearing on the probable continuation of the vanadium stratum beyond the outcrops.

Many drifts and openings in the vanadium stratum in the different parts of the district, several of them extending more than 100 ft. in from the outcrop, show no regular change in the character, grade, or extent of the ore. A study of the outcrops and of these workings convinces me that the vanadium stratum is practically continuous within the zone and that the outcropping vanadium deposits are not formed by surface enrichment from the evaporation of out-pouring solutions nor by localized deposition similar to fissure and contact vein deposits.

Vanadium is found in these deposits chiefly as the cementing material or matrix of the standstone stratum, although it also permeates the sand grains sometimes to the centre, a matter of importance in the treating of the ore. The vanadium matrix is described by W. F. Hillebrand as a "crypto-crystalline alumino-vanadio-potassium silicate resembling roscoelite (vanadium mica), but with the percentages of Al_2O_3 and V_2O_3 reversed. It constitutes over 25% of portions of the sandstone, and contains nearly 13% V_2O_3." This mineral is not easily soluble, as is evidenced by the unchanged character of the exposures.

Sufficient data to calculate the average thickness of the vanadium stratum are not available. In several places 6 to 20 ft. is exposed for several hundred feet horizontally, and in many places it is 6 to 10 in. thick, while in other places it is a mere seam or sometimes absent entirely. A safe average of the minable deposits would be 2½% V_2O_5. The ore is of a distinct olive-green and is easily sorted from the buff or yellow sandstone in mining. The shade of green indicates roughly the grade—the darker green being richer.

Metal Production and Prices in 1911

By L. Vogelstein

Copper

*An examination of the admirable statistics of the Copper Producers' Association shows that while recent developments in the market may have taken the trade by surprise, they have been entirely logical. These figures, together with best obtainable foreign statistics may be tabulated as follows, all figures being in pounds of copper.

		1911.		1910.		19109.
Stock January 1		122,030,195		141,766,111		122,357,266
Production		1,431,938,338		1,452,122,120		1,405,403,056
		1,553,968,533		1,593,888,231		1,527,760,322
Domestic deliveries	709,611,605		749,426,542		705,051,591	
Exports	754,902,233	1,464,513,838	722,431,494	1,471,858,036	680,942,620	1,385,994,211
		89,454,695		122,030,195		41,766,111

The world's production and consumption of copper last year and for three years preceding may be estimated as follows, in tons of 2240 lb. each:

Estimated World's Production of Copper

1911.	1910.	1909.	1908.
870,000	856,650	834,940	746,585

Estimated World's Consumption of Copper*

	1911.	1910.	1909.	1908.
Germany	220,000	208,826	194,449	187,127
France	103,000	92,838	85,688	80,509
England	165,000	148,187	110,648	134,492
Austria-Hungary	38,000	37,150	34,605	36,973
Russia	30,000	28,031	21,451	21,450
Italy	32,000	31,014	25,189	29,496
Other European countries	25,000	25,500	22,200	21,700
U. S. of America	316,791	334,565	314,755	214,734
Other countries	25,000	26,000	24,500	22,000
	954,791	932,111	833,485	748,480

*Figures of consumption of all countries except United States include old metals consumed, estimated at about 10% of the above total.

Stocks of Copper in England and France, According to Foreign Statistics

December 31, 1908	46,227	
" " 1909	101,972	— increase, 55,745
" " 1910	72,952	— decrease, 29,020
" " 1911	47,350	— " 25,602

Prices during the year have fluctuated as below:

	Standard spot. £ s. d.	Electrolytic. cents.
Opening	56 6 3	12.45
Highest	63 15 0	14.025
Lowest	53 1 3	11.85
Closing	63 11 3	14.025
Average	57 1 1	12.376

A considerable shrinkage of production during the last four months occurred. Just why refinery production should have declined when an increase was expected, has been a subject of considerable discussion, such decrease not having been supported by mine or smelter returns available. If imports be considered, the discrepancy widens rather than otherwise. That some restraint has been placed by large producers on their output is undoubted, but on the other hand when the large reductions in stocks are considered, together with the very flattering prospects for future consumption, it must be admitted that such increased quantities of copper as may come on the market from present producers, plus the new production which will first appear in 1912, will be taken care of readily. The total increase from both sources in 1912, as compared with 1911, may be estimated to be at least 170,000 pounds.

From all the above it would seem a fair deduction that while the recent advance has been rather spectacular, and has been accompanied by considerable speculation, and while sharp reactions may be expected, the era of low prices has been left behind and the copper industry enters the new year under more favorable auspices than since 1907. The exceptionally large deliveries of the last few months for export as well as for domestic consumption do not represent actually increased consumption, but in part a shifting of stocks from producers to consumers and speculators. A permanently higher level of prices will be reached and maintained, as soon as business conditions in this country shall have emerged from the effects of the panic, and the political unrest, the tariff agitation, and all the other causes which have deterred capital from new investments be set at rest.

Copper and Pig Iron Consumption

Year.	Iron, tons.	Copper, pounds.	Lb. of copper consumed per ton of pig iron.
1911	23,750,000	709,611,605	29.9
1910	27,100,000	749,400,000	27.7
1909	25,600,000	705,100,000	27.6
1908	15,900,000	479,700,000	30.2
1907	25,800,000	477,600,000	18.5
1906	25,300,000	682,100,000	27.0
1905	23,000,000	636,600,000	27.7
1904	16,500,000	494,600,000	30.0
1903	18,000,000	534,900,000	29.7
1902	17,800,000	501,300,000	28.2
1901	15,900,000	432,600,000	27.2
1900	13,800,000	394,000,000	28.5
1899	13,600,000	423,100,000	31.1
1898	11,800,000	277,800,000	23.5
1897	9,700,000	237,400,000	24.5
1896	8,600,000	215,000,000	25.0
1895	9,400,000	266,100,000	28.3
1894	6,700,000	198,400,000	29.6
1893	7,100,000	158,100,000	22.3
1892	9,200,000	265,100,000	28.8
1891	8,300,000	212,000,000	25.5
	309,100,000	8,340,900,000	27.0

One of the foremost American copper experts many years ago expounded the theory that copper consumption in this country runs parallel with iron consumption. Above is given an estimate of iron and copper consumption for 1911, and a comparison for the relative figures for the past twenty years. It will be noted that the average for 20 years was 27 lb. of copper per ton of pig iron. It will further be

*Statistics of production and prices in the American metal market have been printed, but the general summary prepared by L. Vogelstein & Co. has become such an institution in the metal trades that it is reproduced here with only minor abridgment.—Editor.

noted that aside from the panic years 1907 and 1893, the minimum copper consumption per ton of pig iron was 22.3 lb. and the maximum 30.2 lb. Indicated consumption for the year 1911 is 29.9 lb. per ton of pig iron. Such comparisons have little value for a single year on account of the change in the invisible supplies of both copper and pig iron. Over a long period of years these figures can be considered absolutely reliable.

Lead

The lead market has been without particular feature during the year just closed. Prices, with comparisons with previous years, have been as follows, in cents:

MISSOURI BRANDS, EAST ST. LOUIS

	1911.	1910.	1909.	1908.
Opening	4.37½	4.65	4.10	3.62½
Highest	4.47½	4.65	4.67½	4.50
Lowest	4.12½	4.15	3.80	3.55
Closing	4.35	4.37½	4.62½	4.00
Average	4.30	4.33	4.10	4.10

DESILVERIZED, NEW YORK

	1911.	1910.	1909.	1908.
Opening	4.50	4.70	4.20	3.50
Highest	4.50	4.70	4.70	4.60
Lowest	4.25	4.40	4.00	3.50
Closing	4.45	4.50	4.70	4.20
Average	4.45	4.49	4.29	4.20½

No statistics of lead are available except at the end of the year. Consequently dealers have no information intermediately, and the price changes are chiefly in sympathy with surrounding conditions. Specifically, the industry has suffered from the high price of linseed oil, which has doubtless operated to reduce consumption of white lead and still more to restrain dealers from carrying stocks. A recovery from both effects is to be expected with a return to normal conditions in 1912, and on this assumption a large and profitable year's business may be looked forward to with considerable confidence. Prices of soft Spanish lead in London, together with equivalents in U. S. currency, have been as follows:

	London, per ton, £ s. d.	Equivalent per pound, cents.
Opening	13 0 0	2.83
Highest	15 18 9	3.46
Lowest	12 15 0	2.77
Closing	15 15 0	3.42
Average	13 19 0	3.05

Present rates of duty of 2⅛c. per pound on pig lead and 1½c. per pound on lead in ore, will be the subject of acrimonious debate when the tariff question is reopened. However, as is the case with spelter, the local market, except sentimentally, is not likely to be affected by any readjustment of duty reasonably in prospect, as can be seen by comparing current domestic prices with those prevailing in foreign markets.

Spelter

The figures of the Geological Survey permit compilation of the following table, figures being in tons of 2000 lb. each:

	1911.	1910.	1909.	1908.	1907.
Stock Jan. 1	23,232	11,206	19,622	26,366	3,824
Imports	285	1,960	9,454	881	1,778
Production:					
Domestic ore	273,807	252,479	230,225	190,749	223,745
Foreign ore	14,237	16,705	25,535	19,675	26,115
Total available	311,561	282,350	284,836	237,671	255,462
Exports	18,598	13,234	2,900	3,882	2,127
	292,963	269,116	281,936	233,789	253,335
Stock Dec. 31	9,025	23,232	11,206	19,622	26,366
Consumpt'n, est.	283,938	245,884	270,730	214,167	226,969

The market has maintained its reputation for erratic and unexpected fluctuations. East St. Louis prices last year and for the three preceding years have been as follows, in cents per pound:

	1911.	1910.	1909.
Opening	5.35	6.05	5.00
Highest	6.40	6.05	6.27½
Lowest	5.17½	4.85	4.52½
Closing	6.17½	5.30	6.05
Average	5.61	5.40	5.40

During November 1911 as high as 6⅞c. was paid for immediate delivery, while at the same time forward sales were made at 6⅜ cents.

PRODUCTION AND CONSUMPTION COMPILED FROM FIGURES OF THE U. S. GEOLOGICAL SURVEY

Tons of 2000 lb. each.

	1911.	1910.	1909.	1908.	1907.
From domestic ore, desilverized	208,428	192,583	194,033	167,790	207,583
Soft lead	189,386	169,244	151,222	130,882	129,757
	397,814	361,827	345,255	298,672	337,340
From foreign ore and base bullion	89,706	108,553	102,857	97,761	76,849
Total smelter production	487,520	470,380	448,112	396,433	414,189
Consumption (estimated)	391,000	376,021	370,013	317,651	373,500

The consumption abroad has been phenomenal. A convention formed to control prices and regulate output in Europe was compelled to concentrate its energies on holding prices down rather than holding them up, owing to the extraordinary demand. London prices have been as follows:

	£	s.	d.
Opening	23	17	6
Highest	27	15	0
Lowest	22	17	6
Closing	26	15	0
Average	25	5	7

An examination of the various price tables herein presented shows a curious and yet logical interdependence between the different metal markets and the extent to which they sympathize with surrounding conditions, though the latter are at times at variance with specific conditions affecting the metals individually. It will be observed that each of the three preceding years closed with a rise in prices similar to that witnessed in the latter part of 1911. These movements generally have lasted into the new year and until some adverse development or natural reaction operates to check the advance. The upward movement in 1911 has been caused by an unprecedented consumption, while production increased only moderately.

As to the future, the extent which this market and in fact all the metal markets are affected by surrounding conditions has been indicated above, and these conditions will necessarily continue to play a part in fixing prices. Should present optimistic expectations in the iron and steel industry be fulfilled, there is likely to be a recurrence of high prices,

particularly during the first quarter of the year, or until present production can be supplemented by the output of works now building. Even thereafter business activity seems likely to keep demand fully up to supply for a long time to come, and in conjunction with large consumption outside this country, a fairly high level of prices is apparently assured.

Even a reduction in the present tariff rates, which are 1¾c. per pound on metallic zinc and a sliding scale rate on ores, would have no great effect either on output or prices so far as this country is concerned.

Tin

The tin market has repeated its usual variegated and turbulent history during the past year, shown by the following figures:

	London, per ton, £	s.	d.	New York, cents per pound.
Opening	179	15	0	39.37½
Highest (June 9)	233	0	0	47.00
Lowest (Sept. 25)	171	0	0	37.60
Closing	205	0	0	44.77½
Average	192	7	6	42.605

The causes leading to these erratic fluctuations are still so fresh in the public mind as to make extended comment unnecessary.

Production and stocks, tons 2240 pounds:

Statistical brands.	1911.	1910.	1909.
Straits shipments	55,265	54,600	58,500
Australia	4,140	4,650	5,350
Banca	15,131	13,500	11,600
Billiton	2,200	2,200	2,200
Total	76,736	74,950	77,650
Non-statistical brands.			
Bolivian	22,500	17,550	18,000
Chinese	2,500	2,200	.....
English	5,800	5,800	5,600
Sundries	3,000	3,000	3,000
Total	33,800	28,550	26,600
Grand total	110,536	103,500	104,250
Afloat December 31	7,319	6,025	9,802
Visible supply December 31	16,514	17,194	20,918
Stock December 31	9,195	11,169	11,116
Apparent consumption	111,216	107,224	103,260

One important development during the year was the adoption by the London Metal Exchange of the so-called 'standard contract' making any tin running 99¾% a good delivery instead of only Straits and Australian as heretofore, and permitting the delivery of 99% tin under penalty of £7 per ton. By reference to the foregoing table, it will be seen that the quantity of tin available for trading on the Exchange has thus been practically doubled, which it is hoped will insure a broader and more stable market. The so-called 'Syndicate' abroad which holds the bulk of the London stock (consisting almost entirely of Straits tin) has opposed the new contract, as from motives of self-interest its members were bound to do, and results of the controversy are still in doubt. The immediate future of the market is hard to gauge on this account, and while this is true, it is also true that a good demand for tin next year is seemingly assured, and whatever form of contract is used for Exchange trading, supplies will not be increased. On the contrary, the outlook is for a substantial reduction of stocks, and high prices are likely to be witnessed for a long time to come.

THE United States produced 260,080 tons of asphaltic material in 1910, whereas only 228,655 tons was produced in the previous year. The greatest increase was in the production of asphaltic road oil which rose from 128,861 tons in 1909 to 159,424 short tons in 1910. This product was worth $2,207,937, as against $1,558,463 in 1909.

State Taxes in California

General interest in the workings of the new system of taxation in California under which public service corporations are taxed solely for the benefit of the State, while all the taxes on real estate and personal property go to the cities and counties, warrants republication of the following summary of results of the first year under the new system, made by the State Board of Equalization.

The Board, finding that the revenues of the State from the taxes referred to, together with all other revenues not devoted to special uses, equalled and exceeded the sum of $12,404,670, held that it was unnecessary to levy an ad valorem tax for general State purposes, and no general State tax rate was fixed. The apparent revenues of the State were:

Public service corporations taxes	$ 8,776,095.46	
Franchise taxes	1,677,745.00	
	$10,453,840.46	
Less estimated delinquency.	50,000.00	
		$10,403,840.46
Inheritance taxes (less $250,000 to school fund)		600,000.00
Corporation license taxes		807,000.00
Fees Secretary of State		280,000.00
Automobile licenses		50,000.00
Interest on State deposits		120,000.00
Tax redemptions		100,000.00
Preston, Whittier, and Sonoma collections.		180,000.00
Miscellaneous		75,000.00
Total general fund receipts		$12,678,840.46

The following statement shows in round numbers the taxes levied upon the different classes of corporations:

Steam railroads	$ 3,736,000
Street railways	1,040,000
Telegraph	25,000
Telephone	400,000
Express	102,000
Car companies	89,000
Gas and electric	1,225,000
Banks	1,635,000
Insurance companies	523,000
Franchises	1,678,000
Total	$10,453,000

ARKANSAS DIAMOND-BEARING peridotite areas were discussed at the recent meeting of the Geological Society of America by L. C. Glenn. He offered evidence of the circulation of presumably thermal waters about the margin of the original pipe described by J. C. Branner. A supposed extension of the peridotite area proves to consist of disintegrated peridotite mixed intimately with well-rounded quartz sand and occasional water-worn chert pebbles and was evidently water-laid. Indications of the age of this material narrow the period within which the extrusion of the peridotite must have occurred. Any information bearing on the origin of diamonds in nature is welcome since, despite the large amount of study devoted to the subject, the problem is far from being solved.

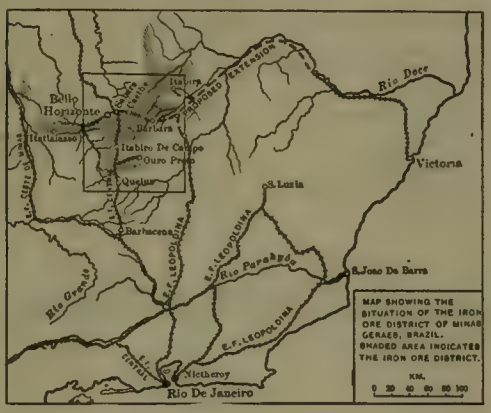
IN EXCAVATING for cellars at any place it is good policy to run a level line over the course for the proposed sewer. Then if the land slopes locally to the east, but it is desirable to conduct the sewage to the west, the cellars can be excavated to only a shallow depth at the eastern end and the concrete built up two or three feet above the ground. This will save several feet of digging along the entire line of sewers, and is in contrast to the predicament which sometimes arises when it is decided to put sewers in where the cellars were all dug equally deep but are at various elevations.

Hematite Ores of Brazil

By C. K. Leith and E. C. Harder

*The iron ores of the Minas Geraes district of Brazil are more nearly like the Lake Superior iron ores in their types, geologic association, richness, and quantity than anything yet discovered. The situation of the district with reference to the coast appears on the accompanying sketch map. The distance from the coast is 300 to 400 miles.

The important ores in this district are massive hematite and jacutinga.[1] Secondary concentration resulting from the impurities has enriched much of the jacutinga ore but has not been sufficient to form ore deposits from ordinary iron formation or itabirite[2] as has been the case in the Lake Superior district. Brazilian ores are associated with vast quantities of residual or transported fragmental ores, usually of a somewhat lower grade than the bedded ores, and therefore not to be immediately utilized, but still constituting enormous fair-grade deposits for the future. Parts of this ore not cemented are locally as rich as the massive ores and will be early utilized. Because of glaciation, the counterparts of the fragmental ores are not abundant in the Lake Superior region.



Estimates of tonnage for the region as a whole would be premature with the present state of knowledge, but it is certain that the estimate of O. A. Derby for the International Congress of Geologists, of two billion tons for the district, is conservative. Of the high-grade massive hematite and jacutinga ranging from 63 to 69% iron, the tonnage is probably not far short of the total reserve of available ores in the Lake Superior region today. Individual deposits contain several hundred million tons.

The rich and important Brazilian massive hematite and jacutinga ores seem to be the result of direct sedimentary deposition, as more or less hydrated hematites, without much impurity, which have since been merely dehydrated and have required no extensive secondary enrichment to make rich ores out of them. Counterparts of these in the Lake Superior region are relatively insignificant, the nearest being the specular hematites of the upper parts of the Negaunee formation in the Marquette district of Michigan, and the hard blue hematite of the Soudan iron formation at the Minnesota mine in the Vermilion district of Minnesota, but both of these have suffered secondary concentration. In each of the sedimentary iron formations of Lake Superior there are certain layers originally richer than others which have required less secondary enrichment than others to make iron ores from them, but in all of them more or less conspicuous secondary concentration has been necessary to make ores even from the richer layers. Furthermore, the evidence is good in the Lake Superior region that the original iron formation was deposited dominantly as ferrous compounds (iron silicate and carbonate), which have since been oxidized, rather than being deposited directly as ferric oxide.

The porous portions of the jacutinga beds, the leached carbonates, and the replacement deposits of manganiferous iron ore of the Brazilian field, represent a secondary enrichment essentially by the leaching of carbonate and silica and by oxidation and local transportation of the iron, this secondary concentration being similar in all essential respects to that which has produced the Lake Superior hematites. In porosity and slumping, due to leaching of carbonate and silica, the ores are similar in appearance to those in the Lake Superior region. They are on the whole much less hydrous and are more crystalline. In the Brazilian field the leaching of silica is less extensive, however, than in the Lake Superior district, for the reason that the silica to be leached is largely in the form of coarse quartz sand and locally recrystallized under the influence of dynamic metamorphism and intrusion, each individual presenting relatively small surface in proportion to its mass, and therefore being with difficulty dissolved by the percolating waters. In the Lake Superior iron formation the silica is in the form of fine chert presenting large areas in proportion to mass and being leached much more readily. The fact that so little of the silica in the itabirite has been dissolved and transported may be partly due to this. The concentration of the jacutinga is apparently largely due to the leaching of carbonate.

The fragmental ores formed by ordinary processes of weathering and erosion probably were at one time present in the Lake Superior region in enormous quantities as they are now in Brazil, but erosion represented by the pre-Cambrian unconformities and glaciation has removed them. The only counterparts of these ores in the Lake Superior region to be found now are in conglomerates at the base of the series resting on iron formations.

It thus appears that each of the principal classes of Brazilian iron ores has its counterpart in the Lake Superior region and that much the same processes of ore concentration have been active in both districts, but that the relative effectiveness of these processes and their results have differed in the two districts. In the Lake Superior district primary sedimentation was not sufficient to produce iron ore. Important secondary concentration was the essential controlling factor. In the Brazil region primary sedimentation produced abundant and rich ores; secondary concentration was a minor factor, only locally important in developing ores.

The study of the origin of sedimentary iron ores has been directed toward their secondary alteration to such an extent that little progress has been made in ascertaining precisely the topographic, climatic, or other conditions controlling the deposition of sediments rich in iron. The proof that there are in Brazil beds of iron oxide running up to 2000 ft. in thickness, containing 65% or more of metallic iron, which were deposited substantially in this form, brings investigators squarely against a problem of sedimentation which requires for its solution much more extensive knowledge of the factors that have influenced sedimentation of iron-bearing beds in their variable occurrence over the world.

*Abstract from *Economic Geology*.

[1]The term jacutinga is also applied to soft laminated itabirite. In this paper, however, it is not used in this sense. The term itabirite is frequently applied to the iron formation as a whole, including the ores, but in this paper it is used only for the ferruginous sandy rock which forms the bulk of the iron formation and with which the ores are associated.

[2]This name was originally proposed by Eschwege, in 1822 ('Geognostisches Gemalde von Brazilien') for the massive pure iron ore of which the peak of Itabira do Campo, among others, is composed, and which is associated with a schistose rock composed of granular quartz and scaly hematite which he discriminated as iron-mica schist (*Eisenglimmerschiefer*). By common usage the name has come to be applied to the latter rock, and it is only in this sense that its retention can be justified as a convenient term for a rock type that would otherwise have to be designated by an awkward and misleading descriptive name. Through variation in the relative proportions of the constituent elements this type of rock grades off on one side to a purely quartzose and on the other side to purely hematitic phase. The phases sufficiently rich in iron to be commercially valuable may be conveniently designated as itabirite ores.

Physiography of the East African Plateau

By George L. Collie

Four physiographic regions may be recognized in British East Africa: (1) the coastal plain; (2) the foot plateau; (3) the gneiss plateau; (4) the lava plateau, which includes within its boundaries the great Rift valley. The coastal plain is generally but two or three miles wide. It is composed of recent coral rock, and it is a true degradation plain; the agent is probably marine erosion. Rising rather abruptly from the coastal plain is the great plateau which extends to the basin of Victoria Nyanza. The frontal portion, called by Gregory the foot plateau, is underlain by sedimentaries of Mesozoic age. The main portion of the plateau is gneiss, but toward its western border there have been great extravasations of lava, which have completely covered the original gneiss surfaces over a belt 100 miles wide and extending north and south indefinitely. The lava flows are connected with the rifting processes that have formed the Rift valley. The underlying rocks have some bearing upon the minor features of the different regions, but this is a matter of detail. The plateau as a whole from ocean to the Victoria Nyanza basin should be considered as a unit in its large aspects. The plateau is a very ancient feature; it has been thoroughly peneplained, though great residual masses of gneiss remain, especially in the region between Voi and Kiu. These mound rocks in some cases rise to the dignity of mountain ranges. The most remarkable feature of the plateau is the constant, uniform rise of the peneplained surface from sea-level to a height of nearly 10,000 ft. at the Man or Western escarpment of the Rift valley. The plateau surface is really a great beveled slope which rises on the average about 20 ft. to the mile for 500 miles. The plateau is typical of those that lie in the monsoon region, in that only the higher portions and those that lie near the sea-level are being acted upon by normal erosion. The intermediate and by far the greater area is being degraded by deflation and sheet-flood erosion chiefly. There are two brief and widely separated rainy seasons. The conditions are such that, in the main, there is a large intake of ground water and relatively little run-off, and hence little dissection. In the interim between rainy seasons the ground becomes parched and dry, so that deflation becomes of importance and offsets dissection. The plateau confirms the truth of observations made in South Africa and elsewhere that one type of peneplaination may go on at any altitude above sea-level. This type of peneplanation does not require desert conditions, as is sometimes said. Thirty inches of water falls annually over much of this plateau, but this does not require monsoon conditions in which rainfall is concentrated in widely separated rainy seasons with arid or semi-arid conditions between.

Dunderland Iron Mines

The Dunderland Iron Ore Co. was formed ten years ago to exploit an extensive deposit of low-grade iron ore in Norway near the port of Mo on the Ranen fjord. The company has spent immense sums of money trying to beneficiate the deposit by dry-crushing and magnetic separation, but it has been a failure so far; thus forming a strong contrast to the great iron-ore industries of central and northern Sweden and Lapland. The scheme was pushed here by Sir Joseph Lawrence, who is also well known as the introducer of the linotype in England. It had the active support of many leading English and Welsh iron-masters. The metallurgical outfit was constructed on an immense scale with Edison giant rolls and magnetic plant. Any amount of mechanical and electrical troubles cropped up, and finally the plant had to be abandoned. Two years ago the Ullrich wet magnetic concentrator was recommended. This process emanates from Krupp's. Henry Louis, the consulting engineer, and D. A. Bremner, the manager, tried it on a small scale, and subsequently a plant to treat 40 tons per day was sent to the mine for practical demonstration. It is stated that the results [illegible], so plans have been prepared for a plant to treat 200,000 tons per year, capable of being easily duplicated. Arrangements are also being made for the erection of a hydro-electric station for the provision of current and power. Further progress is prevented at present by the difficulty of raising the necessary new capital. The company is so overwhelmed with shares and debts that any new financial arrangement must give great anxiety to the new subscribers and the old creditors. The present position of the company is that there are £200,000 of prior lien bonds, £648,000 debentures and funded debenture interest; of share capital, there is £1,000,000 in preference shares and a similar amount of ordinary shares.

*Abstract of paper read before the Geological Society of America.

Electrolytic Recovery of Zinc

By Thomas Sammons

A new process for the electrolytic recovery of zinc has been successfully worked out by Chitaro Yoshida, the proprietor of a copper mine in Iwashiro Province, Japan. The zinc ore is dissolved in the electrolyte, and from this liquid the zinc is precipitated by electrolysis. The process is simple, but several obstacles have been found. For instance, the presence of a small quantity of copper, antimony, or arsenic is enough to render the process futile. One of the defects of the process heretofore has been the spongy form in which the zinc adhered to the cathode. To prevent this, carbon was tried instead of lead in the anode. The carbon was coarse and dissolved in the sulphate of zinc, and the zinc which gathered on the cathode was then found to be refined to a degree rarely surpassed by the imported metal. During 1910 Japan exported 24,747 tons of zinc, valued at $383,485, and imported 11,581 tons. It is believed that a new industry will be built up in Japan as a result of this new process.—*Consular Report.*

Building Stone From Slag

By George Nicolas Ifft

The manufacture of building stone from smelter and blast-furnace slag is an industry of considerable importance in Germany, and is carried on to a greater or lesser extent at nearly all such plants. The process is not patented and is very simple in detail. Practically all blast-furnace and smelter slag is suitable for stone-making. Slag for this purpose must, however, be in a granulated state. After it has been allowed to harden it is unsuitable. All attempts to utilize slag that has been crushed or ground, after having once hardened, have failed to result in a solid stone. The slag is granulated by the addition of water as it flows hot from oven or furnace. It is then mixed with lime—pulverized slaked lime or milk of lime—in the proportion of 7 to 10 parts of slag to 1 of lime, according to the nature of the slag, and while moist in this condition is subjected to pressure in molds of the desired size and shape. A special type of press, with pressure power of 22,000 to 50,000 kg. (kilo = 2.2 lb.), is used. An improved type of press of this kind costs about $3000. Practically any form of power may be used and any desired shape of mold. The granulated slag after being thoroughly mixed with the required proportion of lime, is allowed to stand one hour before being put through the press. After being pressed, the stones are stacked in the open air, where, after three or four weeks, according to the weather, they are ready for use. Under low temperature they harden slowly. If subjected to frost before thoroughly hardened, they are crumbled and destroyed. Operations may, however, be continued in the winter, the stones being hardened in steam-heated drying-rooms. These stones grow constantly harder with time, and after several years show a resistance of 100 kg. per square centimetre.—*Daily Consular Reports.*

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Mill and Cyanide Plant Records

The Editor:

Sir—The fact that the unarranged material was submitted for consideration only, and was marked "not for publication", exonerates me from any blame because 'Mill and Cyanide Plant Records' has appeared in your issue of December 2 in a form that makes it almost unintelligible, and of little practical value.

The matter enclosed in squares and representing (1) Mill records, (2) Amalgam records, (5) and (5a) Filter and press records, (9) Bullion Book, (11) Assay Book, and (12) Determinations, are headings for each page of the book or sheet in question, the last column in each case being left for a space for remarks, for example:

FILTER-PRESS RECORDS

Date	Shift	Press No.	From		Filling		Washing		Discharging		Remarks
			Charge No.	Vat No.	from	till	from	till	from	till	

The sand and slime plant records should be arranged in the same way but "totals & averages" refers, naturally, to the results of the work for the period, and not to the clean-up; and "extraction %" should take the place of "extraction, percentage, per ton, $", as below:

SLIME-PLANT RECORD BOOK

Date filtered	Charge No.	Vat. No.	Tons	Assay		Extraction		Amount called for by assays
				Heads	Tails	per ton	%	
TOTALS & AVERAGES								

Clean-up No. .....
.....19....

.....oz. bullion of average fineness .....
= ..... oz. fine gold.

Remarks:

.....
Cyanide Manager.

The "summary of treatment results", abridged, should appear as follows:

SUMMARY OF TREATMENT RESULTS

for the ..... weeks ending ..... 19....

Tonnage.....

	Oz.	$ per ton	%
Recovered by amalgamation			
" cyanidation			
Total recovery			
Value of residue			
Value of ore milled.....			

....
..... 19... Metallurgist.

The "leaching vat records" are very nearly correctly arranged, the whole sheet being used for a charge, but entries of "tons" and "%" of solution applied should be alllowed the whole of the right-hand side of the sheet, since such entries are generally numerous, corresponding to the number and cyanide strength of washes given forming the treatment. A. W. ALLEN.

London, December 16, 1911.

[We regret greatly the misunderstanding and errors in printing Mr. Allen's article. The manuscript was received by us in the regular course in a form we assumed to be satisfactory to him. We are, of course, glad to make the correction.—EDITOR.]

'Dig to the Depths'

The Editor:

Sir—The enclosed editorial is from Nevada's leading newspaper. Verily, "distance lends enchantment." "Sink the shaft to great depths, regardless of the fact that the surface of the lode never gave the slightest indications, and does not now, of ever becoming a mine. Squander a large amount of money, instead of the small amounts now being squandered, MAKE ore exist where it never has and where the indications are it never will, but ABOVE ALL PROSECUTE THE WILD-CATTER, who deceives people regarding the mines of our glorious state!!!!" The mine referred to is the Wedekind. It has never been and never will be a mine, and is now, as it has in the past, absorbing hundreds of dollars for every little one-pound specimen of lead-silver ore found in its stringers.

A SUBSCRIBER.

Elko, Nevada, December 29, 1911.

[The advisability of systematic development instead of "woodpeckering the surface," is something about which all agree, but the editorial in question, quoted below, is an excellent example of the misinformation upon which it is well not to base development.—EDITOR.]

"Heretofore the error in developing the resources of the great dyke that extends to the northward from Reno has been in woodpeckering the surface over a great area and at no place attaining to any consequential depth.

"If the money that has been expended in sinking hundreds of shallow holes had been devoted, through community of interest, in sending down several bores to great depth, Reno would now doubtless be a big, bustling, prosperous mining camp.

"It is true of at least one property, the Wedekind, that the water level brings a bulge to the zone of mineralization,

with an accompanying lowering in values, but that would naturally occur at the point where the percolation of waters bringing the secondary enrichment forces the walls asunder and permits the occupation of the crevice with waste.

"At greater depth it will almost undoubtedly be found that the vein contracts and grows heavier with value, not in lead, but in the nobler metals.

"The big dyke must be worked in different fashion from narrow ledges of pure silica, where faults and slips are the only imperiling features. This granite walled fissure, two miles in width, naturally contains its surface ores but as the cake contains its raisins, in widely separated lenses, and the wider the dyke the farther apart the heavy enrichments.

"But at the greater depths there is almost certain to be concentration. The granites will be found to have approached and the many lenses to have concentrated into one definite, well walled vein.

"Thus far the operators at Wedekind have but reached, not the cream, but the surface scum.

"To the depths, gentlemen; to the depths, and may nature well reward you!"

Tanganyika Concessions, Ltd.

The Editor:

Sir—The articles in your issue of January 20, 'Mining in the Belgian Congo in 1911,' by Sidney H. Ball, and 'Claims of the Tanganyika Concessions,' from your London correspondent, indicate the great interest being taken in this Central African mining enterprise.

This work is being done by the proprietary company, the Union Minière du Haut-Katanga, a corporation with headquarters in Brussels and in which the Tanganyika Concessions is but a minority shareholder. At the Union Minière meeting last month, M. Jadot, the director, gave estimates of tonnage exposed in ten of the company's claims, aggregating 10,000,000 tons, and his statement has been taken as if new and important, when, in fact, he was but repeating estimates made five or six years ago based upon a few cross-cuts run for the sole and special purpose of "establishing to the satisfaction of the Katanga special committee that the mines were workable," and without the slightest intention of putting ore 'in sight' to be measured. The figures have a meaning about like that which would attach to the publication now of some one's estimate ten or twenty years ago of ore then proved in Butte, Montana, or along the Mother Lode of California—districts, by the way, in which mining is conducted on the assumption that there is ample ore in the ground for a continuance of business and guiltless of any attempt to "estimate tonnage." However, your London correspondent, referring to the Tanganyika meeting, says: "This leads me to the most interesting of all the statements made at the recent meeting, a remark really quite incidental, to the effect that Mr. Frecheville had vouched for 1,800,000 tons of 12% ore." At both the Tanganyika and Union Minière meetings those figures were clearly given as Mr. Frecheville's estimates, made five years ago, of the ore in the Kambove workings alone; additional estimates being also as clearly stated for other claims he inspected, and at length the idea seems to be gradually dawning that his inspection had nothing whatever to do with the operations of the mine, but was connected entirely with some private share-dealing proposals. At the same meeting Robert Williams much more pertinently said, "In fact, it seems to me that what we are calling mines are simply the outcrops of a belt of copper which runs from one end of the country to the other."

The toy furnace now treating a little over 100 tons of ore daily from the Star of the Congo mine is on the Lubumbashi river ten or twelve miles southeast from the extreme southeastern mine of the belt, which thence extends northwest nearly two hundred miles, and it is fed by a crooked, three-party railway meandering around 1800 miles up from Beira on the Indian ocean. It is in no sense a properly situated and constructed central reduction works with suitable railway transport, and should be taken only for what it really is—a testing plant. The important works will come in due time.

By due time is meant the following: In Katanga, as has been pointed out from the beginning, there are two classes of oxidized copper ores, one that can be turned readily into copper by blast furnaces, and another not adapted to such treatment. Both exist in really enormous quantities along the belt, and constructive engineers who were employed to build up the enterprise openly and admittedly confined their attentions to the first kind and relegated the other to the future; while the wiseacres, the learned and technical critics, both inside and outside the lines, have made the second prominent and slighted the first. Now anyone, no matter who or what he be, stating that it is either difficult or very expensive to get copper from either class of ore, is speaking from ignorance, not from knowledge. He means that it is very difficult or very expensive to make copper by the processes with which he is acquainted, and assumes that ends the matter. It does not end it. For over twenty years past there have been no large deposits of good-grade oxidized copper ore available for treatment, and therefore, of necessity, attention has been forced to confine itself to the working of sulphide ores, with the result that a surplus of copper is being made from materials not long ago considered valueless. Suppose conditions had been reversed, who will assume that methods would not have been worked out to efficiently and economically extract copper from high-grade, silicious carbonate? That is exactly what will have to be done in Katanga under superb local conditions for working, and some one will some day, may any day in fact, do it; and it is futile to ignore the consequences. Further, it is known that success in copper enterprises has come from cheapened transport and the outlay of vast sums of money in huge plants to handle economically a great tonnage. The mechanical improvements are wonderful, but when it is understood that, where concentration is used, from 25 to 40% of the metallic content is lost, the metallurgical results are not quite such as to recommend any 'great specialists' wedded to such method to people with chemical and metallurgical problems to solve.

Tanganyika Concessions, Ltd., has grown into a holding company, upon which has devolved the work of opening up South Central Africa, and its great expenditure and large financial deals have been in the railroad and not on the mining side of its business. Its shares are the 'market counters' through which it gets money; when they are high, work goes ahead rapidly; when they are low, some things lie idle. Lately they have fallen heavily, and hence are written and talked about a lot; but they have fallen several times in ten years, only to rise again, and that is why they are attractive. Men of speculative tendencies so like to gamble that every community has to restrain them by law from taking certain chances, and 'Tanks' constitute a lawful gamble. Whether or not this is a legitimate basis for a great mining company to finance upon is a matter of individual opinion, but it must be conceded that in all great industrial undertakings it is 'the other people's money' that is used, and the methods of securing this vary with circumstances. For instance, to get it in this country it has been necessary to go to what is termed 'the interests', 'the system'. Wall Street is not in disrepute, though many people have a notion there has been too frequently an excessive 'rake-off to the house' and sometimes even a 'brace game'. When rich placer ground was found in Alaska every outfitter, transport man, hotel proprietor, real estate dealer, and handy chap from Juneau to San Diego trumpeted the glad tidings, in the hope that the resulting stampede would fill his pockets with other people's money, and it happened just so in many cases. That Tanganyika Concessions, Ltd., has succeeded also is clear from Mr. Ball's description of Elizabethville. To read of that town increasing its white population from 100 to 1500 in a year, with thirteen miles of boulevards laid out, cafés surrounding the 'Place Royale', and town lots bringing from $9000 to $12,000, is bewildering to one who, a few years ago, by forced marches with a few picked carriers on starva-

tion rations, reached Kipushi, one day from the Star of the Congo, and could go no further, as not another pound of native food could be had.

This mining company, Tanganyika Concessions, Ltd., has done more in ten years to open darkest places in Africa to the world than have all other agencies combined during the centuries, and back of it all is a charming Scotch gentleman from Aberdeen, Mr. Robert Williams.

J. R. FARRELL.

San Francisco, January 22.

Heating Cyanide Solutions

The Editor:

Sir—In your issue of January 6, under heading of 'Heating Solutions,' Alfred James in his 'Progress in Cyanidation of Gold and Silver Ores During 1911', expressed a desire for data on benefit of heat on extraction. The following tables of comparison, showing extraction on Belmont ore, with different degrees of temperature, may be of interest. The benefit shown has been borne out to our entire satisfaction in practice.

I. ORE Au 0.05 oz., Ag 18.2 oz., TOTAL VALUE $10.15

	Agitation,		Tailing.		
Agitator.	Hours.	Temp.	Au, oz.	Ag, oz.	Val.
Belmont	60	Cold 60°	0.015	3.1	$1.86
"	60	Warm 90°	0.01	1.7	1.06
Pachuca	60	Cold 60°	0.02	3.8	2.32
"	60	Warm 90°	0.015	2.1	1.36
Bottle	60	Cold 64°	0.02	3.4	2.12
"	60	87°	0.01	2.5	1.49
"	60	109°	0.01	1.7	1.06

II. ORE Au 0.05 oz., Ag 20.6 oz., TOTAL VALUE $11.30

	Agitation,		Tailing.		
Agitator.	Hours.	Temp.	Au, oz.	Ag, oz.	Val.
Belmont	48	+ 90°	No sample taken.		
Pachuca	48	+ 90°	0.015	2.6	$1.61
"	48	60°	0.02	4.5	2.67
Belmont	69	+ 90°	0.01	1.7	1.06
Pachuca	69	+ 90°	0.015	2.1	1.36
"	69	60°	0.02	3.8	2.32

Material agitated in each of the above tests was taken from collectors and contained the gold and silver remaining after concentration and that dissolved in crushing and conveying at head of mill.

To maintain a heat of 90° in the agitators, boilers are run two 8-hr. shifts during summer and three 8-hr. shifts during winter, being fired with crude oil at a cost of $2.05 per barrel at the mill, making cost per ton of ore treated $0.161 for past nine months. Degrees of heat are marked + 90 to show they were kept as near 90° as possible, varying from 90 to 95 degrees. A. H. JONES.

Tonopah, Nevada, January 17.

[This note on experience at the Belmont mill, courteously furnished by Mr. Jones, should stimulate others to relate their experience, as the line of investigation is one along which accurate data are badly needed.—EDITOR.]

The Way of a Man With a Mine

The Editor:

Sir—Your issue of the *Press* dated December 16 arrived here today, and, as usual, its contents were avidly devoured. Unfortunately, the frosting of one article, very satisfactory in itself, failed of ready digestion. I refer to the quotation and the origin thereof given by T. A. Rickard, at the conclusion of his very able article. The limitations of an itinerant library fail to support a somewhat treacherous memory, but at the risk of an accusation of pseudo-sapiency, I venture the theory that the distinguished editor of *The Mining Magazine* has confused the 'Tale of the Heathen Chinee' with 'Certain Maxima of Hafiz' by one R. Kipling.

CHAS. S. HALEY.

Forks of Salmon, Cal., December 20, 1911.

The Editor:

Sir—Permit me to protest against Mr. Rickard's crediting Bret Harte with the excerpt from the 'Maxims of Hafiz'. Probably no one has more admiration for the genius of the late Mr. Harte than I. Furthermore, I will admit that Mr. Kipling seems to have gone rather to seed of late, but do let justice be done, even though the ceiling fall.

STANLEY C. SEARS.

Guanaceví, Durango, Mexico, December 21, 1911.

[Our correspondents' letters illustrate the fallibility of memory as applied to quotations. In Kipling's 'Departmental Ditties' one of the 'Certain Maxims of Hafiz' given is:

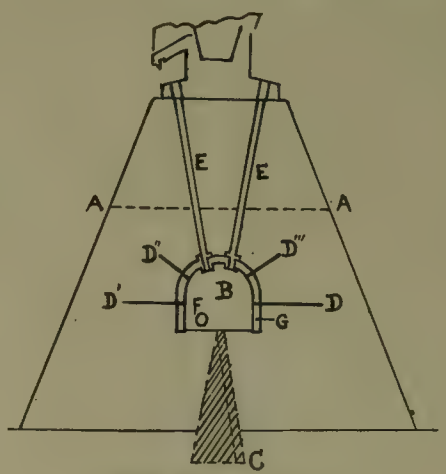
"The ways of a man with a maid be strange, yet simple and tame,
To the ways of a man with a horse, when selling or racing the same."

The version of this given by Mr. Rickard undoubtedly represents Bret Harte's sentiments in regard to mining, even though he did not chance to express them in precisely that form.—EDITOR.]

Stamp-Battery Cam-Shafts

The Editor:

Sir—In the Discussion columns of your issue of January 13, under 'Stamp-Battery Cam-Shafts', an error has been made in saying that I proposed a bearing between each stamp. This should be a description of the City Deep cam-shaft bearings, a part of the Leschinger patent. To explain what I meant by "placing the line shaft immediately under the cam-shaft", the sketch will make clear.



BATTERY FOUNDATION PLAN.

Through the centre of the concrete foundations is placed a cast-iron tube about 2 ft. in diameter, *BG*. Into this casting are screwed the pipes *E E'* to receive the mortar bolts. If these bolts are 1½-in. diam., the pipes are 2 in.; if 2-in. bolts, the pipes are 2½ in. in diameter. The line-shaft boxes *F* are also placed in this hollow, so that the cam-shaft is vertically above. It may be objected by some that the bearings cannot be oiled without stopping the mill. This can be overcome by a connection with this pipe at right angles in the centre of the foundation, so that one could crawl in and examine all the boxes and bolts, and replace those that are broken. The projections *DD' D''D'''* are projections from the casting for reinforcement purposes. The mortar bolts may be replaced, if broken, by lowering into the hole *C*, which may be made of the same size pipe as *EE'*. The bolts at the back of the mortar may be taken out from the top. *AA* is the level of the sole-plate for the battery posts. This will make my meaning clear, I believe.

ALGERNON DEL MAR.

South Pasadena, January 15.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling and smelting.

A GOOD cement for chemical apparatus is made of 20 parts gutta percha, 10 parts of yellow wax, and 30 parts of shellac, melted together.

FOR the purpose of improving aluminum, without increasing its specific gravity, it is mixed with 4 to 7% of phosphorus, whereby the density, tenacity, and especially the toughness are said to be enhanced.

LEAF BRASS is also called Dutch gold, or imitation gold leaf. It is made of copper, 77.75 to 84.5 parts, zinc 15.5 to 22.25. Its color is pale or bright yellow or greenish, according to the proportions of the metals. It has an unusual degree of ductility.

IN order to impart to aluminum the appearance of mat silver, plunge the article into a hot bath composed of a 10% solution of caustic soda saturated with kitchen salt. Leave it in the bath for 15 to 20 seconds, then wash and brush; put back into the bath for half a minute, wash anew and dry in sawdust.

HAMMER-DRILLS are used near Atlin, British Columbia, in breaking lumps of frozen gravel. The bit used is sharpened as is a moil, and cuts into the clay and gravel quickly. The vibration of the drill seems to shatter the material and, by prying a little, lumps as much as ten feet in diameter can be broken.

THE eight-hour law in California applies to all persons employed in underground mines or workings, or who are employed in smelters and other institutions for the reduction or refining of ores or metals. The State Supreme Court has held that the latter phrase includes quartz mills, and hence that the statute is applicable to millmen.

TO FACE a cast-iron pulley with leather, apply acetic acid to the face of the pulley with a brush, which will roughen it by rusting, and then when dry apply a cement made of 1 lb. of fish glue and ½ lb. of common glue, melted in a mixture of alcohol and water. The leather should be placed on the pulley and dried under pressure.

ROASTING and magnetic concentration is the favorite process for treatment of complex zinc-iron sulphides. In the Wisconsin district many of the individual mines support cheap plants of this sort which permit the production of a sufficiently high-grade product to bring about competitive bidding for the concentrate. An electrostatic plant was built and treated mixed ores till burned. In this plant a merchantable product was made from the iron sulphide which in ordinary treatment is lost.

SHAKING PLATES have been hitherto generally adopted on the Rand. At the Randfontein Mines it has been shown by experiment that movement is not at all essential nor does it contribute in any way to increased efficiency. Stationary plates have therefore been adopted at Randfontein and elsewhere, and in general there is a tendency, in addition, to materially reduce the total area of the plates from that previously in use. No loss of efficiency has yet been noted by reason of this reduction, while there has been some economy.

AN excellent cement for porcelain and stoneware is obtained by mixing 20 parts of fish glue with an equal weight of crystallizable acetic acid and evaporating the mixture carefully to a syrupy consistency so that it forms a gelatinous mass on cooling. For use, the cement thus obtained is made liquid again by heating and applied to the fracture with a brush. The pieces should now be pressed firmly together, by wrapping a twine tightly around them, until the cement has hardened.

BUNKER COAL is usually taken on by merchant steamers at both ends of a trip. The Pacific Mail boats, however, frequently carry enough coal from Japan for the round trip, and the White Star line is about to adopt the practice of taking on board sufficient coal at New York for a round trip. Other lines of transatlantic ships are to do likewise, mainly because domestic bunker coal averages higher in quality than most of the bunker coal of western Europe and is supplied at low cost, as compared with foreign coal of prime steaming grades.

DURING the last fiscal year 23,272 square miles of the United States was topographically surveyed by the U. S. Geological Survey and 6460 sq. mi. revised or resurveyed, making a total of 29,732 sq. mi. About 37% of the entire United States, exclusive of Alaska, has now been thus surveyed. These surveys are represented by more than 2000 separate sheets. The price of the standard topographic map sheet is 5c. each, or $3 per hundred. Index maps of the various States showing the area covered by each separate sheet will be furnished free on application to the Director of the Survey, Washington, D. C.

THE ordinary concentrated sulphuric acid contains 95% of acid, or between 35 and 36 times normal. Any acid stronger than this must be made by adding fuming sulphuric acid to the ordinary acid. Strong sulphuric acid and the fuming acid absorb moisture very rapidly from the air, and thus become diluted in a short time. In order to overcome this difficulty the following apparatus may be used to weigh the acid for analysis: A small pipette similar to a medicine dropper was inserted in one hole of a two-holed rubber stopper and the other end of the hole plugged with a glass rod. In the other hole was inserted a glass rod bent at the upper end so that the whole arrangement could be hung on the arm of a balance. The weight of the apparatus was then found. In using the apparatus the pipette was removed from the stopper, filled with acid, quickly dried, put back into the stopper, and weighed. The whole apparatus was then carefully washed with water, the washings and acid diluted, titrated with standard alkali, and the result calculated for the strength of the acid in per cent of SO_3. The strengths of the ordinary concentrated acid and the fuming acid were determined in this way, and the percentage of each necessary to form the required mixture calculated.

TANTALUM ORE is not in demand in the United States; so far as known the only firm reducing tantalum from its ores is Siemens & Halske, A.-G., of Charlottenburg, Germany, which draws tantalum wire, which is sold to incandescent electric-lamp manufacturers, and sells metal to firms which manufacture surgical and dentists' instruments and pens. During 1910 the firms forming the National Electric Lamp Association used 1,500,000 metres, equivalent to 4,921,250 ft., or more than 932 miles, of tantalum wire for filaments in incandescent lamps. The wire was of various sizes, and was valued at $43,000. The weight is not known, but was probably less than 100 lb. It seems likely that the tantalum used for lamps in the rest of the world is not greatly larger in quantity than that used in the United States. The quantity used in instruments and pens is not large, and probably the whole output of metallic tantalum does not exceed a short ton per year. It is made from Australian and American ores. Tantalum minerals free from columbium and other objectionable elements are found in considerable quantity in the Greenbushes and Pilbara districts of Western Australia, but the American tantalum minerals are mostly columbites carrying large percentage of columbium, so that at the same price Australian tantalum minerals are preferable. The latter are stibiotantalite (tantalate of antimony), tantalite (iron tantalate), and manganotantalite (tantalate of manganese).

Special Correspondence

BULAWAYO, SOUTHERN RHODESIA

CHARTERLAND DEVELOPMENTS.—RHODESIAN GOLD PRODUCTION.—SEARCH FOR LABOR.—SLEEPING SICKNESS CLOSES NEAREST SUPPLY.—PLAN TO IMPORT WORKERS FROM LIBERIA.

The popular impression outside of Rhodesia appears to be that mining in Charterland is at a standstill and that the short-lived boom of 1909-1910 has left Rhodesia a mining country that was. It is quite true that things in Matabeleland and Mashonaland are not nearly so promising today as they were a few months ago, that business is not nearly so brisk, and that Rhodesian mining properties and shares are in nothing like the demand they were. But to suppose that gold mining is a thing of the past is to adopt an erroneous opinion of the industry. The mineral output of the country is being well maintained; indeed, were a little more native labor forthcoming, an immediate and substantial increase of the gold output would result. More important still, a large amount of development work is being done. In fact, despite the shortage of native labor, the good work of exploration begun in 1909 has not been allowed to abate, but is steadily being continued. It is common knowledge that Rhodesia's great need has been development. The smaller mines, and indeed the majority of the larger projects of the country, possessed no ore reserves of any consequence whatsoever until a year or two ago when mining in Charterland was commenced on really sound and business-like lines.

In 1910 one of the leading mining men of Matabeleland remarked to me, that the next three years would show what place southern Rhodesia was to take in the list of the world's mineral producing countries. That view was a correct one. The exploratory work, now being conducted on the various mineral belts of southern Rhodesia, is going to either make or mar the country. Because the gold output is not rising by leaps and bounds, and because the many foolishly optimistic statements made at the time of the boom are not materializing, it must not be imagined that the country's industry is on the wane. Considering the paucity of the labor supply and the large percentage of the supply which is being devoted to development, the present production of Rhodesia must be adjudged satisfactory.

The gold output of Rhodesia since the beginning of 1910 has been as follows:

	1910.	1911.
January	£227,511	£207,903
February	203,888	203,055
March	228,385	231,947
April	228,273	221,296
May	224,888	211,413
June	214,709	215,347
July	195,233	237,517
August	191,423	243,712
September	178,950	225,777
October	234,928	218,862
November	240,573	.....
December	199,500	.....
	£2,586,201	£2,216,829

The scarcity of native labor in Rhodesia seems to become more serious as the months go by, and the situation today is causing great anxiety. The native population of the territories ruled by the British South Africa Co. is large, but it is one thing to possess a large native population and quite another thing to have a large working native population. Rhodesia's position in regard to native labor is certainly not enviable. She cannot hope to secure any appreciable or useful complements from the Transvaal or other territories of the Union of South Africa, nor indeed from a great deal of Portuguese East Africa, because the labor recruiting agents of the Witwatersrand have a monopoly in these areas. Nyasaland and northeastern Rhodesia have wellnigh closed their doors to the southern Rhodesian province, the province in which all the important mines are situated. In both these states the dread scourge of sleeping sickness has lately advanced and increased to an appalling degree, and furthermore, the Nyasaland planters are loth to allow any of their none too plentiful laborers to seek work outside their own frontiers.

The mines of Rhodesia must in fact look largely to Matabeleland and Mashonaland, together with northwestern Rhodesia or Barotseland, as suppliers of native labor, and none too much is at present forthcoming from these territories. In regard to Barotseland, it may be remarked that native labor recruiting agents employed by the Tanganyika Concessions, Ltd., are scouring the territory for labor and are further adding to the tribulations of the southern province. In these circumstances it is not surprising to learn that the controllers of the Rhodesian mining industry are considering the employment of natives from parts of Africa other than those adjacent to Rhodesia.

It is understood that important proposals, which concern themselves with the West Coast of Africa, are now receiving the attention of the Executive of the Rhodesian Chamber of Mines. It is suggested that native labor shall be imported from Liberia, from Angola, and other places on the West Coast. Of course the concluding of satisfactory negotiations with the governments of these states has first to be arranged, and, as yet, no announcement has been made by the Rhodesian authorities in regard to these proposed plans. It is, however, quite clear that something must be done to relieve the stress of the situation, and if labor is not obtainable from the territories controlled by the British South Africa Co., the leaders of the industry in Charterland will have to look farther afield.

It is interesting to learn that at last the board of directors of the Tanganyika Concessions, Ltd., has decided to use the Wankie Colliery Co.'s coke. Hitherto imported coke has been employed for the blast-furnaces of the Katanga, and the cost of importation has placed a severe tax on the company's expenditure. The Wankie colliery is situated in northern Matabeleland, and it has for long been a matter for surprise, that no seeming attempt has been made to come to an arrangement with the only producing coal mine in Rhodesia. It as yet remains to be proved that the Wankie company is capable of producing a class of coke suitable for the Tanganyika Concessions company's needs, but it is at any rate of much interest to learn of this development in connection with the company's smelting program.

TORONTO, CANADA

COLD WEATHER PROMOTES WEST SHINING TREE PROSPECTING.—GENERAL FIELD NOTES.—DIVIDEND RECORD FAILS TO RELIEVE MARKET.

The extremely cold weather has seriously interfered with construction work and surface operations at Porcupine, further delaying the completion of the mills at the Dome and other properties. The freezing of the lakes and streams has facilitated travel, and since the cold set in there has been a considerable movement of prospectors into the West Shining Tree district, where additional good finds are reported. The Timmins townsite, on Miller lake, which has now a population of about 600, has been incorporated as a town, being the first settlement in the Porcupine area to obtain the civic status. Within its limits are included the Hollinger mine, the Campbell Veteran claim, the Dixon and Miller-Middleton properties, and other holdings of the Timmins-McMartin-Dunlap syndicate. The force employed on the Bewick-Moreing properties has been reduced, operations during the winter being confined to the shaft at No. 1 camp and the camp near the Foley-O'Brien line. Ernest Williams, who has been in charge, is returning to London. At the annual meeting of the Dome on January 3, some important changes were made in the directorate. Ambrose Monel was elected president, with W. C. Edwards as first vice-president, and Messrs. De Lamar and E. C. Converse, both of New York, became members of the board. W. W. Mein, formerly of the Robinson Deep mine, South

Africa, was appointed consulting engineer. Henry Hoover, at present superintending the construction of the mill for the Merrill Metallurgical Co. of San Francisco, will join the Dome staff as mill superintendent when the mill is finished. The total expenditure on the Dome to date is stated to be $800,000, exclusive of the loss in the fire last summer, which cost the company $109,236 in excess of the insurance. The Hollinger has ordered 27 electric motors for its mill, varying in size from 10 to 100 hp., from the Canadian General Electric Co., to be delivered before the end of February. At the McIntyre a 28 ft. vein of mineralized schist and quartz, which it is hoped will yield good milling ore, has been opened up by a cross-cut from No. 1 shaft on the 200 ft. level. In cross-cutting on the 100 ft. level at the Imperial property, several small veins, all carrying visible gold, have been found. Operations will be resumed shortly at the Success, where a reorganization of the company has been effected by the withdrawal of the English stockholders. The Preston East Dome declined to make the third payment due for the Preston property, amounting to about $25,000, so that the claim reverts to its former owners, the Logan Silver Mines, Ltd. The former company retains the three East Dome claims, which will be actively developed. The Gold Peak company, recently organized, has taken over eight claims in Turnbull and four in Ogden township owned by C. H. Moore and Archibald Brown. The Pearl Lake has ordered new machinery comprising a hoist capable of working to a depth of 1000 ft., a double-drum 10 by 12 machine, and 100-hp. boiler. The shaft has reached a depth of 225 ft., and a station for storage has been cut at the 200-ft. level. The Vipond shaft is to be put down from the 200-ft. level for 100 ft. farther. At 200 ft. the vein has been driven on for 65 ft., the ore carrying about $24 per ton. The completion of the mill by spring is contingent on the delivery of material and machinery on time. The Lucky Cross, at Swastika, has cut a 6-ft. lens of quartz on the 100-ft. level.

GOLDEN STAIRWAY TRENCH, LOOKING TOWARD DOME EXTENSION.

The dullness of the Cobalt market is unaffected by the dividend record for 1911, which considerably surpasses that for the previous year. Excluding the close corporations and privately owned properties, 12 dividend-paying mines returned to their shareholders last year a total of $8,395,558, as compared with $6,460,817 in 1910. The total payments of dividends since the beginning of operations to the end of 1911 amount to $28,611,131, and it is estimated that if the returns from the other properties were included, the aggregate would be about $40,000,000. The most important happening in connection with the Cobalt district lately is the shipment, since the year opened, of what is stated to be the richest carload of ore so far sent out. It comprised 31.3 tons from the 500-ft. level of the Temiskaming, and contained 200,728 oz. silver, valued at $110,397. The record was previously held by the Crown Reserve for a car of 19.9 tons, averaging 8903 oz. per ton. The Nipissing state mill for December shows a production of 407,114 oz. silver, valued at [illegible]. The cash on hand as of January 6, was given as over $1,000,000, from which the forthcoming dividend of $140,000 must be deducted. The La Rose directorate has adopted a deep mining policy for the main property. The winze, which was put down 120 ft. from the 240 ft. level, will be sunk an additional 100 ft., and at this depth a station will be constructed and extensive cross-cutting and drifting done. A statement of the financial position of the McKinley-Darragh, on December 28, shows a total of $660,111, including cash in hand, ore at smelter and in transit, and ore ready for shipment. The Comagas is opening up new territory on the 75 ft. level with good results. Only 25 of the company's 40 acres have so far been prospected. A winze put down from the 225 ft. level on the eastern end of the property, where the conglomerate is deepest, is now 40 ft. down in good ore all the way. The mill is treating 186 tons of ore per day averaging 36 oz., though mine ore still furnishes over half the production. The cost of production is only 8.8c. per ounce.

The Ontario Government has withdrawn the islands in Lake Temagami from prospecting and from sale or lease. There is no reason to believe that valuable minerals exist there, and it is desired to keep the islands as a resort for tourists and sportsmen.

SALT LAKE CITY, UTAH

LEAD SMELTERS RAKE FIELD FOR CONTRACTS.—SMELTING AND MINING INTERESTS INVESTIGATE FERTILIZER MANUFACTURE.—FISH SPRINGS MINE REPORT.—BINGHAM EARNINGS.

Time was when the lead miner of Utah and the adjacent states was made to feel that he was indeed fortunate to get a smelter which would accept his ores at any price which would permit him to mine his ore. Times have changed. It isn't the miner who actually has developed ore who is now doing the worrying, but the smelter manager, and some interesting developments are now being watched for by people who understand the situation thoroughly. Ever since the International S. & R. Co. decided, a year or more ago, to put in a lead stack at the Tooele plant, there has been some general scrambling for lead ore. Rumors of a community of interest between the International (controlled by interests allied with the Amalgamated Copper) and the Guggenheim corporation, the A. S. & R. Co., apparently never reach the men in the field, as the fight for business is becoming hotter and hotter. Both sides have been scouring the country for contracts, offering all kinds of inducements, and the International has gone as far away as the Coeur d'Alene after ore. The big producers are sitting back and having a fine time, while the small producers who once had to sit for hours in the anteroom waiting their turn, and generally their turn-down, are now being courted and flattered. One of the largest and earliest contracts obtained by the International was that for the output of the Daly-Judge at Park City. For months, while the new smelter was being erected, the International has been buying the ore and stacking it up at Tooele. When the new lead smelter is blown in shortly, it will have enough Daly-Judge ore to last it for some time. All the companies are fighting for the rest of the Park City output, and here F. A. Heinze has bobbed up with a strong card to play. Mr. Heinze has a long-time contract for the output of the Silver King Coalition, the largest silver-lead producer in the state. He secured it when he was preparing to build a smelter in Utah. When he was obliged to give up that project at least temporarily, he still had the ore contract. He is now doing business with the A. S. & R. Co. It is stated that if he should divert this business elsewhere, it would be a serious blow to the Murray plant of the American, on account of the scarcity of desirable lead ores.

Smelting, mining, and agricultural interests are turning their attention to the chances for building up a fertilizer industry centring in Salt Lake City. A recent bulletin

of the U. S. Geological Survey states that Salt Lake and Ogden form logical centres for such an industry, because of the recent potash and phosphate discoveries in the surrounding country, and because of the immense amount of sulphuric acid which can be made as a by-product from the smelters. At present the manufacture of sulphuric acid from the fumes has not been attempted on any large scale, because of the lack of a profitable market.

The annual report of the Utah mine at Fish Springs draws attention to the record of this remarkable little mine, which is in the desert of western Utah, 75 miles from the nearest railroad station, at Oasis. The wagon-haul costs $12 per ton, and yet the mine has gone steadily on for twenty years without closing down or levying an assessment. It has produced $1,198,000 in silver-lead ore and paid $281,860 in dividends. The 1911 production was 1,459,150 lb., the ore averaging about $86 per ton. As a result of the recent visit to Utah of James P. Graves, president, and Henry N. Sweet, a director, of the Bingham Mines Co., it is announced that a more aggressive development campaign will be entered upon. Mr. Graves states that the net earnings for the year were $112,000, out of which is deducted $32,000 bond interest.

JOPLIN, MISSOURI

DECREASING THE COST OF SHAFT SINKING.—QUALITY OF JOPLIN ZINC ORES IMPROVE.—BIG DRAINAGE PLAN FOR AMERICAN MINES.

Through the installation of a deep well pump in an 8-in. drill-hole, seven feet from the shaft he is sinking, J. M. Short, owner and operator of the Geronimo mine on the Connor land in the western part of Joplin, has reduced his cost of sinking $7.50 per foot. Formerly the cost was as high as $25 per foot, due to the heavy volume of water that had to be handled before progress could be made and because of the necessity of either removing the pump which was in the shaft or guarding it with heavy timbers at each blast. The latter course often resulted in serious damage to the pump. The cost of sinking is now $17.50 per foot. The shaft was down to a depth of 70 ft. when pumping arrangements were changed. The shaft is to be sunk to a depth of 126 ft., if ore is found at the expected level as indicated by drill clippings, taken from a hole on the site of which the shaft was sunk. About 56 ft., therefore, remains to be sunk. At the saving per foot mentioned the total saving will be $415. The cost of putting down the 8-in. drill-hole near the shaft was $150, which, when deducted from $415, leaves a net saving of $265. Had the system been adopted earlier the saving would have been greater. But the mere item of expense is not the feature of greatest importance. The saving of time is the chief item. Prior to changing pumps the company was sinking barely 5 ft. per week; the same work is now accomplished in 16 hours. This is the first time this method of shaft drainage has been tried in the Joplin district. It would appear necessary that the shaft be sunk either through open ground, thus permitting free drainage of water to the drill-hole, or that two drill-holes be sunk, one squarely in the centre of the shaft and the other nearby for the pump. At the Geronimo mine, where the shaft went through almost impervious limestone, it was necessary to follow the latter method. At this mine, open ground is found beneath the limestone, and both drill-holes penetrate this stratum. Thus, when the water descends through the drill-hole in the bottom of the shaft, care being exercised to keep the opening free from dirt, it enters the open ground, traverses the intervening space to the other drill-hole, and is raised with the deep well pump.

An assay taken from a conglomerate mass of zincblende, accumulated from small samples taken from scores of mines throughout the Missouri-Kansas district, exclusive of the low-grade mines of the Miami, Oklahoma, camp, shows the average metallic zinc content for the year 1911 to have been 57.10%, or an increase over the assays of past years. This condition was due to the opening of numerous mines which turned out a choicer quality of ore than is customary in this district. However, the percentage of iron was much higher than usual, running 2.40%. In 1910 the figures were 56.55% zinc and 2.10% iron; in 1909, 56.30% zinc and 2% iron. In 1904, the banner year in the matter of choice ores produced, the zinc content touched 57.97%, and iron only 1.84%. One of the biggest drainage projects undertaken in Joplin district properties has just been completed by the American Zinc, Lead & Smelting Co., operating the largest sheet ground mines in Missouri. A drainage drift, 1000 ft. in length, connecting shaft No. 7, at the extreme north part of the developed area of the American land, with the old workings to the south, has just been finished. Aside from the novelty of the new drainage idea, this is the longest single drift ever driven by any company of the district. Machinery for a powerful central pumping plant at shaft No. 7 has been installed. Eventually the company intends to erect a concentrating-plant at the north shaft.

At the United-Lehigh mine at Carl Junction development is being conducted in sheet ground from one shaft, and in soft ground from another. At the latter, drifts have been driven under a substantial cap-rock of limestone, which is, in reality, the bedrock of the old soft-ground workings. The company, with raises through the limestone into the rich pillars left in the old ground, pulls the dirt down into the lower levels, from which it is removed to the mill. Mules, as underground car haulers, have been replaced with a rope haulage-system at the Golden Glow mine on the Underwriters' land at Webb City. Dirt is now being hauled underground from a point 700 ft. distant from the shaft.

The Webb City Smelting & Manufacturing Co., manufacturers of pig lead, has been taken over by the American Metal Co. The Webb City corporation was capitalized at $75,000. The sale was made at a loss of $20,000, which the stockholders bore. Smelters of lead claim there was little or no profit in the industry in 1911, and the Webb City plant, being a new one, having started barely a year ago, was not in position to withstand the pressure. The average price of pig lead through 1911 was about $4.375 per 100 lb., East St. Louis quotations. Ore ranged in price from $27 to $32 per 1000 lb. In handling the ore the cost is divided as follows: 50c. for buying expense, 50c. for hauling, and 50c. for freight to the smelters for each 1000 lb. Add to this $1.50 freight on metal per 1000 lb. to East St. Louis from the local district, and the total expense is $3. The smelters claim a margin of $10 per ton is necessary if they are to make a profit. In 1911 the margin was often under $6.

AUSTIN, TEXAS

SIGNIFICANCE OF ELECTRA OILFIELD TO TEXAS.—STATE RANKS SIXTH IN PRODUCTION.

In a brief review of the oil development of the state, William B. Phillips, director of the bureau of economic geology and technology of the University of Texas, says:

"With the coming in of the Electra oilfield, Wichita county, 150 miles northwest of Fort Worth, which has now a production of about 10,000 bbl. per day, the oil situation in Texas has entered upon a new phase. With the exception of the Navarro county oilfields near Corsicana and Powell, practically all of the Texas oil has been obtained from the formations represented in the coastal plain counties of Jefferson, Hardin, Liberty, Harris, and Matagorda, which are upper Cretaceous and Tertiary. These are the formations which have yielded by far the greater quantity of oil produced in Texas, and they continue to supply the bulk of the oil secured here. In the Electra field, however, there is a different set of conditions. While the Cretaceous is represented, there are two, and perhaps three, other formations which are to be considered, the Carboniferous and the Permian, with beds which may prove to be Permo-Carboniferous.

"It is of interest to state the total production of petroleum in Texas since the earliest reliable statistics were gathered. Since 1889, including 1910, the total production of petroleum in Texas has been 147,460,188 bbl., each of 42 gal.

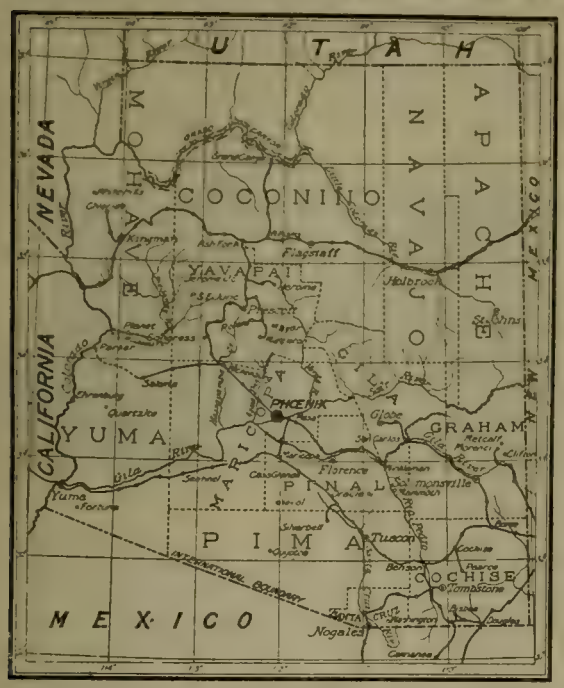
Considering the total production of the different oil producing states, Texas ranked sixth in the following order, Pennsylvania and New York, Ohio, California, West Virginia, Oklahoma, and Texas.

"The production in the United States since 1859 is given as 2,378,907,864 bbl. Texas reached its high water mark in 1905 with 28,136,189 bbl. Since that time there has been a marked reduction in output, and in 1910 Texas produced 8,899,266 bbl. During the last five years the production diminished by 19,236,963 bbl. of oil."

GLOBE, ARIZONA

WORK STARTED ON KINGDON SHAFT.—NOTES OF DISTRICT.

The preliminary of concreting the Kingdon shaft of the Old Dominion company has begun, under the direction of Paul Michaelson, contractor, and C. H. Wendeman, construction engineer. The work is being done under contract. The shaft will be concreted from the collar to a depth of 1000 ft. The work will be done in sections, beginning at



ARIZONA.

the top. This will be the first concrete-lined shaft in the Southwest.

Charles S. Smith, president of the Old Dominion and of the new Arizona Commercial company, is visiting the mines, and states that work will not be begun by the Arizona Commercial until the bonds of the old company have been foreclosed and the new company takes possession of the property, or some time in June or July. It is proposed to confine the work to the old Copper Hill shaft near the United Globe ground of the Old Dominion and to make some arrangement with the Superior & Boston whereby the latter company will develop the ground tributary to the Eureka shaft. James Neary, superintendent of the Magna copper mine at Superior, thirty miles west of Globe, states that 300 ft. of driving has been done on the eighth level, opening up a vein of rich copper ore as much as 15 ft. wide, the shipments averaging 26% copper. The mine formerly was known as the Silver Queen and is now owned by the Gunn-Thompson company.

Ore is being hauled from the Duquesne group, fifteen miles west of Globe, and loaded on the car at Miami preparatory to shipping to the smelter at El Paso. The ore is reported to run well in gold, silver, and lead.

At the Superior & Boston mine on Copper hill, the crosscut north, from the McGaw shaft, on the twelfth level, is within a short distance of the vein and is purposely being advanced slowly so as not to cut the Great Eastern vein before the arrival of the 200 ft. of 12-in. pipe for the water column between the twelfth and tenth levels. The present flow is about 750,000 gal. per day, most of which comes from the upper levels. The Miami Copper Co. continues to produce at the rate of 2,500,000 lb. of refined copper per month with five of the six units of the concentrator in operation. The sixth unit should be running by February 1 or a few days later. It is proposed to resume churn-drilling in the near future, but this work has not yet been started, as reported in some Eastern papers.

The Inspiration Copper Co.'s dam across Pinal creek, 16 miles from the mine, will be the chief source of water-supply for the concentrator. It will be built of concrete rubble masonry, will be 75 ft. long, and average 25 ft. high. There will be a concrete forebay and a tunnel to connect with the pumping station. The method of concentration recommended by J. M. Callow is being tested by him in the experimental mill. It is designed to be an improvement on the roughing system as practised in many of the large mills of the country. It aims, by means of graded crushing, to produce a comparatively small amount of slime.

LONDON

EL ORO'S FUTURE POLICY.—SAN RAFAEL VEIN TO BE EXPLORED IN DEPTH.

The El Oro Mining & Railway Co. has published a report made by R. T. Bayliss giving his views as to the future policy to be adopted at the El Oro gold mine, Mexico. He has recently paid a visit to the mine in his capacity as chairman of the company, and has conferred with R. M. Raymond, the local director, and A. F. Main, the manager. Their unanimous opinions are given in his letter. Upon personal examination on the spot, Mr. Bayliss is confirmed in his opinion that the upper part of the San Rafael vein, that is, above the 486-ft. level, affords no further prospect of new discovery, so he advises the suspension of development work. There is a large amount of ore remaining in the stopes, and he recommends that this be extracted without delay so as to curtail the item of expenditure which would otherwise be involved in keeping the workings in good order. The labor released by the abandonment of development in the upper workings is to be utilized in exploring the lower parts of the San Rafael vein, especially in the southern portion between the 486-ft. and 1000-ft. levels. The developments on these levels in the northern part have been disappointing, but strong hopes are held out that better results will be obtained at the southern end. On the branch or west vein the recent developments have been excellent. This orebody was first found in the 1000 ft. level and has now been proved to be continuous from the 786-ft. to the 1300-ft. levels. The ore is high grade and streaky, and much rock has to be broken with it, but the average content of the whole is $17 per ton. The exact structural relation between the two is not yet quite clear. There are indications that somewhere between the 1000-ft. and 1150-ft. levels the two veins are adjacent if they do not actually join, but below this the branch vein dips away to the west. On the San Patricio vein the ore appears to be distributed in much the same way as in the San Rafael. After providing rich ore on the first and second levels, the vein gradually became lower, until on the fourth level no continuous orebody has been found. The indications are that at a lower level in the southern part richer ore will once more be found, as happened on the San Rafael. Mr. Bayliss writes hopefully of No. 4 vein, still farther to the west, and recommends that development work should be continued. As regards the future policy of the company, Mr. Bayliss recommends that the extraction of ore from the San Rafael be reduced to 20,000 tons per month, expected to yield an annual profit of £150,000 per year, or £50,000 less than at present. In the meantime the developments at depth in the San Rafael, the San Patricio, and the No. 4 will, it is hoped and confidently expected, provide a continuation of the ore supply for the mill.

General Mining News

ALASKA

Prince William Sound

Three hundred and fifty tons of high-grade copper ore was shipped early in the month from the Fidalgo-Alaska mine to the Tacoma smelter. This is the first shipment made from the property.

The Tanana

From a recent mill-run, it is estimated that the last 101.2 tons of ore from the Rexall group will yield $180 per ton. The Rexall group is on Wolf creek, and is operated by Cooper & Stillman, lessees.

Shaft-sinking will be started in the near future by August Peterson, layman on 17 Goldstream. H. H. McDonald, one of the owners of the claim, is in charge of the property.

ARIZONA

Gila County

Three drifts have been started from the station on the 800-ft. level in No. 2 shaft of the Live Oak mine and all are breasted in ore. Drifts and raises are being driven on ore at the east end of the orebody on the fourth level.

Pinal County

January's production of the Ray Consolidated, it is expected, will pass the 3,000,000-lb. mark, the increase being possible both by the higher grade of ore treated, and also by greater tonnage handled per unit of concentrator, which has been treating about 4000 tons of ore per day in the four units which are in commission. The fifth unit is now operating, while the second has been shut down for the purpose of making certain adjustments to conform to the No. 1, or model unit, it being the intention to shut down one unit at a time until the necessary adjustments have been made for the entire plant. The average grade of ore treated at Ray during November was 1.75 to 1.80% copper, as against the average of the company's ore reserves of 2.17%. On this grade of ore, extraction in the concentrator has been running nearly 70%. The cost of producing copper at Ray Consolidated at the present time is approximately 9c. per pound, based on smelting concentrate at Hayden. The sixth unit of the mill is to be ready about April 1.

Yavapai County

(Special Correspondence.)—Oil excitement still continues throughout the Verde river district, there being three rigs at work, and more reported on the way. William Stephens reports the drill of the Verde Valley Oil Co., near Camp Verde, to be down over 200 ft. and work progressing rapidly. The new Verde line of the Santa Fe is now working five different crews on grading work, and steel has been laid for several miles out of Cedar Glade.

S. S. Ballard and Thomas Martin, owners of the patented group of claims known as the United Verde Junior property, have bonded the same to A. H. Lyons and W. M. Malody for $12,000 cash or $25,000 in two years. Messrs. Lyons and Malody subsequently assigned the bond to the Black Hills Copper Co., which adjoins on the west.

It is reported that work will start, in the near future, on the 10,000-ft. adit of the Jerome Tunnel company. The portal of the adit will be almost due east from Jerome and will run directly under the town, tapping the United Verde mine at a depth of about 1600 ft., and several other valuable properties at nearly the same depth.

Prescott, January 20.

Yuma County

The D. & W. M. Co.'s annual report, recently issued, states that milling-grade ore has been opened up on five levels, to a depth of 700 ft. The underground development amounts to 3150 ft., and with a mill the property could easily be put on a paying basis, according to J. W. Fink, president and general manager for the company.

CALIFORNIA

Eldorado County

It is reported that M. P. Powell and R. S. Young have sold the Humiston and Eureka quartz properties to San Francisco capitalists. The mines are in the Latrobe district.

Kern County

Late newspaper reports state that the Antelope Valley G. M. Co. is about to build a mill to treat ore by amalgamation. The company's property includes the vein discovered several years ago by E. M. Hamilton.

San Francisco County

A. B. Ruggles, recently reëlected president of the San Francisco Stock Exchange, has announced the following appointments: Governing committee, A. F. Coffin, William Bannan, George S. Clark, C. D. Laing, E. P. Barrett, T. S. Robinson, and J. Kullman; finance committee, E. Epstein, W. H. Hannon, and G. C. Sneider; membership committee, J. H. Berghauser, Edmond Godchaux, W. H. Moise, W. J. Hayes, and J. McKenzie; stock list committee, F. D. Atherton, R. L. Colburn, S. D. Landecker, Fred Rodda, and B. L. Wilson. In the first committee T. S. Robinson replaces B. F. Shaw, who declined to serve, and J. Kullman replaces Nat Boas, who is about to leave the city for some time, while otherwise the committee is as last year.

Shasta County

(Special Correspondence.)—The Mammoth Copper Co. has started preliminary work for the installation of another bank of cooling pipes, making nine in all. This will enable the company to operate three furnaces throughout the year. Current rumors are to the effect that an attempt will be made to operate the Balaklala smelter during the present year, by treating the fumes with the Cottrell system and a sulphuric acid annex. It is understood an active development campaign is about to be started at the Golinsky copper mines by the German syndicate, which acquired the holdings last fall. Albert Vestal has acquired eight claims of the White Oak group, in the Lower Springs district. George F. Graves, of Redding, and Frank Bein, of Kennett, were the former owners.

Redding, January 20.

The Quartz Hill mine, Old Diggings, and the Mt. Shasta mine, Shasta district, have been shut down. It is said they will resume in the spring.

Tuolumne County

(Special Correspondence.)—The Bonanza pocket mine, first worked in 1851, and which has yielded about $2,000,000, is being unwatered and retimbered for another period of activity. It is situated in the northern part of Sonora, completely surrounded by residences, and has not been worked for nearly twenty years, though there is yet considerable ground that has not been explored. The vein is in a slate formation and is from 4 in. to 1 ft. wide. The property was lately bonded to Los Angeles men, among whom are R. L. Summerland, A. J. Koll, and C. W. Mitchell.

John Witney has become interested in the Humbug Tunnel mine and intends to explore the property. A deposit of gold-bearing gravel was uncovered a short time ago. The outlook at the Omega is reported to be good. The working crew has recently been considerably increased, and in a short time the mill will be started. At the Saratoga gravel mine, on Table mountain, operated by V. J. F. Dieu and associates, the gravel deposit has been reached. Arrangements are being made for electric power at the Columbus mine, near Tuolumne. The construction of an electric transmission line to the Slap Jack has been completed and the property is now being unwatered. Actual mining will begin about February 1.

The crew of men which was engaged in reopening the Mayflower mine, bonded only recently by W. H. Scott to W. P. Daniels, has been withdrawn owing to some disagreement between the parties to the bond. Outcroppings of a large vein on a 5-acre tract in the southern part of Tuolumne recently purchased by Frank Paff for a residence

assay up to $20 per ton. The vein will be opened by sinking a shaft.

Tuolumne, January 20.

Yuba County

While other officers of the company decline to discuss the action, it became known recently that E. W. Tarr has resigned as general manager of the Tarr M. Co. His resignation will be acted on at a meeting near the end of this month. He organized the company and was one of the leading members throughout the five years of its existence.

COLORADO

Denver County

At a meeting at Denver, January 13, of mining men of the state, an organization was formed with the avowed purpose of exterminating wild-cat mining companies and of preventing fraudulent misrepresentation on the part of miners and prospectors. R. Kenehan, State Treasurer, was elected president. No name as yet has been selected for the body.

El Paso County

The ninth Edwards roaster is to be installed at the Golden Cycle mill at Colorado City February 10, according to Hugh McGarry, general manager for the company. A kominuter, for fine-grinding and preparing the ore for

ISABELLA MINE, BULL HILL, CRIPPLE CREEK.

the roasters, has been put in. Both the Cycle and the Portland mills are reported to be operating at capacity at the present time. In an official statement Mr. McGarry has denied any reported sale of the Golden Cycle M. Co. property to the A. S. & R. Company.

Lake County

At the big Chief an incline shaft will develop a large zinc-carbonate orebody. The incline will be sunk from the bottom of the present shaft, 800 ft. deep, where a 22-hp. electric hoist will be placed. About 700 ft. of wire will be required to supply power from the surface. About 25 cars of ore per day is being shipped from the Castle View, and a similar amount from the Crescent and Catalpa. Other properties of the district are being actively developed. Among them, work has been resumed in the South Winnie shaft on Breece hill.

Park County

The Mill Gulch M. Co., operating about 25 miles north of Cripple Creek, claims to have discovered a large deposit of copper ore assaying 2.4 to 23.3% copper. R. K. Thomas, of Colorado Springs, who is at the head of the Colorado Development Co., asserted that an offer of $200,000 for the property has been refused. It is rumored that the A. S. & R. Co. made the offer.

Teller County (Cripple Creek)

The Mary McKinney M. Co., the oldest corporation in Cripple Creek, will legally expire March 31, and steps are being taken toward reincorporation.

Linderfelt & Stewart have secured a lease on the Deadwood mine, Bull hill. Eight sets of sub-lessees are developing the property at present.

The Modoc M. Co.'s board of directors and officers were reelected at the annual meeting of the company, January 17. Two dividends, each requiring the disbursement of $5000, were paid during the year. Work is to be started soon on the 1100-ft. level, 200 ft. below the present depth of operations. The tonnage shipped during 1911, according to the annual report, averaged $41.50 per ton. All of the company's ore is shipped to the Ellers smelter at Pueblo. The total production was about 1700 tons. Two sets of lessees are developing the property, and it is stated that the policy of keeping the development ahead of the actual production will be maintained.

A quartz vein assaying $42 to $600 per ton, on the Smuggler claim of the Isabella group, Bull hill, has been found. The discovery was made under Lester Grant, superintendent for the company, and not by lessees.

Gillingham & Burns, lessees, have discovered ore assaying $30 to $200 per ton on the fifty level, Morning Glory No. 4, of the Work Gold M. & M. Co. property.

MONTANA

Lincoln County

(Special Correspondence.)—It is believed that there is considerable gold in the ground upon which Libby is built, this having been demonstrated recently by panning the gravel from a hole that has been excavated for a bridge pier. There are alternate strata of gravel and clay in the wash under the town, and in the gravel the gold seems to be quite plentiful.

A. M. Balfour is in town from the Blacktail mine, in the West Fisher gold belt. Work has been suspended at the property for the winter, but will be resumed as early in the spring as the weather will permit. Mr. Balfour and his associates have a lease on the property, which is equipped with a stamp-mill.

Libby, January 22.

Silverbow County

(Special Correspondence.)—It seems quite probable that W. A. Clark will introduce into this district a German process for treating zinc ore which, so far as experiments with zinc ore from Clark's Elm Orlu mine are concerned, have proved highly successful. A Butte man who has inspected the German process while abroad, says that the Butte zinc ore contains from 1 to 3% iron, 2 to 4% manganese carbonate, 1 to 2% chalcopyrite, 15 to 22% sulphur, insoluble complex silicates and quartz constituting the gangue matter running as high as 56%. After some experiments, the German who conducted them said that he did not see technical difficulties in treating the Butte ores, as similar ores had been treated successfully. With Butte ores containing a large percentage of complex silicates, a rough concentration will be necessary to remove a large part of the gangue. That can be accomplished without causing noticeable losses in the metallic content of the ore and ought to concentrate more than 90% of the metallic compounds from ore containing 18 to 20% zinc. The Butte product would assay about 30% zinc, and it would be an excellent material for the German process, the lime in the gangue remaining in the concentrates, with additional lime, crushed coal or coke breeze necessary for making bricks, with the concentrate or crushed ore, would be sufficient as flux. The ore is also roasted to overcome the greater percentage of sulphur. Some further tests are to be made in the presence of a representative of Mr. Clark, and if they are successful the process will be introduced in this district.

Butte, January 20.

NEVADA

Churchill County

The Nevada-Fairview M. Co. has levied an assessment of ½c. per share to provide for a "small indebtedness created on account of the necessity of doing assessment work on the unpatented claims, and also to provide for the patenting of these claims during the present year, thereby obviating the necessity of expending any further money for assessment work."

Clark County

The Quartette shaft has intersected the orebody at the

1350-ft., its lowest level. A 15-hp. hoist has been erected at the Princess shaft of the Searchlight-Spokane property, where driving is about to be started from the 370-ft. level. The mill is being prepared for operation. Some changes are to be made in the mill at the Lucy Grey property, Crescent district, of which Carl Anderson is manager, says a report from Searchlight.

ELKO COUNTY

The Bourne mill is running steadily and treating about 45 tons of ore per day. The grade of ore is improving and the shipments of bullion have increased. The Pavlak mill is treating a good grade of ore. In the mine connections are being made to improve the ventilation which will be completed in a few days.

At the Bluster-Success properties, which are under option to George Wingfield, about 30 miners are employed. Four adits on the Success have been driven on the vein, all showing good milling ore with a fair amount of high grade. At the Bluster the cross-cut adit will soon tap the vein at a depth of about 300 ft. The Buckeye company has bought off the contractor who had charge of the development work on that property, and it is expected the Syracuse, New York, people who have an option on the property at $250,000 for 75% of the stock will now take hold. The vein is showing a large quantity of milling ore with streaks of high grade. The Alpha and Flaxie are under option. Development work is being done on both properties.

LINCOLN COUNTY

A contract for the construction of the Prince Consolidated railroad, about nine miles long, has been let and the work will be started in the near future; it is to be completed by April 15. The line will obviate an expensive wagon-haul in delivery to the Tooele smelter. T. J. Bivens will be the engineer in charge of the road. The contract was let to the Thompson company, of which George Thompson, of Salt Lake City, is manager.

LYON COUNTY

The new Mason Valley smelter recently made its first shipment of matte, amounting to 9 tons, to the A. S. & R. refinery at Garfield. The matte was 40 to 60% copper, which at Garfield will be refined to commercial copper ingots.

The Copper Belt railroad is said to be doing well. Another locomotive, making three in all, has been put in operation. An average of 1600 passengers per month, principally those to and from Reno, and a heavy freight business have been developed. The passengers are handled with a gasoline motor car which makes regular trips.

W. Mont Ferry, president of the Yerington Central Copper Co. has written another note to stockholders urging them to sign proxies in order that a unanimous vote may be taken to make the stock assessable. The letter repeats that the directors believe that ultimately the property may be sold for more than the debts of the company, so that stockholders may receive a return for their money.

The Peer Gold Mining Co. has been incorporated to develop the Peer, Bernice, and Annex claims on Mt. Como, near Dayton. H. C. Cutler, of Reno, is president of the company, which is capitalized at $1,000,000 in $1 shares. The claims adjoin the Nevada Deep Mines property.

It is rumored that a group of Eastern capitalists will take up the remaining $50,000 in bonds on the Nevada-Rockland mine, 26 miles southwest of Yerington, and operate the property. It is said that they will rebuild the mill. Among them are G. A. Ditlinger and R. J. Palmer of Pittsburg, R. F. Stevenson of Washington, Pennsylvania, and A. Vignos of Canton, Ohio. These men inspected the property January 23.

NYE COUNTY

It is rumored that a body of unusually rich ore has been found on the 400-ft. level of the Poak-Steen-Cicala lease.

The report of the Tonopah Midway M. Co. for the year ended December 31 shows a balance on hand in the banks of $35,521, receipts from ore of $47,528, and from the sale of a fraction, $5000, making a total of $88,049. Disbursements were: labor, $34,606; superintendence and salaries, $5100; geology, $385; supplies, $6384; water, $1268; lumber, $1154; fuel, $7974; assaying, $1072; general, $3039; legal, $88; insurance and taxes, $746; balance with banks, $7849; due from Nye & Ormsby (suit pending), $16,799; total, $88,049. Shipments of ore amounted to 2035 tons, valued at $65,700. Transportation and treatment cost $18,173, leaving a net value of $22.35 per ton. A total of 2665 ft. of development work was done, against 32,771 ft. the preceding year.

For the quarter ended November 30, 1911, the Tonopah Belmont Development Co. made the following report: Receipts from sales of ore bullion, $884,161; expenses, $427,114, leaving net earnings for the quarter of $457,046; miscellaneous income brought the total net income up to $463,672. There was due from smelters, loans on collateral and cash in banks, November 30, 1911, $1,292,072. The total income of $463,671 for the quarter ended November 30, compares with $454,377 for the quarter ended August 31. Based on the last quarter, Tonopah Belmont is making net earnings of approximately $1,850,000 per annum. The company has 1,500,000 shares outstanding, on which $1 per share per annum is being paid. The present rate of earnings indicate that Belmont is adding approximately $350,000 to its present large surplus.

During the quarter ended November 30 the Tonopah Mining Co. made the following monthly profits: September, $132,349; October, $153,536; and November, $172,316; making a total of $438,201. These figures somewhat exceed those of the preceding quarter, when net earnings amounted to $418,025, which, with miscellaneous income, made a net of $432,885. Tonopah Mining Co. is paying $1.60 per share per annum on its 1,000,000 shares of stock. At the present rate of production, the company is maintaining a surplus above dividend requirements of from $125,000 to $200,000 per annum.

An 18-ft. quartz vein assaying about 78 oz. silver and 1.2 oz. gold has been discovered on the 1000-ft. level of the Mizpah Extension mine, according to a recent report from Tonopah. The Tonopah Belmont Development Co. main shaft is reported to have intersected the Belmont vein at a depth of 1375 ft. The McNamara M. Co. mill has been put in operation, making four plants at Tonopah. These, with the two at Millers, give a total of 260 stamps dropping in the district.

The shipments from the Tonopah district last week were as follows: Tonopah M. Co., 3500 tons; Belmont company, 2550 tons; Tonopah Extension, 948 tons; West End, 700 tons of ore. The total production, 8513 tons, was valued at $212,825.

STOREY COUNTY

At the regular meeting of the Alpha Con. M. Co., January 18, the old directors were reëlected. An assessment of 5c. per share was levied on the capital stock.

WASHOE COUNTY

New engines will be erected at the Reno-Ruhl G. M. Co.'s property and a double shift employed in the near future. Five buildings have been completed recently. The property is three miles north of Reno. At the annual meeting, held in that city January 22, C. S. Laumeister, Sr., of San Francisco, was elected president of the company, for which W. J. Thompson is superintendent.

WHITE PINE COUNTY

The Eastern M. Co., backed by New York investors, has taken an option on five gold claims from A. R. Nuckolls and Fred Borchert, of Cherry Creek, for a reported price of $25,000. It is stated that $6500 cash has been paid. W. A. Douglas is president of the purchasing company; and E. E. Everhardt, of New York, secretary-treasurer. The company was represented in the deal by Mr. Douglas. A 1000-ft. adit will be the first development undertaken, and it is rumored that a mill may be built. The property is in the Cocomongo district.

NEW MEXICO

GRANT COUNTY

(Special Correspondence.)—Two units of the Hurley

concentrator at the Chino Copper Co.'s plant have been put in operation, and a third will be placed in commission on about March 1. Construction work for two additional units to the mill is well under way.

Hurley, January 16.

UTAH

Juab County

The Gold Chain last week shipped 12 cars of ore. Lessees in the Gemini are reported to be developing new ore. It is rumored that the Grand Central shaft, now 2200 ft. deep, will be sunk farther. The Montana shaft has been sunk to a depth of 265 ft. Other properties in the district are active, and it is rumored that an assessment will be levied to provide for resuming development at the Tintic Central mine.

Salt Lake County

The South Hecla M. Co. has levied assessment No. 1, of 6c. per share, delinquent February 20. The report for the period September 15, 1900, to December 31, 1911, states that 416 ft. of drifts and 62 ft. of raises have been driven, and some timbering has been done in the Quincy and Dwyer adits. Two small shipments of ore were made to

UTAH-APEX MINE.

test the property. More shipments were prevented, it is stated, in February by a contract to transfer the property in exchange for 120,000 shares capital stock of a new corporation designed to acquire also the properties of the City Rocks M. Co. of Utah and the Grizzly M. Co. of Wyoming. The deal ultimately fell through. The cash statement shows receipts of $22,365, of which $10,000 was from a note, $10,503 from sale of stock, $1170 from the boarding house, and $692 from sale of ore. The company has on hand $110. The resources of the company are rated at $515,954, including the treasury stock, and the liabilities at $512,604.

The Kirk & Leavell engineering firm has secured a lease on the workings of the Utah-Apex mine from the 400-ft. level to the surface. The same lessees are operating the Last Chance and Horace Greeley group.

Despite urgent orders, additional equipment for the Bingham & Garfield railroad has not been delivered. The Utah Copper Co. is handling all of the ore possible with the present rolling stock. Six sections of the Arthur mill have been remodeled.

Tooele County

E. P. Mathewson is quoted as saying that owing to high freight rates the lead refinery planned by the International S. & R. Co. will not be situated at Tooele, Utah, where the company's lead smelter is to be blown in some time in February. The blast-furnaces have been completed, and about a third of the bags have been hung in the bag-house.

WASHINGTON

Ferry County

(Special Correspondence.)—The Knob Hill Co. has furnished the following report of its operation and production from August 1, 1910, to January 1, 1912: [illegible] tons of ore shipped to the smelter had a gross value of $[illegible], freight and treatment charges $[illegible], net value $[illegible]. During the year 1911, [illegible] tons of ore was shipped, having a net value of $[illegible]; total ore shipments, [illegible] tons, gross value, $[illegible]; freight and treatment charges, $75,789.67; net value, $[illegible]. The average net value per ton was $20.89; metals produced, [illegible] oz. gold and 31,914 oz. silver. During 1911 the work in the mine amounted to 2622 ft. Two stations on the fourth level were cut.

The North Washington Power & Reduction Co. is finishing its mill with waterproof siding. The boilers are being slow-fed, to dry out, preparatory to putting on steam. The steam and compressed-air lines are being distributed, and on arrival of some missing pipe, the generator will be put in motion, to relieve the company's main electric lighting plant of an overload. This arrangement will be temporary, while the company is building a transmission line from the British Columbian boundary, it having a contract for the sale and distribution of light and power for Ferry county and surrounding mining districts south of the boundary line, from the West Kootenai Power & Light Co., at Bonnington falls, B. C.

The Republic Mines Corporation has opened on the 400-ft. level of the Surprise mine, a stope 70 ft. long, having an average width of 5 ft. on ore averaging about $20 per ton. The main incline shaft on the Surprise is down 540 feet.

The San Poil Consolidated company is laying in concrete retaining walls for its mill. The Hope company is still confining its operations to the winze going down from the adit-level, which is nearly completed.

Republic, January 19.

WYOMING

Fremont County

Quartz mining is reported to be drawing many to Atlantic City, about 35 miles south of Lander. There are placer properties there, too, it is said, which would prove valuable if sufficient water could be secured. One company claims to be producing about $8000 worth of gold per month.

CANADA

British Columbia

The Portland Canal M. Co.'s report for the year ended October 31 has been published, and includes the following items. Expenses, $83,332; receipts from ore, exclusive of concentrate and on dump, $18,433; liabilities, 10% debentures $87,500, sundry creditors $24,485, loan $15,000; cash on hand, $2927. The property is valued at $538,277, the plant at $129,840, mine development at $56,599, and other assets at $9320.

Ontario

The Crown Reserve M. Co., Ltd., has declared its January dividend, No. 24, of 2% and a bonus of 3% for the same period, payable February 15 to stockholders of record January 31. The transfer books will not be closed.

Shipments from the Cobalt district during the week ended January 12 amounted to 118,750 oz. bullion, valued at $64,602, and 246 tons of ore. So far this year the district has shipped 467 tons of ore and 190,647 oz. bullion valued at $103,907.

Stockholders of the Green-Meehan M. Co., Ltd., at their annual meeting, authorized the property to be sold for $150,000. E. W. Wright was elected president of the company.

Yukon

A report from Dawson states that John McCrimmon found a nugget weighing over 84 oz. on Barker creek, near Stewart City.

MEXICO

Chihuahua

Machinery is being purchased for the new 40-ton mill of the Leon Grande G. M. Co. at Santa Rosalia. The company, after a year's development work, is about to start actual production, according to recent report. Matt Hoveck

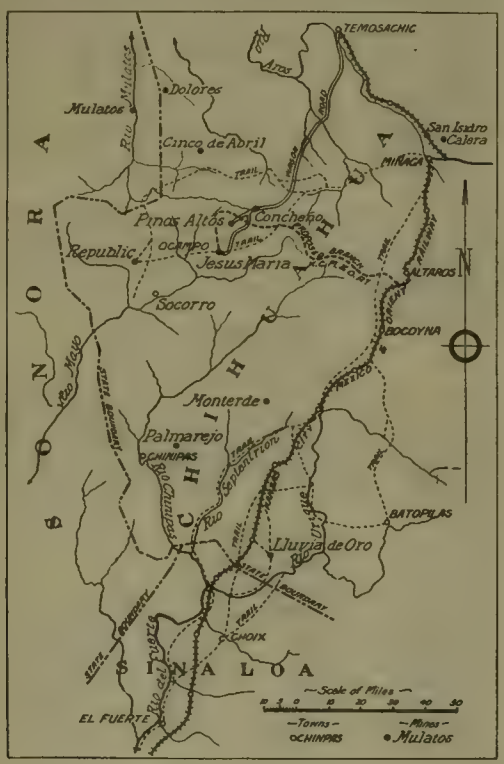
is manager for the company, which has a short lease on the Berly M. Co.'s mill, eight miles from its property, for use until the Leon Grande mill is erected. An initial run of about 1200 tons of ore will be made in the near future.

The Rio Plata M. Co. on December 29 paid its regular quarterly dividend of 2% per share.

JALISCO

The Mexicana M. Co., Tapalpa district, is about to place an order for a smelter, probably with an El Paso house. The machinery is to be at the mines within two months. The remodeled plant of the mining company has been in operation for a short time, with a good production of copper concentrate, with some silver and gold, says a recent report. William H. Childs is general manager for the company, which is the holding corporation for the Keystone M. Co. of Shamokin, Pennsylvania, a reorganization of the old Keystone Copper Smelter Co. of Philadelphia.

W. A. Gray, of Peoria, Illinois, has organized the Mexico Development Co., to operate the Quilitan copper prop-



WESTERN CHIHUAHUA.

erty in the Autlan district. Neal Kinross, formerly with the Chatterton company, will be general manager of the property.

SONORA

A rush is on toward the Cañada and Baboyohui rivers on account of recent placer discoveries. Alaska 'sourdoughs', among the goldseekers, estimate that there will be about 5000 men there within six months.

J. D. Dowdle and John Speer, of Douglas, Arizona, state they have found large deposits of rich copper ore in the vicinity of Laduro. At present it is difficult to do prospecting work there, and to reach the place it is necessary to go by way of Guaymas and the west coast.

PHILIPPINE ISLANDS

MASBATE ISLAND

(Special Correspondence.)—The Colorado mine, at Aroroy, has been developed and equipped to maintain a production of 100 tons ore per day. Among the equipment are an aerial tramway, a 20-stamp mill, and an all-slime cyanide plant.

Aroroy, December 12.

Goldfield Consolidated Report

The regular report of the Goldfield Con. Mines Co., as furnished by A. H. Howe, is as follows.

During the month of December 1911 the total production was 29,127 tons, containing $769,170, or an average of $26.41 per ton, the whole being milled with an average extraction of $24.76 per ton or 94.01%. The total net profit was $503,477 or $17.29 per ton. During the month 3415 ft. of development work was done. The total cost of mining, development, milling, office, and general expense was $7.54 per ton, distributed as follows:

Mining:		
Development	$0.93	
Stoping	2.31	
		$3.24
Transportation		0.08
Mining		2.13
Marketing ore shipped		0.60
General expense		0.56
Bullion tax		0.24
Construction		0.69
Total cost of operation		$7.54
Miscellaneous earnings		0.07
Net cost per ton		$7.47

In the Clermont the 413-sill was extended, and produced 1076 tons of average $24 ore. The 495 cross-cut in the hanging wall of the 420 stope is being extended in ore of average $20 grade. The 604-H raise from the 1000-ft. level, going up toward the 534 on the south end of the 900-ft. level, produced 150 tons of $41.34 ore. In the Mohawk the 3-E sill on the 150-ft. level, near the old Sheets-Ish workings, was again extended, and produced 2223 tons of $23.35 ore. The sill in the K section of the 111 stope on the first level was extended, and produced 38 tons of ore averaging $43.82. The 293 drift on the second level has produced 37 tons of average $16.53 ore. The 406-X cross-cut from 495 intermediate, between the third and fourth levels, produced 218 tons of ore, averaging $23.15 per ton. The 490-B raise, from the 495 intermediate produced 108 tons of ore averaging $23.15 per ton. At the Red Top the 353 intermediate, between the second and third levels, north of the shaft, produced 56 tons of average $20 ore. The 305-DX raise from 353 intermediate produced 217 tons of average $35.14 ore. The 352 sill, on the third level, north of the shaft, was extended and produced 228 tons of average $29.14 ore. The third level main cross-cut from the shaft is being driven across to the Laguna shaft, and a station and pocket cut at the Laguna. Upon the completion of this work the Laguna shaft will serve both mines, and the Red Top surface plant will be dismantled. At the Laguna the 718-ft. level of the Hazel is being driven toward the Laguna shaft, and will be connected by a vertical raise from the bottom of the shaft. The shaft will be carried down to the 725-ft. level, and all work will then be done through the one central shaft for this section of the property.

The total construction expenditure for December was $42,000, as mentioned in the preliminary report. This construction extended over a period of several months, and the total amount was not charged off in December, but will be charged off at the rate of $15,000 to $20,000 per month. One of the furnaces in the roasting plant has been completed and will be in operation by February 1. The other will be ready within a few days.

The prediction is now made that the new lead smelter of the International S. & R. Co. at Tooele will be blown in by February. Three reverberatory furnaces are at work on copper ores, and a fourth is ready for use when it is needed. The plant is now treating about 700 tons of copper ore per day, and is stacking up the lead ore, which is being delivered to it under contract, ready for the completion of the lead stack.

Among the Copper Mines

At the Inspiration the experimental mill is running steadily and the temporary warehouse is finished. Underground work has not yet been resumed.

The Tuolumne new surface plant, Butte district, will not be in commission before the middle or latter part of the month, as some delays have occurred which were not anticipated.

Drilling in the Butte mines by electricity has been proved practicable through the experiments carried on by the North Butte company, and the equipment of all drilling machines in the company's mine for operation by electricity is now in progress. While the officials are non-committal at present, it seems to be understood that the Anaconda company will introduce the same system in the near future.

The new Butte & Superior company concentrator, on which work has just been started, will have a capacity of 750 tons per day instead of 500 tons as was originally intended. The company is now maintaining shipments of 500 tons per day, and with the ore blocked out shipments of double that amount could easily be kept up for a long period of time, so it has been decided to make the mill capacity 750 tons. Some of the directors were in favor of making the capacity 1000 tons per day, but A. B. Wolvin, president of the company, opposed this, taking the view that if it should be found that the mill should have the greater capacity it could be increased later.

Ore reserves at the leading porphyry mines, with the number of shares that will be outstanding when all bonds are converted and the proposed annual capacity of the mills, are estimated by George L. Walker as below:

Company.	Tons ore demonstrated.	Shares when all issued.	Treatment tons ore annually.
Utah Copper	320,000,000	1,619,349	8,500,000
Nevada Consolidated	40,000,000	1,998,892	3,000,000
Miami	18,000,000	749,000	1,000,000
Chino	54,000,000	800,000	1,750,000
Ray Consolidated	75,000,000	1,350,000	2,800,000
Inspiration Consolidated	45,300,000	927,500	2,625,000

Developments at the Lake Copper property continue satisfactory, and within a few months regular production should commence, says the *Boston News Bureau*. The shaft is now bottomed at the ninth level, where a station has been cut, but little or no driving has been done here as yet. One side of the new skip-road is expected to be in readiness within a few days, but the other side will probably not be done until the middle or latter part of February. By March, however, all construction in the shaft should be finished, and then all that will remain to be done is to make a clean-up underground preparatory to stoping and hoisting regularly. This may take a month or two, but production certainly should not be delayed much beyond the early part of May.

It is expected that early in February operations will be resumed in the Robert Emmet company mine, Butte district, of which W. Q. Ranft, of New York and Boston, is president. An unusually heavy flow of water and a lack of the money necessary to carry on operations necessitated a suspension of work some time ago. Mr. Ranft, in calling a meeting of the stockholders for January 22, announced that all financial arrangements had been completed to discharge pending obligations and that sufficient money is left over to meet operating expenses for some time to come. The shaft of the Robert Emmet is down to a depth of 500 ft., and it is intended to carry it down at least 200 ft. more, and for that purpose a lot of new machinery has been ordered. At the time it was necessary to cease operations a fine body of ore had been found.

Obituary

J. B. Hobson, who died at Victoria, B. C., this month, was one of California's pioneer mining engineers. Born in Ireland in 1844, he came to California as a boy and began work in the mines. He was prominently connected with hydraulic mining in Placer county and was instrumental in organizing the California Miners Association. He was one of the men who secured the passage of the Caminetti bill, but when that failed to rehabilitate hydraulic mining he went to British Columbia, where he opened the Cariboo and Horsefly hydraulic mines in the Cariboo district for Sir William Van Horn and his associates. When the properties were sold to the Guggenheims he remained as the manager. Recently he has been active in development of other properties in the Province. Mr. Hobson served a short term as assistant to William Ireland when the latter was State Mineralogist of California and he was active in many ways in the development of Western metal mines.

John Walter Young, second vice-president of Chalmers & Williams, Inc., died January 14 at his home, Evanston, Ill. Mr. Young, who was 56 years old, had heart disease for several years. He was born in Brooklyn, New York, in 1855. He was graduated from the Brooklyn Polytechnic Institute and went to Leadville in 1878. From then on he was actively concerned with metallurgical development in America, having been associated at various times with Karl Eilers, W. B. Frue, Walter McDermott, and other leaders. He turned his attention to the manufacture and sale of mining machinery and did much to build up foreign trade in that line of goods. In 1890 he became vice-president of Fraser & Chalmers, and from 1900 to 1907 was European manager for the Allis-Chalmers Co. Mr. Young was a member of the American Institute of Mining Engineers, the Montana Society of Engineers, the Chicago Club, the Midwood of Brooklyn, Engineers of New York, and the Alta of Salt Lake City, Utah. He was well and favorably known throughout the wide circle of American mining men.

Archibald G. Brownlee, who died at Idaho Springs, Colorado, January 16, was one of the group of brilliant Canadians who have done so much to develop the mining and metallurgical industries of the United States. Born in Ottawa in 1857, he came to this country when seventeen years of age. He served in the United States Army and later in the Indian service. Finally he went into mining, to which he devoted the greater part of his life. At the time of his death he was manager and principal owner of the Stanley mine at Idaho Springs, and was also interested in the Japan-Flora and other properties. He was a capable manager and won success. He found time for wide reading, for pictures and travel, and for public service. He was one of the directors and a member of the executive committee of the American Mining Congress, and was active in the building of a mill at Georgetown to test the Malm process on a commercial scale. He was a modest, likeable man who did good work and will be sadly missed.

Ernest R. Buckley, who died at the Stratford Hotel, Chicago, January 19, from pneumonia, was one of the younger generation of geologists, devoted to economic work. He was born in Massachusetts Sept. 3, 1872, and graduated from the University of Wisconsin with the degree of Ph.D. in 1898. He served successively as Assistant State Geologist of Wisconsin, Director of the Missouri Bureau of Geology and Mines, and mining geologist for the Federal Lead Co. Lately he had devoted his whole time to consulting work, having but recently opened an office in Chicago. Mr. Buckley's death was entirely unexpected, he having but just returned from a professional trip to the West. He possessed a vigorous intellectual honesty which required him to carefully reëxamine the premises upon which any work was built, and was a painstaking student of ore deposits whose writings constitute an important contribution to the science of ore genesis. One of the last of his papers

on the subject formed a chapter of 'Types of Ore Deposits' and dealt with the Missouri lead region that he knew so well. Mr. Buckley, however, found time for duties other than technical. He served at various times as Sunday-school superintendent, city alderman, and as director, vice-president, and later president of the American Mining Congress. To the latter he devoted much time and labor, and it is but fair to say that much of the success that has come to the Congress was due to his work. Mr. Buckley leaves a widow, but no children.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

S. H. Ball is in Arizona.

A. P. Rogers is in Arizona.

George H. Garrey is in Mexico.

C. W. Merrill has gone to Colorado.

Karl Eilers was at Denver last week.

J. Nelson Nevius is in San Francisco.

J. B. Lippincott was in San Francisco.

S. W. Mudd has returned to Los Angeles.

C. T. Durell was at Kalgoorlie last month.

G. W. Metcalfe was in San Francisco recently.

J. W. Malcolmson is expected in San Francisco.

James O. Clifford is at Santa Rita, New Mexico.

Courtenay DeKalb was in San Francisco last week.

T. A. Rickard is expected in San Francisco in March.

F. B. Weeks is at Paradise, Butte county, California.

Joseph Barrell is lecturing at the University of Illinois.

Morton Webber has returned to New York from London.

W. W. Mein has returned from New York and Porcupine.

E. A. Prentis, Jr., is at the Ventanas mine, in Durango, Mexico.

W. H. Emmons will lecture at the University of Chicago April 1 to June 20.

K. Ito and T. Watanabe, of the Nippon Oil Co., are visiting California oilfields.

F. C. Gilbert has gone to Panama, but will return to Colorado early in February.

Richard Kleesattel will be in Arizona and Mexico till spring, on examination work.

A. C. Veatch is at Los Angeles and will be in the California oilfields for some weeks.

George E. Webber is in San Francisco, which he will hereafter make his headquarters.

E. V. Daveler is assistant superintendent for the Ray Con. Copper Co. at Hayden, Arizona.

William Knox has returned to San Francisco from London and will leave for Nikolaievsk.

Theo. H. M. Crampton has been examining the property of the North Fork M. Co., in Colorado.

S. T. Wellman has completed his work on the electric furnace at Heroult, California, and returned to Cleveland.

Arthur D. Little has been nominated as a member of the corporation of the Massachusetts Institute of Technology.

C. M. Eye is returning from the Philippines by way of Europe. For the present his address is 1012 Sawatch street, Colorado Springs, Colorado.

H. B. Barling has been appointed manager in Honduras for the New York & Honduras Rosario M. Co. Mr. Barling's address until further notice will be in care of the above company at San Juancito, Honduras, Central America.

The regular meeting of the San Francisco Section of the Mining and Metallurgical Society will be held following dinner at the Palace Hotel, Monday, February 5, at 6:30 p.m.

Market Reports

LOCAL METAL PRICES.

San Francisco January 25.

Antimony	11—11½c	Quicksilver (flask)	43.50
Electrolytic Copper	15—16¼c	Tin	47—48¼c
Pig Lead	4.70—5.65c	Spelter	7¼—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.60—9.75; large $7.60—8.50

METAL PRICES.

(By wire from New York.)

Average daily prices in cents per pound.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Jan. 18	14.13	4.45	6.33	56⅜
" 19	14.13	4.45	6.30	56¼
" 20	14.13	4.45	6.30	57¼
" 21	Sunday.	No market.		
" 22	14.13	4.45	6.30	57⅜
" 23	14.13	4.45	6.30	57¼
" 24	14.13	4.45	6.30	57⅜

COPPER SHARES—BOSTON.

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, Jan. 25.		Closing Prices Jan. 25.
Adventure	5¼	Mohawk	$ 54
Alloucz	40	North Butte	25
Calumet & Arizona	61	Old Dominion	46
Calumet & Hecla	425	Osceola	108
Centennial	19	Parrot	—
Copper Range	52½	Shannon	9⅜
Daly West	5	Superior & Boston	4⅛
Franklin	11⅞	Tamarack	29
Granby	36½	Trinity	6
Greene Cananea, ctf.	8⅜	Utah Con	16
Isle-Royale	21	Victoria	5¼
La Salle	5	Winona	5⅜
Mass Copper	8	Wolverine	96

NEVADA STOCKS.

(By courtesy of San Francisco Stock Exchange.)

San Francisco, January 25.

Atlanta	$ .16	Mayflower	$ .02
Belcher	.50	Mexican	4.32
Belmont	8.40	Midway	.30
B. & B.	.15	Montana-Tonopah	1.05
Booth	.06	Nevada Hills	2.20
Chollar	.16	Ophir	1.47
Combination Fraction	.14	Pittsburg Silver Peak	1.27
Con. Virgina	.77	Round Mountain	.50
Florence	.55	Savage	.14
Goldfield Con.	4.45	Tonopah Extension	1.46
Gould & Curry	.09	Tonopah of Nevada	7.12
Jim Butler	.38	Union	1.25
Jumbo Extension	.22	Vernal	.16
MacNamara	.27	West End	.83

OIL SHARES.

(By courtesy of San Francisco Stock Exchange.)

San Francisco, January 25.

Associated Oil	$43.00	Peerless	$ 4.50
Brookshire	.54	Pinal	2.90
Caribou (New Stock)	1.25	Premier	.40
Claremont	.84	P. S. Petroleum	.17
Coalinga National	.13	Republic	.40
Con. Midway	.02	Silver Tip	.95
Empire	1.05	Sterling	1.40
Enos	.10	S. W. & B.	.20
Maricopa National	.23	Turner	1.07
Midway Premier	.27	Union	99.62
Monte Cristo	1.30	United Oil	.31
Palmer	.72	W. K. Oil	2.55

MINING STOCK QUOTATIONS—NEW YORK.

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. Jan. 25.		Closing Prices. Jan. 25.
Amalgamated Copper	$ 64	La Rose	$ 3⅜
A. S. & R. Co.	71⅜	Mason Valley	11¼
Braden Copper	5½	Miami Copper	24
B. C. Copper Co.	4½	Mines Co. of America	3¼
Butte Coalition	22½	Nevada Con	19
Chino	26⅜	Nevada Utah	⅛
Davis Daly	⅝	Nipissing	6¾
Doble	⅝	Ohio Copper	¾
Dolores	4	Ray Central	1⅜
First National	2⅜	Ray Con	17⅛
Foley O'Brien	¼	South Utah	⅜
Giroux	4½	Superior & Pittsburg	18
Goldfield Con.	4½	Tenn. Copper	37⅛
Greene-Cananea	8½	Trinity	6½
Guanajuato Con.	⅜	Tuolumne Copper	3⅛
Hollinger	14	United Copper	1½
Inspiration	10⅛	Utah Copper	55½
Kerr Lake	2¾	Yukon Gold	3⅛

World's Pig Iron Production

The world's pig iron production now amounts to more than 60,000,000 tons, as shown by the figures below, the estimates for 1911 being from the New York *Journal of Commerce*.

	1909.	1910.	1911.
United States	13,789,242	27,303,567	22,800,000
Germany	8,881,373	14,793,325	15,000,000
Great Britain	8,959,691	10,216,745	9,800,000
France	2,660,966	4,032,459	3,800,000
Russia	2,889,789	2,956,000	2,850,000
Belgium	1,001,872	1,803,500	1,700,000
Austria-Hungary	1,472,695	1,990,684	1,800,000
Sweden	518,263	604,300	600,000
Canada	86,090	740,210	750,000
Spain	289,315	425,000	400,000
Italy	15,619	343,600	340,000
Japan	54,299	162,000	160,000
Other countries	100,000	241,420	250,000
Total	40,228,214	65,711,355	60,250,000

Pig Iron Consumption

	Tons.	Tons.
U. S. stock January 1911	2,100,000	
U. S. production, 1911	22,800,000	
U. S. imports, 1911	151,200	
Total supply available		25,051,200
Exports, 1911	120,000	
Stock estimate January 1912	1,800,000	
Total withdrawn from supply		1,920,000
Apparent consumption		23,131,300

Joplin Prices and Production

The highest and average prices per ton for zinc and lead ores in the Missouri-Kansas district during the past 12 years are summarized as below by the *Joplin News Herald:*

	Zinc.		Lead.	
	High.	Average.	High.	Average.
1911	$54.50	$39.03	$64.00	$57.42
1910	52.00	40.18	58.00	52.57
1909	55.00	40.47	60.00	54.78
1908	47.00	34.40	66.00	55.03
1907	53.50	43.68	88.50	68.90
1906	54.00	43.30	87.00	77.78
1905	60.00	44.88	80.00	62.12
1904	53.00	35.92	62.00	54.80
1903	42.00	33.72	60.50	54.12
1902	42.00	30.33	50.00	46.10
1901	34.00	24.21	47.50	45.99
1900	38.50	26.50	56.50	48.82

The output of the Missouri-Kansas zinc and lead district for the past 14 years is summarized as below:

	Zinc Ore		Lead Ore		Combined
Year.	Tons.	Value.	Tons.	Value.	Value.
1911	266,377	$10,398,947	46,244	$2,656,565	$13,055,512
1910	296,976	11,926,782	44,419	2,335,422	14,262,204
1909	301,206	12,192,770	44,186	2,420,878	14,613,648
1908	259,598	8,917,073	39,119	2,152,896	11,069,969
1907	286,587	12,521,522	42,034	2,898,405	15,419,927
1906	278,929	12,079,602	39,188	3,049,573	15,129,175
1905	252,435	11,334,320	31,679	1,968,480	13,302,800
1904	267,240	9,601,200	34,362	1,886,150	11,487,350
1903	234,873	7,920,520	28,656	1,550,870	9,471,390
1902	262,545	7,973,770	31,625	1,457,120	9,430,890
1901	258,306	6,353,950	35,177	1,617,700	7,911,650
1900	248,446	6,584,290	29,132	1,407,810	7,992,206
1899	255,088	9,590,456	23,888	1,272,008	10,862,464
1898	234,423	6,319,867	26,791	851,947	7,171,814

Lake Superior Copper

The production of the Calumet & Hecla and its eight subsidiary companies, for 1911, is given as follows by the *Boston News Bureau*, in pounds of fine copper:

	1911.	1910.
Calumet & Hecla	75,145,027	72,968,545
Osceola	18,258,245	19,446,566
Ahmeek	15,147,365	11,844,954
Tamarack	7,470,545	11,066,606
Isle Royale	7,307,734	7,367,399
Allouez	4,899,025	4,055,702
Superior	3,276,731	3,181,041
Centennial	1,528,440	1,572,566
La Salle	284,007	640,410
Total	133,317,119	131,931,789

Cobalt Dividends

Dividends paid by the principal companies operating in the Cobalt district during 1911 were as follows:

Mine.	%	Amount.
Beaver	8½	$170,000
Buffalo	42	420,000
Coniagas	36	1,440,000
Crown Reserve	70	1,238,162
Kerr Lake	33	990,000
La Rose	8	600,000
McKinley-Darragh	50	1,123,666
Nipissing	30	1,800,000
Right-of-Way	4	59,942
Temiskaming	9	225,000
Temiskaming & Hudson Bay	1800	139,698
Trethewey	20	189,090
Wettlaufer	15	225,000
Total for year		8,620,558

Iron and Steel, Ore and Coke Output

Figures for the iron and steel trade of 1910 and 1911 are given below.

	1910.	1911.
Ore, Lake Superior	43,442,397	32,930,441
Ore, all sections	56,889,734	46,000,000
Pig iron and alloys	27,303,567	22,800,000
Coke, Connellsville	18,689,722	16,000,000
Coke, all sections	41,708,810	36,000,000
Steel ingots and castings	26,094,919	21,000,000
Rails	3,636,031	3,000,000
Plates	2,807,728	2,600,000
Sheets	1,435,619	1,300,000
Wire rods	2,241,830	2,200,000
Structural shapes	2,266,890	2,100,000
Fabricated steel shapes	1,196,000	1,291,000
Merchant bars, iron and steel	3,785,731	3,600,000
Tin and terne plates	722,700	700,000
Wire nails and spikes, kegs	12,704,902	12,000,000

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

MARKING BOUNDARIES OF MINING CLAIM—CONFLICTING LOCATIONS

Where stakes were set to mark the boundaries of a mining claim and the proper notice posted, this is a sufficient marking upon the ground, although the corner stakes were not inscribed with the name of the claim. And the fact that a mining claim which has gone to final entry without adverse claim includes the original discovery on which a prior claim was based, does not necessarily defeat the right of the prior locator to the remainder of his claim, if other veins have been discovered on such portion and it is shown that there was no actual intent to abandon the claim.

Bingham Amalgamated Copper Co. *v.* Ute Copper Co., 181 Federal, 748.

CONSTRUCTION OF LEASE OF COAL MINE

A lease conveyed to the lessee all the coal under a tract of land with the exclusive right to mine and remove the same for a period of twenty years, with the right to erect any underground entries, railroads, etc., necessary to mine and remove the coal from "said land," with the right to remove all fixtures when further mining became unprofitable; it also permitted the lessee to remove coal mined from adjoining land not embraced in the lease through the shaft located on the leased premises, upon paying a specified royalty for all coal so removed. The lease also granted to the lessee the use of five acres of the surface upon which to sink a shaft, erect buildings, railroads, etc., and contained a provision to the effect that if before the expiration of the lease the coal in the leased premises were exhausted the lessee could use said five acres so occupied to mine coal from adjoining lands upon the payment of a certain sum per acre. In an action to enjoin the lessee from using entries under the lands of the lessor to mine coal from other lands through a shaft not on plaintiff's land, the court held that under the terms of the lease, on the principle that the expression of one thing in a contract was the exclusion of all others, the lessee could not use entries under the lands of the lessor to mine coal from other land through a shaft not on the lessor's land.

Thomas Beck & Sons *v.* Economy Coal Co., (Iowa) 127 Northwestern, 1109. October 1910.

LEASE OF COAL LANDS TO INDIANS—REGULATIONS OF SECRETARY OF INTERIOR

The United States statute provides that the coal lands of the Choctaw and Chickasaw tribes of Indians should be under the control and supervision of two trustees, who should perform their duties under the rules as prescribed by the Secretary of Interior. It also provides that each lease should include 960 acres and be for a term of thirty years, and that the royalty should be paid on all coal produced by the lessees at the rate of 15 cents per ton, and gave the Secretary power to reduce or advance such royalty when it was to the best interests of the Indians, and required an annual payment in advance of $100 for each of the first two years, $200 for the third and fourth year, and $500 for the fifth and each following year, to be treated as advance royalty and credited on royalty when any mine was developed and worked. On failure to make such payment for 60 days, any lease should be null and void, and all payments made should be the property of the Indians. Under this statute the Secretary of the Interior has no power to require lessees of such mines to mine on each lease 3000 tons the first year, 4000 tons the second, 7000 tons the third, 8000 tons the fourth, and 15,000 tons the fifth and each succeeding year, or pay the royalty on such quantity if not mined, and also prescribe that a failure to do so would forfeit the lease.

United States for the use of Choctaw and Chickasaw Nations *v.* McMurray. 181 Federal, 723.

Recent Publications

RAPPORT DES OPERATIONS MINIERES DANS LA PROVINCE DE QUEBEC DURANT L'ANNEE, 1910. Pp. 109. Ill., inserts. Quebec, 1911.

ALUNITE, NEAR MARYSVALE, UTAH. By B. S. Butler and H. S. Gale. Bull. 511, U. S. Geol. Survey. 64 pp. Washington, D. C., 1912.

THE STONE INDUSTRY IN 1910. By Ernest F. Burchard. Advance chapter from 'Mineral Resources of the United States, 1910.' Pp. 42. Washington, D. C., 1911.

OCCURRENCE OF POTASH SALTS IN THE BITTERNS OF THE EASTERN UNITED STATES. By W. C. Phalen. Bull. 530-B, U. S. Geol. Survey. 19 pp. Washington, D. C., 1911.

THE PRODUCTION OF MAGNESITE IN 1910. By Charles G. Yale. Advance chapter from 'Mineral Resources of the United States, 1910.' Pp. 6. Washington, D. C., 1911.

THE PRODUCTION OF PETROLEUM IN 1910. By David T. Day. Advance chapter from 'Mineral Resources of the United States, 1910.' Pp. 136. Washington, D. C., 1911.

WATER RESOURCES OF ANTELOPE VALLEY, CALIFORNIA. By Harry R. Johnson. U. S. Geological Survey, Water-Supply Paper 278. Pp. 92. Ill., inserts, index. Washington, D. C., 1911.

THE PRODUCTION OF PLATINUM AND ALLIED METALS IN 1910. By Waldemar Lindgren. Advance chapter from 'Mineral Resources of the United States, 1910.' Pp. 10. Washington, D. C., 1911.

PRELIMINARY REPORT ON THE ROAD MATERIALS AND ROAD CONDITIONS OF OKLAHOMA. By L. C. Snider. Oklahoma Geological Survey, Bull. No. 8. Pp. 191. Ill., insert maps. Norman, Oklahoma, August 1911.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1909. Part XI.—CALIFORNIA. By W. B. Clapp and F. F. Henshaw. U. S. Geological Survey. Water-Supply Paper 271. Pp. 256. Ill., index. Washington, D. C., 1911.

CONTRIBUTIONS TO ECONOMIC GEOLOGY, 1910. By C. W. Hayes and W. Lindgren. Bull. 470, U. S. Geol. Survey. 558 pp.; ill. Washington, D. C., 1911. Many of the papers that make up this useful volume have already appeared in the form of separates.

MINING LAWS OF AUSTRALIA AND NEW ZEALAND. By A. C. Veatch. Bull. 505, U. S. Geol. Survey. 180 pp. Washington, D. C., 1911. This is a reprint of a report originally published as a part of the proceedings of a joint committee of Congress to investigate the Department of the Interior and the Bureau of Forestry. It is now reprinted in more convenient form for the benefit of mining men, at the instance of W. L. Fisher, Secretary of the Interior.

The following advance chapters from the 'Mineral Resources of the United States for 1910' have recently been received:

'Production of Antimony, Arsenic, Bismuth, and Selenium in 1910', F. L. Hess, 10 pp.; 'Production of Tungsten, Nickel, Cobalt, Vanadium, Titanium, Molybdenum, Uranium, Tantalum, and Tin in 1910', F. L. Hess, 35 pp.; 'Production of Copper in 1910', B. S. Butler, 70 pp., map; 'Production of Gold and Silver in 1910', H. D. McCaskey, 39 pp.; 'Mine Production, Gold, Silver, Copper, Lead, and Zinc, in the Western States and Territories in 1910', A. H. Brooks, C. N. Gerry, V. C. Heikes, C. W. Henderson, H. D. McCaskey, and C. G. Yale, 308 pp.

Bristol's Ink-Type Recording Instrument

An illustrated description of Bristol's patented semi-transparent smoked-chart recorder has been previously published, and although these recorders are fundamentally simple in their construction and hundreds are in daily service, there has been a call for a recorder in which the record is made with ink. To meet the demands for a frictionless ink type of recording instrument to parallel the smoked-chart as near as possible in fundamental simplicity and to accurately record fractions of milli-volts, and adapted for use as a recording electric pyrometer, the instrument illustrated herewith has been developed and placed upon

FIG. 1.

the market by The Bristol Company of Waterbury, Conn., and is described by the company as below.

These instruments are the result of several years of study and experience with an original Bristol patented design of a frictionless ink recorder using a hinged electrical move-

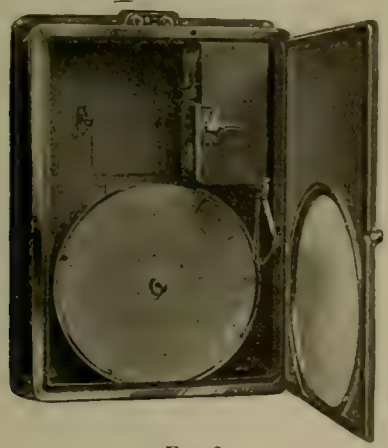
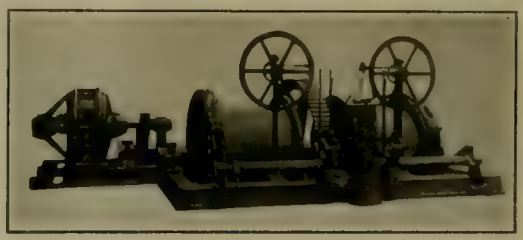


FIG. 2.

ment carrying a retaining receptacle for marking-fluid which extends over the path of the recording tip and is provided with means for periodically making contact with the source of marking-fluid and the chart. Fig. 1 is an interior view showing the galvanometer movement case hinged to the back of the instrument and carrying the inking pad in front of the recording arm. Fig. 2 shows the sensitive electrical movement swung to one side for convenience in removing the record and inserting a fresh chart. A capillary gold tube, open at both ends, is carried at the end of the recording arm at right angles to the surface of the chart. The inking pad is suspended from the case of the electrical movement and is curved to correspond with the arc covered by the motion of the end of the recording arm. When the movement is swung back into its operating position as shown in Fig. 1, the recording arm can swing free, accommodating itself to the position corresponding to the delicate current which is to be measured. The clock which revolves the chart at the desired speed also automatically presses the inking pad toward the chart every ten seconds, bringing one end of the capillary tube into contact with the chart and the opposite end simultaneously into contact with the inking pad. A fine dot of ink is left on the chart and the capillary tube is replenished with ink from the pad. The recording tube thus carries a constant supply of ink, and its perfect balance, which is very important, is always maintained. The electrical movements used in these recorders are made especially for the purpose by the Weston Electrical Instrument Co. The instruments have been thoroughly tested in practical service for more than two years past. Although the most important applications of these recording instruments have been for pyrometers, they have also been used for electrolytic research, recording voltmeters, and recording shunt ammeters.

Nevada-Douglas Electric Hoist

An interesting type of double-drum electric hoist was built for the Nevada-Douglas Copper Co., at Mason Valley, Nevada, by the Wellman-Seaver-Morgan Co., and is illustrated in the accompanying figure. This hoist consists of two drums of 60-in. diameter with 42-in. faces. They are built with steel-plate shells, each drum running loose



GENERAL ELECTRIC HOIST OF NEVADA-DOUGLAS COPPER CO.

on the main drum shaft and being fitted with taper bronze bushings, and each having band friction-clutches and powerful band brakes. The hoist is therefore, adapted to operation either in balance or independently, as desired. Each drum has a capacity for winding 1200 ft. of 1-in. rope in two layers. The load handled amounts to 9800 lb., including skip and rope. The skip runs on a 45° incline at a speed of 400 ft. per minute. Each drum is equipped with large dial indicators for showing the position of the skip in the shaft.

As will be observed, the drums are mounted low in the frames, so that all tendency toward variation and consequent noise is eliminated. The hoist is fitted with machine-cut gears throughout, with pinions of steel, and the motor is a General Electric motor of the I. T. C. 16-pole type, of 225 hp., wound for 2080 volts, 60 cycles, 3-phase. It runs at a speed of 430 r.p.m. The motor and hoist are securely mounted on one bed plate, the entire hoist being especially planned for severe continuous duty.

Engineering Data

One of the most interesting developments that has come about with our modern system of great industrial manufacturing combinations and immense and specialized factories, has been the production of pamphlets, bulletins, and other publications dealing with the technical applications and aspects of the company's products. A considerable amount of thought has been devoted to the preparation and distribution of this matter. Series of bulletins are arranged which cover the use of a certain mechanical unit in the different fields. Results of authenticated tests, curves, and tabulated figures are given, so that the engineer in utilizing the material may know what to expect under actual

working conditions, aside from any selection from the lists of sizes or capacities that his judgment may indicate.

It was at first undoubtedly true that these bulletins, which must not in any way be confused with house organs or publications composed mainly of interesting or self-interest reading matter, contained material that was more advertising and laudatory in its nature than replete with concise technical information. It soon became evident, however, that the engineer desired definite, concrete statistics concerning the materials and products with which he was dealing. The bulletins accordingly came to comprise more and more such specialized literature, until today they constitute a genuine contribution to the found of knowledge of the world. The very desire on the part of the manufacturer to be able to place gratuitously at the call of actual or potential customers all available data, caused him to undertake many investigations along lines that might otherwise have been neglected or undeveloped. These researches have been conducted on a scale impossible for the individual or even the engineering schools, because of the lack of funds or time necessary. That the reasons for such endeavor are in the main selfish is undoubtedly true, but there is, nevertheless, thereby accumulated a vast amount of informing matter, and the data is usually backed by the willingness of the makers to have their engineers and experts coöperate personally and fully with the staff of the purchaser concerning any questions which may arise.

For some time the Hyatt Roller Bearing Co. has made a practice of issuing bulletins covering in detail the ratings and capacities, indicated uses, and actual application of its flexible roller bearings. Separate issues cover the different types, such as the 'Long Series' for machine tools and similar work, the 'Short Series' for automobile service, those employed in standard shafting boxes, and those for special work in cars used in the transportation of passengers, freight, and mine products. Forms for the entry of questions or specifications are also provided and, with the carefully arranged tables in the bulletins, make it easy to procure the proper bearing for the particular instance. These bulletins are at the call of any interested, and form a collection of special information worthy of a place in any engineer's office.

Sintering Fine Ore

By George W. Maynard.

At the Wilkes Barre meeting of the American Institute of Mining Engineers, June 1911, James Gayley presented a paper entitled 'The Sintering of Fine Iron-Bearing Materials,' in which he made the following statement: "There are vast deposits of magnetic iron ores in the United States and Canada that are too low in iron for use at the present time, but which can be economically concentrated into very rich material; in many cases the fineness of crushing necessary to secure proper concentration has prevented their use except in extremely limited quantities. The reclamation of these orebodies will add tremendously to ore reserves of the United States, and this can best be done by a simple and efficient method of sintering."

The magnetite deposits in the Eastern States have their largest development in New Jersey and the Adirondacks in New York. In the New Jersey Geological Survey for 1911, the number of magnetite mines and deposits is stated to be 366, of which a relatively small percentage produces ore of high enough grade for the blast-furnace without close sorting. In the Adirondack and Lake Champlain districts there are large deposits which have been worked for many years and are still important producers of ore of high enough grade for shipment without close sorting, but the number of low-grade deposits is in excess. The occurrence of apatite, lime phosphate, formerly an unwelcome constituent in some of the large deposits, has now become a source of profit through the adoption of magnetite separation and concentration so successfully carried on at the mines of Witherbee, Sherman & Co., near Port Henry.

Granular ore in the blast-furnace is objectionable, resulting in an abnormal production of flue-dust, irregular working, and a heavy loss. Of the many devices for utilizing high-grade concentrate the Dwight-Lloyd system has been found the best, as to cost, capacity of plant, and the resultant product. The process is essentially automatic and continuous, the output depending upon the regularity of feed, which in the case of magnetite will average about 100 tons per day for each machine. The working costs are embraced in power, fuel intermixed with the ore, labor, repairs, and royalty. The resultant product is a sintered cellular mass presenting an exceptionally large surface to the ignited blast-furnace gases and an increased output over compact lump ore. The results obtained in the treatment of blast-furnace flue-dust have been eminently satisfactory and have been most favorably commended by a committee from the Steel Corporation. Tests have been carried on for several weeks at the American Ore Reclamation Co.'s works at Birdsboro, Pennsylvania.

The size of the grains of ore will depend upon the mesh necessary for the separation of the gangue in the magnetic concentration. About ten barrels of ordinary capacity will usually be sufficient for a test. Apart from the freight charges the tests will be made without cost to parties intending to investigate the process. The Reclamation company will erect plants at the actual cost of erection, and will furnish working drawings. Payment will be based on a tonnage royalty during the life of the patents. Copies of Mr. Gayley's description of the process and plant will be furnished on request, together with the details of cost of plant and the royalty rates. The Birdsboro plant is open for inspection to those who wish to see the working of the machine or who may wish to have sample lots tested. Samples of sintered ore and flue-dust may be inspected at room 1908, 71 Broadway, or 20 Nassau street, New York City.

Commercial Paragraphs

The Calumet & Hecla is installing 32 of the largest sized Hardinge mills as one unit in its new re-grinding plant which is being built to utilize tailing. This installation has been made after two years of competitive trials of several Hardinge conical mills with other fine-grinding devices in the different plants of the company. The Porcupine Gold Mines Co., Ltd., better known as the Vipond Co., of the Porcupine district of Canada, has placed an order for two Hardinge ball mills to be operated in tandem with two Hardinge sliming pebble mills for its amalgamating and cyaniding plant. The Hardinge Co. is also shipping a 4½-ft. ball mill to the Olla de Oro Mining Co., of Bolivia, which mill will be carried over a pass in the Andes at an elevation of 17,000 feet.

An announcement of interest is that of the absorption by the Pelton Water Wheel Co., of San Francisco and New York, of the entire rights, including patents, goodwill, and patterns, of the Doble water-wheel business formerly conducted by the Abner Doble Co., of San Francisco. W. A. Doble, former head of the Abner Doble Co., goes to the Pelton Water Wheel Co. as its chief engineer, vice George J. Henry, Jr., who until recently occupied that position. A particularly strong combination is thus formed, as these companies have for years been recognized as the pioneers in the development of hydro-electric engineering, and the merged experience of the two companies, together with patents now controlled by the Pelton Water Wheel Co., forms an organization with the best possible facilities to cope with any problems in the field of hydraulic engineering. In addition to Pelton and Doble tangential water-wheels, the Pelton Water Wheel Co. manufactures the Pelton-Francis turbine, adapted for medium heads and large powers, besides a line of high-grade centrifugal pumps. Pelton oil pressure governors are also a feature of this company's product. The Atlantic department of the company, with offices in New York City, has recently completed large and well equipped machine shops in Harrisburg, Pennsylvania, the two points of manufacture thus facilitating deliveries to all parts of the world.

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EDITORIAL

TORONTO, in place of Ottawa as first planned, will be the place of meeting of the Canadian Mining Institute, March 6, 7, and 8. Headquarters will be at the King Edward hotel.

BY ERROR in phrasing, our Mexican correspondent was made to say, in our review number, that the Amparo Mining Company continued to pay dividends at the rate of 3 per cent. The fact is that this is the rate per quarter, making the annual rate 12 per cent.

SALE of promoter's shares on a market made for treasury shares, is said to have been one of the causes of trouble at Austin, Nevada, where the Austin Manhattan Consolidated Mining Company is now in the hands of a receiver. This has been one of the most common means adopted for robbing the public and has contributed greatly to the general impression that a buyer of mining shares in the United States is inevitably a gambler.

GEOCHEMISTRY and geophysics fortunately are now attracting much attention. It is well that the border lines between the fundamental sciences be cultivated and knowledge carried from one field into another often proves surprisingly fruitful. As indicative of the demand for exact data in one of these fields, it is interesting to note that a second edition of 'The Data of Geochemistry,' first published in 1908 by Mr. F. W. Clarke, the chief chemist of the United States Geological Survey, has already been found necessary. The new edition of this extremely serviceable book contains much that is new and interesting.

A RECENT meeting of the Le Conte Geological Club, at Leland Stanford, Jr., University, was made the occasion for the transfer to Mr. N. F. Drake, now professor of economic geology in that institution and until recently professor of geology in the Imperial Pei Yang University, of the Order of the Double Dragon, of the third class, conferred on him by the Chinese Government in recognition of his signal service in the cause of education in the Flowery Kingdom. Americans have taken a prominent part in the educational development of the Orient, and the honor thus conferred is a pleasing recognition of disinterested service.

POSTAL FACILITIES between the United States and foreign countries are shrouded in mystery for many otherwise well informed citizens. Most people are aware that letters may be sent to England for 2 cents, but comparatively few know that the same rate applies to Germany, provided the mail goes forward on the German mail steamers. Shanghai, China, also enjoys the same rate, as a United States post-office is maintained in the foreign concession there. Enclosing return postage is often an effective means of eliciting a reply, and it should be more generally known that this can be done in the case of foreign countries by means of a coupon, purchasable at the larger post-offices, which is exchangeable for its face value in stamps in many countries of the Universal Postal Union.

GRUBSTAKING prospectors is proving popular, and, following the lead of Denver, commercial bodies in South Dakota are interesting themselves in a proposal to raise $20,000 for that purpose. The Los Angeles Chamber of Mines and Oil has, however, decided against the proposal, taking the view that "to undertake a commercial enterprise of the kind would destroy the Chamber's prestige as a purely civic organization, and would bring it into direct competition with other development companies." The Chamber has made arrangements to file, for a small fee, descriptions and terms of sale of prospects where they may be accessible to anyone interested, but without assuming any responsibility for the accuracy of the description.

COST of living is a topic of never-ending interest in recent years, and the explanations advanced to account for its enormous increase in recent years are numerous and varied. One can be found in our national debt-habit, and it is interesting to note in this connection that the municipal debt of New York city now reaches $1,057,811,000, or a sum $20,000,000 greater than the national debt. This corresponds to a per capita debt of $218, and 28% of the yearly revenue of the metropolis is required to meet the interest charges. Within five years the debt has nearly doubled, the tax rate has increased 60%, and the credit of the city has altered from better than 3% to worse than 4%. The cost of high living is an important factor in the high cost of living.

PROXIES have been sent to members of the American Institute of Mining Engineers so that those unable to attend the annual session may still register their wishes in regard to matters coming before the meeting. While the form sent out was apparently intended to cover only votes on the amendments now before the Institute, it will allow the holder of the proxy to vote as well on other matters. Since the election of officers is quite as important as any other matter, it would be well to wait until nominations are announced, as required by the constitution, two weeks before the meeting, in order that preferences in regard to officers may also be indicated. We are glad to note that a special effort is being made to secure a large attendance at the annual meeting. A circular letter signed by a large number of the most influential members of the Institute calls attention to the desirability of having as many as possible present in person, and announces that local committees have been formed in New York to arrange for a suitable program and other matters. Let every engineer who can do so, arrange to attend.

Juvenile Waters and Hypotheses

It is commonly said that criticism is easy, but an examination of criticisms would often tend to prove the contrary. Sainte-Beuve wrote reviews of contemporary publications that, as contributions to literature, were often superior to their objects. But present day book-reviewing, from the pressure of the flood of volumes to which each year gives birth, has tended toward a semi-mechanical formalism; the reviewer, after mentioning the title and the author, too often indulges in a few generalizations, commends the excellent illustrations (or some other feature), calls attention to a few typographical errors in order to show that he is both critical and impartial, and the book is reviewed! The review by Mr. A. C. Lawson, given elsewhere in this issue, is so agreeable a contrast to the ordinary one that our readers will peruse it with as much interest as they accord the volume reviewed; it furnishes the dash of tabasco which serves to enhance the dish.

The evolution of geological concepts, conforming with a recent view of the evolution of living forms, appears to be marked by periods of increasing tendency toward variation, succeeded by periods of mutation itself. This is no less true of the conceptions of the origin of ore deposits, and geologists who do not regard themselves as being of advanced age can remember more than one swing of the pendulum of geological public opinion, as under the influence of some vigorous thinker new evidence or new methods of study have been brought to the fore, and, be it said, often over-emphasized. But this latter phase of the matter need not occasion great alarm. There is a story of Kipling's which makes an instructive comparison between a young man in the colonies, and a puppy which gnaws bones, boots, and cakes of soap with undiscriminating zeal. Though annoying at the moment the permanent result is not serious, and this may be also postulated of the younger disciples of a school of thought. Their application of a new hypothesis, like a new jack-knife, to every portion of the edifice of knowledge is not likely to result in serious damage.

It is clear, of course, that indiscriminate use of hypotheses, as well as of jack-knives, should not receive encouragement, and Mr. Lawson will find many readers sympathetic with his protest against too ready application of the hypothesis of the influence of igneous emanations in the formation of orebodies. On the other hand, it is not necessary to banish jack-knives because of the damage which can be done with them, nor it is likely that lasting benefit will accrue from the reading of a hypothesis out of the scientific communion with bell, book, and candle because of its too hasty application to diverse problems. Placing a square peg in a round hole is not profitable, but square holes are known to occur. Geology, in its early stages so largely speculative, has now resolved itself into a study of tangible phenomena—forces and their results. This being true, it is but natural that some tendency should be exhibited to deny the value of speculations when applied to cases where direct study is not possible, even though based upon well known phenomena in other fields of study, and that geologists should be slow to accept the aid of collateral evidence derived from the study of alloys, mattes, and slags, and from the astonishing advances made in our knowledge of physical chemistry within the past two decades is perhaps not remarkable.

The stricture that the doctrine of the origin of ore deposits by magmatic waters does not explain their absence along the majority of contacts may be met by defenders of the doctrine with the *tu quoque*. Why does not every fissure contain an orebody? Why does not every quartz vein, whatever its origin, contain gold? If we apply this acid test all theories are likely to be dissolved. Purely thermal metamorphism would indeed be of importance, if there were any indisputable evidence that it frequently, or ever, occurred. The available evidence of the influence of water vapor in so desiccated a process as ordinary smelting may well give rise to doubt of the possibility of thermal metamorphism in rocks containing moisture which are intruded by magmas that abundantly exhibit evidence of frequently containing large quantities of gases, among them water vapor, in solution. Finally, the puzzling problems which arise in the study of the solidification of so simple a magma, if we may so term it, as an alloy of copper and tin, involving as it does the decomposition of compounds formed at higher temperatures, reactions between solid phases, and molecular migrations, should conduce to patience with the inability of the magmatic geologist to ade-

quately explain all phenomena. Much profit has been derived from the recognition of the important part which igneous emanations have played in the formation of veins. A single hypothesis explaining the origin of all orebodies would be convenient, just as a carpenter might find it convenient to saw, plane, and drive nails with a single tool. But a variety, adapted to a variety of uses, leads to better results, and while vigorous protest against indiscriminating application of any hypothesis may be applauded, juvenile waters as well as juvenile enthusiasms merit patient consideration.

The Goldfield Report

Unusual interest attaches to the annual report of the Goldfield Consolidated Mines Company, since that fortunate corporation owns the greatest gold mine in the world, from the point of view of present production. We printed, January 20, through the courtesy of the mill superintendent, Mr. J. W. Hutchinson, full details of operating costs in the mill, and early last year Mr. Hutchinson allowed us to spread before his professional associates the intimate facts relating to the construction of the great plant under his charge. This week we reproduce, practically in full, the annual report of the company for the fiscal year ended October 31, 1911. It is an excellent report and tells a cheerful tale of a prosperous year. Mr. J. F. Thorn, the superintendent, is to be congratulated upon continued reduction of operating costs and the generally satisfactory condition obtaining. If the stock is selling for less money than a year ago, it is to be remembered that division of capital cannot be indefinitely continued. Little exploration of the deeper levels has been undertaken within the year and the new ore developed was mainly in continuation of known ore-shoots. Mr. Thorn finds, as did Mr. J. H. Mackenzie and Mr. J. R. Finlay before him, that accurate estimates of ore reserves in such a property as the Goldfield, are difficult to make and of uncertain value. Speaking in general terms, he estimates a reserve of 600,000 tons, enough to keep the mill running for two years. No attempt is made to fix the value of this ore, though it is frankly stated that the present grade, $32.55 per ton, probably cannot be maintained. It is hoped to offset this in part by increasing the capacity of the plant. Mr. Thorn's estimate is not put forward as being based upon exact measurements of blocked ore, and is in effect but the personal judgment of a capable and conscientious engineer thoroughly familiar with the property. Presumably it has the approval of the consulting engineer, Mr. J. H. Mackenzie, though no statement to that effect is made in the report. This is to be regretted, since when so little exact data is available it is well to have confirmation of even the best judgment. We sympathize with Mr. Thorn in his disinclination to attempt blocking and estimating an ore reserve in the Goldfield ground. The advisability of undertaking extensive development, under such conditions as obtain at Goldfield, is a matter concerning which engineers differ. The policy pursued saves money to the company now, but invites unfavorable comment when, in the future, the inevitable pinch for ore comes. Mr. Thorn has done well to be frank about the matter. The public evidently accepts his judgment, since the present price of shares is about that called for by two years continuation of the present regular and extra dividends, followed by division of the surplus. The mine may prove to be worth much more than this, we sincerely hope it may, but if the orebody is of such a type and the conditions of working such as not to permit estimates of ore reserves other than as indicated, the present value of the shares is properly low, regardless of what the future may hold for them. The Goldfield is a great mine and many excellent things are being done at the property; one of the best features of the management is the frankness with which unfavorable as well as favorable matters are discussed with the stockholders.

The Mascot Copper Company

Some two and a half years ago, August 21, 1909, we expressed editorially our opinion of the Mascot Copper Company. In response to numerous requests for information we regret to say that nothing made public since has caused us to change the unfavorable opinion then expressed, nor have we any increased confidence in the probability of a favorable outcome as regards the small investor. Despite the elaborate banquets given the stockholders, the souvenir blocks of copper distributed, the display of specimens, the energetic house to house canvass to sell shares, and the publication of letters from mayors, bankers, and ex-governors, we remain unconvinced as to the large value of either the property or the shares in the company. There is undoubtedly some ore in the mine, but how much is the question. It is equally a question how much benefit a minor stockholder is to derive from the sale of the ore. Current rumor among engineers is to the effect that development in depth has proved disappointing. How well founded this is we are not prepared to say; the point is that no one qualified to do so has made a statement. What is needed is a thorough report upon the property and the company by a disinterested and competent engineer. No recent report has been published, and the old ones, dated variously in 1907, 1909, or not dated at all, are lacking in the definite statements of facts and cogent reasoning that are demanded by the situation. The material published by the Mascot Copper Company is mere twaddle, and in no sense the sort of data rightfully expected and furnished, for example, in Mr. Pope Yeatman's report on the properties of the Braden Copper Company. Mascot stock is being sold by the methods usually adopted by irresponsible and fraudulent concerns, and its sponsors can not well object if therefore they must face the same suspicion that properly greets a fakir. The matter would hardly be worth comment except for the fact that the officers and directors of the company include, along with some men of more than doubtful reputation, others of the highest standing. They are men from whom the public naturally expects better things. It is reported that sales of stock to par value of more than $2,000,000 have been made. Much of the money devoted to the enterprise has been supplied because of public confidence in these leaders. They owe it to themselves and to the public to make assurance doubly sure; to meet all questionings with frank, full statements of fact. What the public wants to know, and what in our judgment it has a right to know, is:

1. On the word of a competent and known engineer, after thorough examination, not a mere visit, what are the ore reserves of the property, both as to quantity and grade, and what are the probabilities, if any, of additional reserves being developed?

2. What steps have been taken to determine the proper means of treatment of the ore?

3. What is the financial position of the company, and what will be the distribution of profits, if any, between buyers of the stock now being peddled about, and the promoters?

Until satisfactory answers to these questions are made, we shall continue to recommend that investors let Mascot Copper stock severely alone.

Report of the Goldfield Consolidated Mines Company

The fiscal year which ended October 31, 1911, was the company's banner year at this great Nevada gold mine, according to the president, George Wingfield, in his annual report, not only with respect to tonnage handled and amount of earnings, but to ease of operation combined with freedom from adverse circumstances. The property has produced within the year 330,549 tons of ore of an average value of $32.55 per ton, or $10,760,199. Metallurgical losses of $1.81 per ton, or $597,071, leave a net realization from the year's production of $10,163,127, or $30.74 per ton.

The gross expenses of the company, including mining, milling, transportation, general, taxation local, state and federal, and all construction, have amounted to $2,636,281, leaving a net operating profit of $7,526,846, an increase of $179,154 over the previous year, notwithstanding the fact that the gross returns this year were $110,806 less than last year.

PRODUCTION AND EXPENSES, YEAR ENDED OCTOBER 30, 1911

PRODUCTION

		Total Value.	Aver. Per Ton
330,062	Tons Milled	$10,586,936.42	$ 32.08
487	Tons Shipped	173,262.18	355.77
330,549	Total Production	$10,760,198.60	$ 32.55
	Loss in Tailings	597,071.14	1.81
	Values Realized	$10,163,127.46	$ 30.74

EXPENSES

Mining:	Total.	Aver. Pr. Ton.		
Stoping	$758,472.33	$2.29		
Development	350,985.62	1.06		
		$1,109,457.95		$3.35
Transportation		30,628.70		.09
Milling		626,293.90		1.89
Concentrate Treatment		124,315.70		38
Marketing Concentrate Residues and By-Products		244,583.94		74
Marketing Bullion		49,141.23		.15
Marketing Ore Shipped		17,103.92		05
General Expenses, including Office, Legal, Corporation and Administration Expenses		181,334.80		55
Bullion Tax		126,319.26		.38
Income Tax		27,001.19		08
Total Operating Expenses		$2,536,180.59		$7.66
Miscellaneous Earnings		37,730.30		11
Net Operating Expenses			$2,498,450.29	$ 7.55
Realization from Operations			$7,664,677.17	23.19
Construction			137,831.13	42
Net Realization from Operations			$7,526,846.04	$22.77

Net Realization from Operations is 69.95% of Total Production

PRODUCTION BY SHAFTS

	MILLING ORE.			SHIPPING ORE		
Shaft.	Tons.	Aver.	Value.	Tons.	Aver	Value
Combinat'n	55,878	$24.48	$ 1,367,783.37			
Mohawk	106,358	22 99	2,444,999.31			
Red Top*	55,948	25.74	1,440,069.35			
Jumbo**	111,878	47.68	5,334,084.39	487	$355.77	$173,262.18
Total	330,062	$32.08	$10,586,936.42	487	$355.77	$173,262.18

TOTAL.

	Tons.	Aver.	Value.
Combination	55,878	$24.48	$ 1,367,783.37
Mohawk	106,358	22.99	2,444,999.31
Red Top*	55,948	25.74	1,440,069.35
Jumbo**	112,365	49.01	5,507,346.57
Total	330,549	$32.55	$10,760,198.60

*Includes Laguna.
**Includes Jumbo No. 2.

With this less gross production in 1911, but with a greater tonnage handled by 65,682 tons than that in 1910, total costs have been reduced $3.07 per ton. Construction costs in 1910 were greater than in 1911, but an elimination of construction items for both years still shows a lower cost per ton for 1911 of $1.82. The reduction in general expenses alone shows a saving of 34c. per ton over 1910. Four dividends at 50c. per share each, or $2 per share, were paid during the year, aggregating $7,118,296. The company closes the year with a cash balance of $1,369,177, and with bullion and concentrate settlements outstanding of $451,306. The company has no debts.

Additional milling facilities are being provided at an approximate estimated cost of $70,000, whereby large economies are anticipated in the treatment of concentrate residues. This will narrow the output to bullion alone, all by-products being handled locally at maximum economy. Depreciation of plant and equipment has been written off to the extent of $147,195. Development work on the property during the year equaled 46,739 ft. The property holdings have been increased by the purchase of the Bullfrog Fraction at a cost of $13,000, the Jumbo Fraction at a cost of $2500, and a half interest in the Vinegerone Claim at a cost of $195,000. The company's policy of distributing net realizations as they accrue, to stockholders in dividends, and retaining a cash reserve of not less than $1,000,000, will be maintained.

Mine Report

The following statements by the general superintendent, J. F. Thorn, give details of production and expenses, figured on total tonnage, together with detailed cost on concentrate treatment figured on tons of concentrate only:

OPERATING COSTS

Mining—330,549 tons.	Cost per ton.	
Labor	$2.22	
Supplies	0.99	
Power	0.14	
Total		$3.35
Transportation—330,062 tons.		
Railroad operation	$0.06	
Railroad maintenance	0.03	
Total		$0.09
Milling—330,062 tons.		
Labor	$0.43	
Supplies	1.17	
Power	0.29	
Total		$1.89
Concentrate Treatment.		
Labor	$0.04	
Supplies	0.32	
Power	0.02	
Total		$0.38
Total Operating		$5.71

CONCENTRATE TREATMENT COSTS

Tons Treated—20,306.23.	Cost per ton.
Labor	$0.63
Supplies	5.09
Power	0.40
Total	$6.12

Operating Results.—The stoping cost for the year was $2.29 per ton of ore mined, and development cost was $1.06, making a total mining cost of $3.35 per ton. A total of 46,739 ft. of development work was performed at a cost of $7.51 per foot. The total cost of mining and milling, which includes concentrate treatment, was $5.62 per ton, or $0.66 per ton less than the previous year. The total operating costs, including construction, were $8.08 per ton, a decrease of $3.07 per ton as compared with cost of $11.15 for previous year. During this year the assay building, electrical building, storage-battery plant, and Laguna headframe, which were started prior to November 1, 1910, have been completed. Improvements at the mill have also been undertaken.

Combination.—In the Combination mine 6201 ft. of development work was performed during the year, which, together with the sill floors resulting therefrom, produced 2376 tons of ore worth $17.78 per ton, of a total value of

$42,244. The principal new orebody in this mine is the 136 stope, 140 ft. north of the shaft on the second level, which has produced 6877 tons, worth $88.64 per ton, or a total of $609,602. The indications are that this portion will also be very productive during the coming year.

Mohawk.—In this mine 14,717 ft. of development work was performed, which, together with the sill floors, produced 13,203 tons of ore worth $17.74 per ton, or a total of $234,194. Two important new orebodies were exposed during the year. The 260 on the 350-ft. level, about 360 ft. north of the shaft, which has produced 7836 tons of ore worth $306,397, and the 354 stope on the 450-ft. level, about 800 ft. north of the shaft, which has produced 24,566 tons of ore worth $707,153. The 354 orebody, up to the present time, has not been found on the 350-ft. level, and its existence at that height is undetermined. It has, however, been found on the 600-ft. level of the Clermont and in an intermediate drift between the 450 and 600-ft. levels, which assures the downward continuation to a depth of 600 ft. The downward extension of the 403 orebody, 600 ft. south of the shaft on the 330-ft. level of the Red Top, was also found on the 450-ft. level of the Mohawk. Aside from these large orebodies, several smaller and very productive orebodies have been found. Also, orebodies that were known to exist in some of the caved lease workings have been uncovered and have added materially to the production of the mine. There still remains in this mine a large area, partly developed, which will undoubtedly be very productive.

Clermont.—In the Clermont 14,511 ft. of development work has been performed, which, together with the sill floors, produced 9366 tons of ore worth $40.41 per ton, or a total of $378,489. Several good discoveries were made in this mine during the year, the most important being the westerly extension of the 408 orebody, about 600 ft. west of the shaft between the 600 and 750-ft. levels. This stope produced during the year 27,901 tons of ore worth $49.43 per ton, or a total value of $1,379,071. South and above the back of the famous 401 stope on the 750-ft. level, a very promising orebody has recently been uncovered, and the indications are that it is the upward extension of the 401 orebody, having been displaced by a fault. This orebody will probably connect with 407 and 449 stopes on the 600-ft. level of the Mohawk. The development work in this orebody has produced 1668 tons of $57.05 ore. The downward extension of the 354 stope on the 450-ft. level of the Mohawk has been located on the 600-ft. level of the Clermont, about 480 ft. northwest of the Clermont shaft, and has produced 6308 tons of ore worth $95,433. Below the 1000-ft. level practically all development was stopped because of interference with the sinking of the Grizzly Bear shaft, which is being sunk to the 1400-ft. level. As soon as this shaft reaches the 1400-ft. level, development work on the 1200-ft. level will be resumed; only a very small block of territory at this level has been prospected.

Red Top.—In the Red Top mine 4339 ft. of development work was performed during the year, which, together with the sill floors resulting therefrom, produced 6341 tons of ore worth $15.05 per ton, or a total of $95,486. The downward extension of the Red Top vein is being worked from the lower levels of the Mohawk, the 600-ft. level of the Clermont, and the 450 and 600-ft. levels of the Laguna; therefore no new ore has been credited to this mine below the 330-ft. level. The orebodies on the upper levels, however, have been considerably extended, adding a large tonnage to the reserve.

Laguna.—In the Laguna, 6725 ft. of development work was performed during the year, which, together with sill floors resulting therefrom, produced 3752 tons of ore worth $10.06 per ton, or a total of $37,765. At this mine the downward extension of some of the Red Top orebodies has been found on the 450-ft. level, and a large tonnage will be mined during the coming year. The Hazel shaft, 420 ft. northeast of the Laguna, has been unwatered, and will be sunk to the 900-ft. level; from this point cross-cuts will be driven and a raise made to connect with the bottom of the Laguna shaft.

Jumbo No. 2.—The old Jumbo mine, which was formerly worked by lessees, has been reopened and found to contain a large tonnage of about $15 ore. During the three months it has been in operation, it has produced 3377 tons of ore worth $57,880. 240 ft. of development work was performed, which produced 289 tons of ore worth $10.24 per ton, or a total of $2960. Owing to the fact that the mine has been honeycombed by lessees, it is almost impossible to estimate the tonnage. It is practically assured, however, that this mine will produce a considerable tonnage during the coming year.

PRODUCTION BY MONTHS.

Month	Tons	Average Per Ton	Gross Value
November	24,956	$35.00	$ 873,465.55
December	25,570	29.45	753,109.48
January	27,192	29.33	798,175.24
February	23,675	41.13	973,739.78
March	25,714	43.55	1,119,951.75
April	28,253	37.57	1,061,496.53
May	29,430	32.67	962,110.35
June	28,540	32.36	923,472.87
July	29,253	29.00	848,429.44
August	30,580	29.77	910,477.60
September	26,760	25.28	676,383.20
October	30,626	28.09	860,153.81
Total	330,549	$32.55	$10,760,198.60

PRODUCTION-DEVELOPMENT AND STOPING.

	DEVELOPMENT.			STOPING.		
Shaft.	Tons.	Aver.	Value.	Tons.	Aver.	Value.
Comb'tion	2,376	$17.78	$ 42,243.69	53,502	$24.78	$ 1,325,539.68
Mohawk	13,203	17.74	234,193.58	93,155	23.73	2,210,805.73
Red Top*	5,987	9.16	54,856.94	49,961	27.73	1,385,212.41
Jumbo**	9,972	38.19	380,856.94	102,393	50.07	5,126,489.63
Total	31,538	$22.58	$712,151.15	299,011	$33.60	$10,048,047.45

TOTAL.

	Tons.	Aver.	Value.
Combination	55,878	$24.48	$ 1,367,783.37
Mohawk	106,358	22.99	2,444,999.31
Red Top*	55,948	25.74	1,440,069.35
Jumbo**	112,365	49.01	5,507,346.57
Total	330,549	$32.55	$10,760,198.60

*Includes Laguna.
**Includes Jumbo No. 2.

TOTAL MINING COSTS.

		DEVELOPMENT.		STOPING.	
Shaft.	Tons.	Amount.	Aver.	Amount.	Aver.
Combination	55,878	$ 33,291.68	$ .59	$ 97,616.88	$1.75
Mohawk	106,358	100,459.65	.94	258,165.35	2.43
Red Top*	55,948	87,429.77	1.56	122,847.06	2.20
Jumbo**	112,365	129,804.52	1.16	279,843.04	2.49
Total	330,549	$350,985.62	$1.06	$758,472.33	$2.29

TOTAL.

	Amount	Aver.
Combination	$ 130,908.56	$2.34
Mohawk	358,625.00	3.37
Red Top*	210,276.83	3.76
Jumbo**	409,647.56	3.65
Total	$1,109,457.95	$3.35

*Includes Laguna.
**Includes Jumbo No. 2.

Ore Reserves.—Experience has shown conclusively that it is impossible accurately to estimate ore reserves in these mines, without doing a vast amount of development work at a great expense, which would be entirely useless for the purpose of economic mining. Considering the past performances of the property, the present exposure and possible extensions of orebodies now being worked justify an estimate of ore in reserve amounting to 600,000 tons, or a sufficient tonnage to keep the present mill running at full capacity for practically two years. Owing to the fact, however, that some of the high-grade orebodies have been exhausted, the value of the ore will be somewhat lower. The cost of production has been considerably reduced, which, together with the larger tonnage being milled, will make it possible to maintain a high rate of production from the lower grade of ore.

The prospect for developing ore in addition to the reserve estimated is very promising. Practically no ore has been mined, and only 500 ft. of the 4000 ft. of prospective ground along the strike of the vein has been explored below the 1000-ft. level of the Jumbo, which has produced a large tonnage of high-grade ore; therefore, the chances of finding ore at greater depth have not been nearly exhausted. The possibilities of finding new orebodies above the 1000-ft. level are very good. During the year 1911 the 354, one of the largest orebodies ever discovered in this property,

was found on the 450-ft. level of the Mohawk. Other important discoveries were made on the 150 and 350-ft. levels of this mine. A very important discovery was also made on the 130-ft. level of the Combination mine. Therefore, it is reasonable to expect that the large partly developed area above the 1000-ft. level will produce a large tonnage of new ore during the coming year.

Mill Report

The mill superintendent, J. W. Hutchinson, reports that the new refinery was completed and in operation January 1, 1911, and has fulfilled every expectation. The cost of refining the bullion has been reduced to 7c. per ton, as compared with 19c. per ton the two previous years. The total saving to the company made by the new refinery will be in excess of $60,000 per year. During the year a new plate-room was built, in order to localize the work of amalgamation. A small testing plant and laboratory has also been added. Many minor changes have been made, causing the plant to handle a larger tonnage than previously, and it is expected that it will average 950 tons per day during the coming year. A plant to treat the residue from the present concentrate treatment is now in process of construction. Two Edwards duplex roasting furnaces, with 112 by 13-ft. available hearth area, and one Baker cooler, will be housed in a steel building erected for the purpose. One 5 by 18-ft. tube-mill, together with tanks, agitators, and accessory equipment will be housed in an extension to the present concentrate treatment plant, together with the necessary dust-chambers and storage-bins. The plant will cost approximately $73,000, and will effect a saving to the company of approximately $80,000 per year. During the year the mill ran 96.37% of the total time, and averaged 9.39 tons per stamp actual running time.

Secretary's Report

The report for the year made by the secretary and treasurer, A. H. Howe, shows that during the fiscal year ended October 31, 1911, the issued stock of the company remained at the figure established on September 1, 1910, namely, 3,559,148 shares. The fiscal status of the company during the year has been singularly free from complication or unusual features. The total earnings for the year have been $9,890,028.67. Deducting therefrom gross expenses of $2,510,377.61, which includes construction expense of $137,831.13 and depreciation of plant and equipment of $147,194.98, leaves a net realization for the year of $7,379,651.06. Four regular dividends at the rate of 30c. per share each, and four extra dividends at the rate of 20c. per share each have been made within the year, aggregating $7,118,296. Stockholders have been notified that the issuance of the company's report for the fiscal year ended October 31, 1911, would be delayed owing to the necessity of rearranging accounts to conform with requirements of the United States Government. In explanation of these changes it should be said that under the Act of Congress approved August 5, 1909, and popularly known as the Federal Corporation Income Tax Law, depreciations in the value of property are made available as a deduction against gross income; but the Internal Revenue Bureau of the Treasury Department, having in charge the administration of that law, requires all depreciations so claimed to be shown on the books of account and balance sheets of the corporations claiming the benefit thereof. The methods prescribed for ascertaining such depreciations make necessary the adoption of an estimated unit of depreciation ascertained by reference to the cost of the property subject to the depreciations in question.

A complete account of the computation made necessary in this case could only be accomplished by too extended explanation. Avoiding, therefore, unnecessary detail, it may be briefly stated that the unit here employed for that purpose, in obedience to the requirements of the Treasury Department, is $16.36 per ton, being the estimated average cost per ton to the company of its whole estimated commercial tonnage.

The theory upon which these depreciations for exhaustions of ore are based is the well-known economic principle which has in numerous cases received judicial recognition and approval, and which should always be borne in mind by investors in mining property, namely, that unlike most other business projects, the earnings of a mine distributed in dividends are chiefly derived from exhaustions of the mine property in which the capital has been invested. Therefore, no matter how profitable the investment may prove to be, the dividends should not be regarded as profit in the ordinary acceptation of that term until the net amount realized shall have equaled the capital investment in the mine property. It will be observed that by reason of the adoption of a depreciation unit, as required by the United States Treasury Department, it necessarily results that the net realizations in any year from the company's operations may be derived in part from exhaustions of assets and in part from apparent profits accruing from a net recovery per ton in excess of the estimated cost per ton.

The combined cash balances of the companies at the close of the year were $1,369,177, with bullion and concentrate settlements outstanding of $451,306, and, excepting invoices for the current month, the companies have no debts. In response to numerous inquiries received by the office, there is given below a statement showing dividends to date:

No.	Date.	Rate per Share.	Amount.
1	October 25, 1907	$0.10	$ 353,247.10
2	November 25, 1907	0.10	353,377.30
3	April 30, 1909	0.30	1,066,280.10
4	July 31, 1909	0.30	1,067,364.60
5	October 30, 1909	0.30	1,067,594.10
6	January 31, 1910	0.50	1,779,549.00
7	April 30, 1910	0.50	1,779,574.00
8	July 30, 1910	0.50	1,779,574.00
9	October 31, 1910	0.50	1,779,574.00
10	January 31, 1911	0.50	1,779,574.00
11	April 29, 1911	0.50	1,779,574.00
12	July 31, 1911	0.50	1,779,574.00
13	October 31, 1911	0.50	1,779,574.00
		$5.10	$18,144,430.20

Taking advantage of a reduced express rate which effects a saving of approximately $10,000 per year, the company's bullion is now being marketed at the United States Mint at Denver. A combined profit and loss statement of the Goldfield Consolidated Mines Co. and the Goldfield Consolidated Milling & Transportation Co. is given below.

COMBINED PROFIT AND LOSS ACCOUNT, GOLDFIELD CON. MINES CO. AND GOLDFIELD CON. MILLING & TRANSPORTATION CO.

Earnings:		
Ore Shipments, gross	$ 173,262.18	
Transportation, Treatment and Charges	17,103.92	$ 156,158.26
Concentrate Residues Shipments, gross	$ 370,300.66	
Transportation, Treatment and Charges	212,946.01	157,354.65
Concentrate Residues Reserve, gross	$ 107,312.65	
Transportation, Treatment and Charges on Reserves	23,408.67	83,903.98
Sales Miscellaneous Mill Products, gross	$ 79,918.08	
Transportation, Treatment and Charges	8,229.26	71,688.82
Sales Bullion	$9,432,333.89	
Marketing Bullion	49,141.23	9,383,192.66
Interest and Discount		28,641.66
Miscellaneous Earnings		9,088.64
Total Earnings		$9,890,028.67
Expenses:		
Mining	$1,109,457.95	
Transportation	30,628.70	
Milling	626,293.90	
Concentrate Treatment Plant Operation	121,315.70	
General Expenses	181,334.80	
Bullion Tax	126,319.26	
Income Tax	27,001.19	
Construction	137,831.13	2,363,182.63
Net Realization from Operations		$7,526,846.04
Less Depreciation of Plant and Equipment and Accounts Charged Off	147,194.98	
*Depreciation of Mine Property at $16.36 per ton	$5,407,781.64	5,554,976.62
Combined Net Profits After Deducting Depreciation for Exhaustions of Ore		1,971,869.42

*This item should be added to "Combined Net Profit" to ascertain fund available for dividend purposes. See pages 22-3

Types of Ore Deposits—A Review

By A. C. Lawson

The editor of this book* is also its reviewer, and has published his review under the caption of an introduction at the beginning of the volume. The volume is a collection of papers, most of which have been published before, by Bain, Buckley, S. F. Emmons, Hatch, Hershey, Irving, Kemp, Lane, Leith, Penrose, Rickard, and C. H. Smyth Jr. It is a very readable and instructive book albeit it has no plan or guiding principle. One might cavil at the title, but its meptness is offset by the fact that it is a very attractive and saleable one, and readers will be pleased to discover that there are only as many types as there are authors of the book.

In his review in his book the editor very cleverly summarizes the salient points of the various assays, but quite naturally he does not do so in a critical spirit. He is optimistic and complimentary. He is in good company, and he knows it. It would mar the occasion to dissent from the views of his collaborators, so he abstains from dissent and agrees with all thirteen of them. Whether the authors would all agree with one another is not quite so clear. We might, it seems, get quite different answers from them to the question, What constitutes a type deposit? Are certain deposits types of a class independent of the fluctuating hypotheses of their genesis, or is a settled knowledge of the mode of origin a necessary factor in the definition of a type? Most of the papers are descriptions either of particular deposits or of deposits which characterize particular regions, and in these the genesis of the ore is the matter which concerns both the author and reader most. Irving's paper on 'Replacement Orebodies' is more general, and is perhaps the most successful characterization of a type; although it may well be urged that replacement phenomena may be observed in deposits of different types. Emmons' paper on outcrops, and Penrose's on 'Some Causes of Ore-Shoots,' are also of a general character, but they are really addenda to the book and quite academic in treatment. These last three essays offer such a marked contrast in treatment to the more concrete and stimulating discussions of the first ten that they might well have been reserved for a volume of different scope. They have the merit of summarizing and formulating our knowledge concerning certain phenomena of ore deposits and will undoubtedly be welcome to a large number of readers.

Turning now to the essays of most interest, the first one, by C. H. Smyth, Jr., on the 'Clinton Type of Iron-Ore Deposits,' is an admirably fair and clear discussion of the genesis of what is perhaps the most remarkable and mysterious iron ore. The author presents a strong and sustained argument in favor of the view that these ores are due to primary precipitation of iron salts from sea-water as against the hypothesis of subsequent replacement of limestone by iron salts through the medium of ground water. In his point of view, it is evident, the Clinton iron ore as a type is defined in terms of primary deposition. But those who hold the other view, which makes the ore a secondary product, would cite the Clinton beds as a fine type of replacement orebodies. So that here is the same ore deposit serving as an example of two contrasted types! If a type is to be defined in terms of genesis it must in the present state of the science be defined in terms of hypotheses, and these, as we all know, are unstable. Smyth's argument would be stronger, I might almost say convincing, if he would explain the extraordinary excess of iron in the Clinton sea which his hypothesis postulates. This question he sets aside as extra geological. The trouble with this is that our minds are not strictly geological, and in studying such questions they wander afield into the pleasant and wholesome domain of common sense. We naturally and properly balk at accepting a geological doctrine as satisfactory that leaves a large question unanswered, even if that question be not strictly geological.

The questionable propriety of defining types of ore deposits in terms of genetic hypothesis is even better exemplified in the second essay, by Leith, on 'The Lake Superior Type of Iron-Ore Deposits.' Here the type involves two hypotheses, one to account for concentration of the ore deposits from a lean 'iron formation,' and the other to account for the original deposition of the latter. The first hypothesis, in so far as it applies to the concentration of the iron ores of the Animikie, is very satisfactory and will doubtless find wide acceptance, particularly by those who have read Leith's more extended monograph on the Mesabi ore. But it is not at all clear from any points set forth in the paper or in Monograph LII of the U. S. Geological Survey, of which it is a summary, that the same hypothesis explains the concentration of the Keewatin ores, or the ores at the contact of the Keewatin with overlying Archean sedimentary rocks. The paper loses something of its force in its effort to generalize so broadly as to include the Animikie and the Keewatin ores in the same category. In applying his hypothesis of concentration to the Mesabi ores of the Animikie, one would like to have seen some credit given to J. E. Spurr for his earlier statement of the hypothesis. Spurr's identification of greenalite as glauconite is a very minor matter. Apart from that he clearly expounded years ago the process of concentration of the Mesabi ores in its essential features as now set forth by Leith, who makes no reference to the earlier work.

The second hypothesis is a substitution for others that have been previously entertained to account for the 'iron formation' from which the ores are derived by concentration. Briefly stated, it supposes that the iron formation is an original chemical precipitate on the bottom of the ocean of salts emanating in some aqueous or gaseous form from contemporary submarine lavas, notably ellipsoidal basalt. The hypothesis postulates the submarine origin of ellipsoidal basalt, the ellipsoidal structure being assumed to be due to extravasation under the sea. This assumption is erroneous. The most typical ellipsoidal basalt to be found anywhere occurs in splendid exposures in the city of San Francisco and at many other localities in the Coast Ranges of California and they occur as intrusive rocks; so the ellipsoidal structure is not due to submarine extrusion as Leith believes.

Another unfortunate feature of the hypothesis to some of us who are familiar with Lake Superior geology is that ellipsoidal lavas are not known to occur in the Animikie of the Mesabi range where the 'iron formation' in question is best exemplified. Such rocks are abundant in the Keewatin, but these are geologically far removed from the Animikie, however closely they may be associated geographically. Just what submarine lavas gave rise to the supposed emanations that were precipitated as the 'iron formation' of the Mesabi range? Are the Mesabi iron ores typified by the formation of so precarious a hypothesis?

It is a pleasure to read the third and fourth papers, by Bain and Buckley, the one on the 'Flats and Pitches of the Wisconsin Lead and Zinc District,' and the other on the 'Lead and Zinc Deposits of the Ozark Region.' The pleasure arises not only from the lucid and convincing style of both authors, but also from the fact that here at least we escape the prevailing obsession regarding the efficacy of juvenile waters, to which, as we have just seen, even the Lake Superior iron formations have succumbed. Bain's paper

*Types of Ore Deposits,' edited by H. Foster Bain, with chapters by H. F. Bain, E. R. Buckley, S. F. Emmons, W. H. Emmons, F. H. Hatch, O. H. Hershey, J. D. Irving, J. F. Kemp, A. C. Lane, C. K. Leith, R. A. F. Penrose, Jr., T. A. Rickard, and C. H. Smyth, Jr. 378 Pp., Ill., index. *Mining and Scientific Press*, San Francisco, 1911.

deals primarily with certain interesting structural features which have determined in part the position of the ore-bodies and the type is defined in terms of structure. His discussion of the genesis of the ore is a subordinate matter, but in this he is in agreement with Buckley. Both authors regard the lead and zinc ores of the regions described as due to concentration from overlying sediments, and both support this veiw by argument so cogent that little more remains to be said. Both discussions of the questions of genesis may be taken by students as fine examples of geological demonstration; and it is noteworthy that we have as yet no equally clear proof of the deposition of ores by magmatic waters. The chief merit of the papers is not that they originate the doctrine of genesis by descending waters for these deposits, for that is an old hypothesis, but rather that they are quite convincing as to the correctness of that doctrine.

The next paper, by Lane, on 'Native Copper Deposits,' is not the description of a type, but the statement of a hypothesis accounting for the presence of native copper as the chief ore in a deposit of any type. Lane supposes copper to have been leached from basalt as chloride and to have been precipitated in alkaline sedimenary rocks which owe their alkalinity to their deposition as continental or desert formations. The hypothesis is plausible, but not any more so than Steinmann's explanation of the occurrence of copper at Corocoro.

S. F. Emmons' paper on the Cobalt district is chiefly interesting as a summary of the evidence in favor of the view, which had previously been expressed, that the rich silver deposits of that camp are the product of a process of secondary enrichment due to the descent of salts of silver from upper parts of veins now removed by erosion, and their precipitation as native silver in the lower parts. Why the bottom of the zone of enrichment is coincident with the base of the Huronian or with the base of the diabase sill intrusive in both Keewatin and Huronian is not explained. The acceptance of the doctrine of secondary enrichment does not rob Cobalt of its problems. J. B. Tyrrell's interesting suggestions as to the origin of the fissures at Cobalt are not mentioned, although they have an important bearing on the question of the former upward and the present downward extent of the veins. The Cobalt veins should be regarded as variants as to mineral contents from the ordinary fissure vein rather than as the type of these; and it is pretty clear that Emmons himself in writing the paper had no intention of defining a type.

Hershey, in the next paper, on the 'Geology at Treadwell Mines,' refers to the deposits on the Gastineau channel as the "type par excellence of a large low-grade gold-quartz deposit." But the type appears to be based upon mining rather than upon geological considerations. As usual, he contributes new facts to those recorded by previous observers and throws new light upon the geology of the region, although the genesis of the ore remains a speculative question. The recognition of the fact that part of the slates of previous writers is the sheared margin of the gabbro, and that the latter was intruded into the sedimentary rocks before the intrusion of the ore-bearing dykes of soda syenite, appears to be based upon sound observations. It is not so clear that the light and dark facies of the soda syenite (albite diorite) are distinct intrusions, especially as the ore is practically confined to the light colored rock and the mineralizing action might well be responsible for the bleaching of the dark rock. Hershey's suggestion that the gold is derived from the gabbro is quite as good as A. C. Spencer's that it is derived from magmatic waters. But the allurements of the juvenile water hypothesis are evidently too many for him, since, although he doubts that such waters supplied the gold, he concedes that they may have abstracted the gold from the pre-existent gabbro and deposited it in the crushed soda syenite.

'The Saddle Reef,' by T. A. Rickard, is an old story skilfully retold in a form that will be very useful to students and acceptable to teachers of economic geology. From a structural point of view the saddle reef is a well defined type, and the paper is chiefly a description of the various features exemplified in the Bendigo field. The abundant illustrations are a welcome feature of the paper. Little is said of the genesis of the deposits, but in the last paragraph we find reference to "the irruption of mineral-bearing solutions propelled by steam" as a sequel to the intrusion of few small dykes, from which it may be inferred that even this sagacious author is smitten with the juvenile water affliction.

In Kemp's paper, on 'Contact Deposits,' we have the argument for the efficacy of magmatic water in ore deposition set forth by one of its ablest and most insistent exponents. This doctrine is so important, if true, and the tendency to accept it so widespread, that its exposition is the one paper of the symposium that above all others invites criticism. In his preliminary discussion of metamorphism in general Kemp fails to make any distinction between (1) purely thermal metamorphism wherein the changes in rocks adjacent to an intrusive mass are due to molecular mobility induced by heat alone, and (2) reactionary metamorphism wherein the changes are due to reaction between the encasing rocks and the materials emanating from the intruding mass. From his remarks it is clear that he regards all contact metamorphism as reactionary, which is a very questionable proposition to start with.

The main body of the paper is a skilful weaving of fact and hypothesis, which, however, are not difficult to segregate. The facts are chiefly citations of cases where ores are known to exist at or near the contact of limestone with igneous intrusions. With these ores are associated the lime silicates and notably the lime-iron silicate andradite. Kemp very properly points out that many of these silicates, particularly andradite, cannot be regarded as due to the crystallization of the limestone without the addition of materials which were not originally present in it. He concludes without question that these materials were derived from the intrusive magma and were carried in solution by waters expelled from it at the time of its crystallization. The next step is easy. If the lime and lime-iron silicates have thus been supplied by magmatic waters with the silica and iron which made their formation possible, then, of course, the associated ores have been deposited by the same waters. This is the case in brief for the doctrine of ore deposition by magmatic waters.

There are some minor difficulties, such as the abundant occurrence of the ore in question, both disseminated and in individual bodies, in the igneous rocks in such a way as to leave no room for doubt but that the rock was solidified before their deposition. These difficulties are not fairly met by a passing suggestion that such intra-intrusion ores may have come from magmatic waters given off deeper down where the rock remained molten. Every such case demands particular and detailed observation and discussion before we should be called upon to accept the suggestion as the true explanation of the origin of the ores. As they stand, such cases negative the doctrine.

There are also major difficulties, such as the fact that ore at the contact of acid intrusive and limestone is an exceptional occurrence. There are innumerable such contacts where no ore occurs. The doctrine of magmatic waters as advocated by Kemp should explain the absence of ores of iron and copper at the great majority of such contacts. But the doctrine is silent on this point. But even if these difficulties and others were overcome the doctrine remains feeble and can never attain to the dignity of a scientific theory until it disposes of another possible means of accounting for these ores, which has even greater claims to our attention than the supposed magmatic waters. The means I refer to is the ordinary ground water as affected by igneous intrusion. The circulation of the ground water would in every case be profoundly disturbed by the injection of hot igneous magmas into sedimentary terrains. The disturbance would, however, be far from chaotic. The presence of the hot body would be the controlling influence in determining the circulation. The circulation would always be upward on the periphery of the hot mass. This would be true not only while it was still molten, but also long after it has solidified. Such a circulation of the

heated ground water would be quite competent to do all that is ascribed to magmatic waters, including the formation of zone silicate zones. It would not only bring to a zone of active chemical reaction the materials leached from the surrounding regions, but it would attack the still hot though solid igneous mass itself and abstract from it part of its metallic constituents. And it is significant in this connection that most of the igneous rocks that have ores either on their periphery or within their mass have been subject to very severe chemical attack. Until this very probable means of ore deposition at the contact of limestone and igneous rocks has been disposed of the doctrine of magmatic waters is unnecessary. It remains at best a possibility, one of the fashionable vagaries of our time, not entitled to serious respect as a scientifically established theory.

Hatch's paper on 'The Conglomerates of the Witwatersrand' is an excellent description of the famous gold deposits of the Transvaal. The sketch of the geological history and structure of the Rand, with its illuminating diagrams and maps, will be a most welcome and convenient source of information to American students who cannot readily get access to the earlier scattered papers dealing with the same subject. The paper also discusses the vexed question of the origin of the gold and shows very clearly that the gold is epigenetic.

Gold Mines of Mysore

By Herbert A. Carter

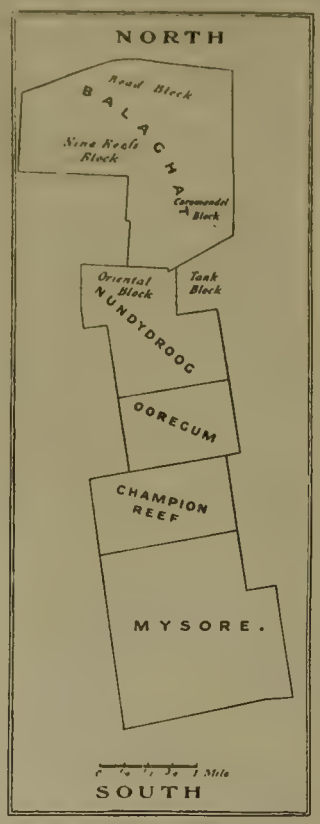
The gold mines of Mysore have long been famous. The existing industry dates from 1878, when a few enterprising individuals, among whom was General de la Poer Beresford, acquired a lease of ten square miles of country for mining purposes. This tract included what are now known as the Kolar goldfields.

The researches of the Indian Geological Department have shown that nearly one-fourth of the whole area of the province, or nearly seven thousand square miles, is made up of Dharwar rocks, the auriferous rocks of India. Three great bands of these rocks stretch across the country from north to south. The most westerly of these cover the east flank of the Western Ghants from Banavasi, in the extreme north of the province, to Hunsur in the south. This part of Mysore being covered with dense forest, little prospecting work has been done. Old native workings have been found at Ikkeri, Bednur, Belur, and Hunsur (Kempenikote). The second of these bands, which is called the Shimoga band, extends from the Thungabhadra river on the north to Nanjangud in the south. This is the largest and best defined of the bands, and covers an area of four thousand square miles, which has been the seat of numerous powerful dynasties, with large and flourishing capitals. The ruins of palaces and temples, in which are to be seen some of the most elaborate stone carvings in the world, are evidence of the enormous wealth of the kings at whose expense they were erected. The state geologists have found many old gold mines worked by the ancients in this belt. A few English companies are now engaged in testing portions of this belt, and good veins are said to have been discovered some ten miles south of the town of Shimoga.

The third belt runs across the centre of the state from Harihar, on the north, through Kunigal, and on to the Cauvery Falls at Sivasamudram. Here also many old gold mines are indicated on the geological map of Mysore, but little or nothing has been done by Europeans to test their possibilities.

In addition to the three great bands of auriferous rocks already named there are numerous small outliers of Dharwar, scattered all over the province, showing that at one time the whole country was one great goldfield. Eons of denudation have washed away thousands of feet in depth of these rocks, and what are now to be seen are merely portions of the Dharwar series, filling the valleys of primeval Mysore. The Kolar goldfields are in one of these small outliers of the Dharwar rocks, situated about 40 miles east of Bangalore. Up to the end of 1909 the Kolar goldfields had yielded £38,600,000 of bullion, and paid dividends amounting to £13,000,000. It is possible to form an estimate of the size of operations on the mines at Kolar, where it is stated that 600 Europeans, 100 Eurasians, and 31,000 natives are employed on the different works, and they are paid 7,500,000 (75 lakhs) of rupees in wages annually, or more than one third of the entire revenue of the Mysore state.

The deepest workings are on the Ooregum mine, where Taylor's shaft had attained a depth of 4010 ft. at the end of 1910. There are several shafts on the field more than 3000 ft. in depth. The Kolar goldfield is 2800 ft. above sea-level. The Mysore gold mine is the chief gold producer at the present time. The return from this mine for 1909



KOLAR GOLDFIELD.

was 228,000 oz. valued at £900,000. There has been, however, a steady decrease in the richness of the ore as greater depth is reached, as will be seen from the following statement of returns:

	Tons yielded.	Ounces.
1886	6,000	15,000
1891	38,000	58,000
1896	64,000	108,000
1901	127,000	164,000
1906	185,000	205,000
1909	234,000	228,000

Near the surface the ore yielded 2½ oz. per ton; at 3000 ft. below the surface it yields less than an ounce. The profits for last year amounted to 70 lakhs of rupees, and the royalty paid to the Mysore Government for the lease of the mine was 6½ lakhs of rupees. The land is owned by the Mysore Government, which leases it out to various companies for a term of 30 years on a payment of 7½% on the annual profit. The branch line of railway from Bonringpet to Marikupam, ten miles, was built by the Mysore Government for the benefit of the gold mines, and it pays a dividend of 10% per annum. The Mysore G. M. Co., Ltd., pays dividends of 35 to 45% per annum.

Labor and Superintendence on the Gold Coast

By Donald F. Foster

The frequency of comment on the inefficiency of the native labor and the carelessness of the white overseer on the Gold Coast is my excuse for the following remarks. At the outset I may as well state that during the time I was employed on the Coast I failed to note that carelessness which is popularly supposed to be the distinguishing feature of the Gold Coast mining man. On the contrary, I found that he would compare favorably with his mining brethren in any country, notwithstanding the fact that he has a bad climate to contend with and has not only to do his work, but also has to teach and set an example to the natives.

It is only in recent years that the native has been accustomed to anything like organized labor. There is the story of the engineer who, some twelve years ago, introduced the wheelbarrow to the native. The native filled the barrow with dirt, called a comrade or two, hoisted the barrow upon his head, carried it to the dump, dumped the dirt, and with the assistance of a friend replaced the barrow on his head and returned, smiling. There are now native clerks, artisans, miners, and laborers who have been taught their work by white overseers. I must not forget the work of the missionaries. Some of their work has been good, but I do not think the policy of teaching the native to believe that he is as good, if not better, than the white man, a good one. The mining man on the Coast, before he can be engaged, has to pass a medical examination in London which is more stringent that that necessary to join either the army or navy. He must also have good references as to character and ability. These precautions are good and necessary, but the man who comes in close contact with the native must, besides being competent to do his work (for there is none quicker than the native to note a man's ability), be able to teach the native, and this teaching requires patience and common sense. I have shown a 'boy' half a dozen times how to do a thing, and the seventh time he has made a bigger botch than at the first attempt. I have called him several names reflecting on the chastity of his mother and the constancy of his father, finishing up with asking him if he would ever learn. He answered me in native dialect to the effect that I had better give him a good 'hiding', and it would help him to remember, as in future when he went to do similar work he would remember the 'hiding' and be more careful. (Note: I complied with his wishes.)

The white man on the Coast is representative of almost every mining country; he comes from Great Britain, America, Australia, India, south and other parts of Africa. There are also some Germans and Italians, the majority of them having received their training in other countries where they have had to do their own work. In West Africa the white man who overworks is usually buried or invalided home, as it is impossible to do manual labor in that country without dearly paying for it.

One of the obstacles of the newcomer to the Coast is the broken English as it is spoken by the native. I have had much enjoyment from the conversation between a newcomer and a native. The following is an example of one of the most frequent occurrences: The white man is not certain that a boy has done a job that he has been told to do, so he questions the boy: "You no do that job?" "No, sah." "Well, you go do him." "I do him, sah." "Just now you say you no do him." "No, sah; I say I do him, sah." After this the white man is more puzzled than before, so he goes to see if the work is done, saying all sorts of nasty things about natives and the Gold Coast in general.

The native is not a quick learner, and once he has learned to do a thing one way it is hard work to teach him that there is a better way; he invariably answers: "My old massa do him this way, sah—he sabe too much, sah." Which, to say the least, is very annoying. Sometimes one engine-driver likes to keep half a glass of water in the boilers—perhaps the next, an inch. If it ever happens that these men change boys there is trouble, as each white man has to teach the boy over again. Personally, I have had experience at two mining properties on the Coast—the Ashanti Goldfields Corporation, Ltd., and at Bibiani, Ltd. I have nowhere met more competent men than those employed by these companies. At Obuasi, the management of the Ashanti Goldfields Corportation, Ltd., has offices, mines, and reduction works. The consulting engineer had a tough problem to face when he took over this group of mines, and deserves great credit for making a dividend-paying mine out of the wreck that had been made by injudicious management. One of the mines was blessed with graphitic walls, and great care was necessary with the timbering; this in a country where there is no good mine timber. The ore is refractory, being a graphitic quartz containing sulphides. The former method of treatment was to wet-crush in stamp-mills, amalgamate and cyanide the sand, the slime being run to waste. The cyanidation of the sand was anything but a success, an extraction of about 30 to 40% being obtained. The mill is now used to treat ore from Justice's Find, the ore being crushed in the mill, sand and slime being separated, sand being leached with cyanide, and the slime being filter-pressed after agitation, an extraction of 90% being obtained. The refractory ore is crushed in ball-mills, roasted in Edwards furnaces, cooled and trammed to cyanide vats where it is leached with cyanide solution, the extraction being over 90 per cent.

The natives at Obuasi had never seen a ball-mill, roaster or filter-press before, and had to be taught how to look after them. This they do successfully. At times, owing to ill health, shiftmen are short and the plant has to be run with one white foreman and native shift bosses. This could not be done if the natives were as inefficient as some writers would have us believe. Nor can the white man be so careless.

According to published accounts, the average cost of mining and treatment-costs on the Rand mines is 24s. (or $5.76) per ton. The total Ashanti costs, including London office and traveling expenses for the white staff, were for the months of July, August, and September of last year, 31/10.5 ($7.65), 32/4.6 ($7.77), 33/2.2 ($7.96). The traveling expenses of the white staff will probably be 8 pence (16c.) per ton. The railway freight on materials is from £2 ($10) to £10 ($50). Thus taking everything into consideration, I think these costs are reasonably low.

Here are a few of the set tasks of the natives. About 3000 tons of sand had to be handled twice by 25 boys in a month. First to transfer from the collecting to the treatment vat, afterward from the treatment vats to the dump by means of cars. They had also to keep the tram lines and dump in order. The actual filling and emptying cost 5.04 pence (10c.) per ton. This is pretty cheap for manual labor. On the dry-crushing plant the cost was slightly higher; 120 tons of crushed and roasted ore being cooled (that is, damped and cooled enough to handle easily) and dumped into the vats by 20 boys, who received an average of 1/9 (42c.) per day. The cost per ton was 3.33 pence (6.66c.). The emptying of these vats was done by 16 boys who were paid 1/6 each. The cost of emptying and filling costing 5.73 pence, or nearly 11.5c. per ton. One shift-boy and helper does all the pumping and making up of solution, the white shift-boss telling him how much cyanide to add. Some of the boys are quite capable of testing and making the cyanide solutions up to proper strength without aid from anyone. One native attends to five No. 5 ball-mills. Another attends to the oiling of the dry-

crushing plant. There is a fireman to each Edwards furnace. One white man and four natives constitute a 50 stamp mill gang, where the plates have to be dressed twice a shift. I have seen a broken stem repaired and the battery running in thirty minutes with one of the gangs.

Owing to ill health my stay at Bibiamaba was short. When I was there the mill was a beautiful specimen of the sectionalized stamp mill, with a huge notice pasted up giving full instructions how to run a stamp mill. This notice had been put up by some former manager and it was a source of much amusement to me.

The mine is three to four days journey from the railway. Everything has to be carried in by natives; the usual load being 60 lb. However, the manager brought in new mortar boxes the sole-piece of which was cast in one piece, the upper part being cast in another which fitted into the sole-piece. These were a great improvement over the other sectionalized boxes that were in use. I do not know the weight of these pieces, but they were carried in by about thirty boys to each piece. The mill was of 55 head of stamps; being of three different makes and three different drops, times of drop, and weight. A shift consisted of one white man and six natives; the plates being cleaned twice a shift and about 6500 tons per month being milled. However, the tonnage crushed for July, August, and September last year

NEW PLANT AT OBUASI.

was 7864, 8516, and 7742, respectively. Taking 18 boys at an average cost of 1/6 per day each, the cost per ton for native labor is 1.14d. (2.28c.), 1.05d. (2.10c.), and 1.12d. 2.24c.) for crushing and amalgamating. This mill was fitted with Hoscur feeders, and I have no doubt that had it been fitted with Challenge feeders, four boys per shift would have been ample.

Perhaps a few remarks on the native laborers will not be amiss. The Fantis are the most numerous and are engaged in all classes of work, skilled and unskilled. Some of them have been to England and taken a mining course in a school of mines. The majority of the clerks are Fantis, as are also the native artisans. The Accra and Gold Coast Castle boys are, in my opinion, the best of the Fantis. The Ashantis are about as lazy workmen as it is possible to find. However, the Ashanti steward boy is possessed of a rare virtue among natives; he is fairly honest and does not, as a rule, thieve from his employer. The Ashanti women are good workers, especially on task work. The average weight of sand a 'mammie' will carry is 60 lb., but on special occasions I have known them to carry 100 lb. These figures have been taken from a large number of weighings. From a labor standpoint an Ashanti and a Fanti 'mammie' are equal. The Lagos boys are the best unskilled laborers on the coast. Many white men do not like them because they object to being hit without reason and hit back. A Fanti can be hit with or without cause, and he does not worry. Some of the Lagos boys are good air-drill operators and some are engine drivers, but the majority are shovelers, trammers, or firemen, in which they excel all other natives. The Kru boy is useful, but in most cases it is necessary to administer a good flogging before obedience is obtained. Once put in their place they are good workers and are employed as artisans and laborers. The Wangaras are the carriers on the Coast and take the place on the Gold Coast that the mule does in the mountain districts of Mexico. As a rule these boys are very tall. They make excellent gangs for shifting heavy machinery.

The native laborer on the Gold Coast may have been in the past inefficient, but it cannot be said with truth today. Every year he is getting better, and it would not surprise me if he takes the place to a large extent of the white shift-boss in the near future. The white man who went to the Coast a few years ago went there not to see how much he could do for his employer, but to see how much he could do him. Today it is different. Much more is understood of the illnesses that are likely to be contracted on the Coast, and the ways of dealing successfully with them. A better class of mining man is being sent out, and nowadays it is necessary to know one's work, and the mere fact of being a friend of a director does not count.

Potash-Bearing Rocks in Wyoming

The Leucite hills of Wyoming, in the Rock Springs coal district, have long been known among geologists as interesting examples of volcanic outflows of an unusual lava. They now assume possible economic importance as a source of potash to meet, in part at least, the steadily increasing demand for this fertilizing material, for which the United States must now look to Germany. The announcement that a Western company intends to erect a plant in the Leucite Hills area for the extraction of potash and alumina from these rocks makes opportune a report recently issued by the U. S. Geological Survey describing the character and distribution of this lava formation and estimating the amount of potash and alumina it contains. Assuming that the process intended to be employed proves commercially feasible, it is highly interesting to note that the Survey places the potash content of the leucite rock 'in sight' at 197,349,617 tons. This estimate is based on a careful geological examination of the area and a series of analyses of the rock, which show an average potash (K_2O) content of over 10 per cent.

During the past 30 years Survey geologists have studied and described in their reports these lava deposits, so that the present brief report by Whitman Cross and A. R. Schultz is simply a realization on the earlier regular geologic work of the Survey. An examination of the area was made by Mr. Cross in 1884, followed by a careful study, describing in exact terms these exceptional rock types, which at that time held only scientific interest. In 1907 and 1908 Mr. Schultz, who was engaged in Government coal-land classification work in the Rock Springs area, made incidental observations of these igneous rocks, and only the press of other work prevented his publishing before this time a scientific contribution on the area which has now come to have economic interest and possible value to industrial chemists who are attacking the problem of furnishing an American potash supply. Should this feature of the potash situation be worked out successfully, the potential value of the Leucite hills would of course be large.

THE THREE WESTERN OFFICES of the Mineral Resources division of the United States Geological Survey, at Denver, Salt Lake City, and San Francisco, have all been moved to new quarters during the past year. The Denver office, at 311 Chamber of Commerce building, is in charge of Charles W. Henderson; the Salt Lake City office, at 825 Kearns building, is in charge of Victor C. Heikes; and the San Francisco office, at 305 United States Customhouse, is in charge of Charles G. Yale.

The Statement of Working Costs

By A. W. Allen

The cost of treatment in milling and cyaniding work can, with few exceptions, be itemized in the following manner:

1. *Salaries.* Superintendence.
2. *Wages.* Shift-men and laborers.
3. *General Stores.* Crusher and battery renewal parts, and battery sundries. Tube-mill pebbles and linings. Cyanide, lime, zinc, and general sundries.
4. *Repairs.* This expense is mainly dependent on the class of machine erected, and is often inversely proportional to the original outlay. 'Repairs' should be kept separate from 'renewals', being generally beyond working control, although they cannot be excluded from working costs.
5. Proportions of power, lighting, and assay costs.

It is presumed that the plant is under the control of a works manager, generally termed a 'mill and cyanide superintendent'. The separation of management into two departments, when there is no line of demarcation in the treatment, makes the proper control of working costs an impossibility, and is a system which invariably results in friction and loss of efficiency.

The keeping of salary and wage accounts offers no difficulty and needs little comment, but it is important that time books should be augmented by other sheets showing the daily labor costs apportioned to each department and so arranged that the amounts can be easily totaled at the end of the period. I find it preferable, in the first instance, to enter amounts of wages due rather than shifts and fractions performed, and each entry is best accompanied by a notation indicating the particular department to which the amount should be charged. Such books are generally kept by the shift-men in the mill and cyanide plant. Form 1 is an example of a page from such a book. A wages segregation sheet should follow and should be arranged so that the notations against each department correspond to those used in the wages book. Form 2 will serve to illustrate the idea.

Store accounts of material in general and constant use should be based upon the same plan, and the contents of the store book should be itemized, as far as possible, to correspond with the wages segregation scheme. The amount of stores consumed during a period should always be based

For the week ending ..... 19 ...

Date		Sunday.		Monday.		Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		TOTAL AMOUNTS
Name	Rate	Amt.	Dept.	Amt.	Dept.	Amt.	Dept.	Amt.	Dept.	Amt.	Dept.	Amt.	Dept.	Amt.	Dept.	DUE.
DAILY TOTALS.			-		-		-		-		-		-		-	

Form 1.

For the week ending ..... 19 ....

Department.	Date. Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	TOTALS.
Rockbreaking.								
Milling.								
Fine Grinding.								
Settlement.								
Agn. Treatment.								
Filtering.								
Pptn. & Smelting.								
Sundry Labour.								
Repairs.								
TOTAL WAGES.								

Form 2.

upon an inventory of what remains; and since cost sheets are rarely compiled oftener than once a month, the labor involved is small, the idea of systematic storage is inculcated in those responsible, and discrepancies and writ-

Store Book

Material :- Cyanide — Department :- Agitation

On hand 1 July, 19[illegible]	[illegible] lb.	@ $[illegible].20	per lb.	=	$[illegible]
Received during the month	[illegible] lb.	@ $0.2[illegible]	"	=	[illegible]
TOTAL	13440 lb.	@ $[illegible].20	per lb.	=	$[illegible]
Inventory 31 July, 1908	9408 lb.	@ $0.20	"	=	[illegible]
Consumed during the month	4032 lb.	@ $[illegible].20	per lb.	=	$ 806.40

Remarks :-

Form 3.

ing-off at ordinary stock-taking time avoided. The following is an example of stores subdivision:

1. *Rock breaking.* Wearing plates, toggles, shovels, etc.
2. *Milling.* Shoes, dies, liners, stems, guides, etc.; mercury, screening, blanketing, etc.
3. *Fine Grinding.* Pebbles, liners, etc.
4. *Settlement.* Lime, etc.
5. *Agitation.* Cyanide, lead acetate, etc.
6. *Filtering.* Filter cloth, acid, pump spares, etc.
7. *Precipitation and Smelting.* Zinc, filter cloth and paper, soda, borax, crucibles, coke, etc.
8. *Sundries.* Oil, grease, waste, packing, belting, and sundry spares.

An example of store-book entry is shown in Form 3.

Assay Costs

These should be compiled in the same way as general costs, the assayer being responsible for the expenditure as well as the stock of material in hand. A separate assay stock book should be kept, but no segregation of wages is necessary. A summary of costs should be compiled monthly, as illustrated in Form 4. A statement of cost

Assay Costs Sheet

For the month ending .... 19..

Item	$	cts.
Salary		
Wages		
Fluxes		
Crucibles, etc.		
Fuel		
Chemicals & glassware		
Sundries		
TOTAL	$	

Form 4.

per assay can be added if required, but the result is generally misleading since the cost is not uniform, a bullion assay, for example, costing less than a fire assay. The total cost should be apportioned at the discretion of the assayer and reported on a sheet based on Form 5.

Consignments of assay office reagents and glassware should be entered in the store book on their arrival, and the cost totaled. A proportion of the amount, calculated to allow the expense to be spread over the period intervening before the next order, should be charged to 'chemicals and glassware' every month. The yearly stock-taking and calculation of value of a quantity of miscellaneous glassware and deteriorated chemicals is an absurd waste of time. Assay-office 'plant' should include balances, furnaces, and all apparatus, but not perishable articles.

Assay Statement Sheet

For the month ending .... 19..

Department	No. of assays	Cost
Mine		$
Mill		
Outside		
TOTAL		$

Form 5.

Power and Lighting Costs

These should be kept in the same manner as the assay costs, there being no need for wage segregation. A separate 'power' store book should be kept, as in the assay office, and monthly expenditure arranged as in Form 6,

Power and Lighting Costs

Average H.P. generated ......

For the month ending .... 19..

	Total cost	Cost per H.P. per 24 hrs.
Labor & salaries	$	$
Fuel		
Oils, grease & waste		
Sundries		
Repairs		
TOTALS	$	$

Form 6.

the cost per horse-power per day being calculated wherever possible. Power and lighting costs for mine, mill, etc., can then be allocated in their proper proportions. With the data obtainable by the use of the foregoing system, an estimation of total working cost can readily be made. Form 7 is an example of simple method of statement.

Working Costs

Tonnage treated ....

For the month ending .... 19..

	Wages	Stores	Total	per ton
Superintendence				
Shift-men				
Rockbreaking				
Milling				
Fine grinding				
Settlement				
Agitation				
Filtering				
Pptn. & smelting				
Propn. of power cost				
Propn. of lighting cost				
Propn. of assay cost				
Sundries				
Repairs				
TOTALS	$	$	$	$

Form 7.

General expenses should not be included in a statement of working costs. The latter are purely for local use as a means of isolating and checking unnecessary outlay and for the encouragement of the introduction of economies.

A common mistake at the commencement of milling operations is to charge to capital expenditure or construction the complete sets of wearing parts erected with the mill. The error of the proceeding is perhaps more obvious in the case of the ball-mill where a set of liners delivered at the mine often costs as much as $1000. To charge this amount to construction would result in a subnormal run-

ning expenditure for six months or so, and a considerable rise in milling cost when a new set of liners was necessary. These fluctuations would be awkward to explain to the millman; and such occurrences are often the cause of statements of working costs being withheld from those who are in the best position to effect economies. The cost of all wearing parts, whether shipped with the original machinery or not, should be separated from the total; and capital expenditure differentiated from what would subsequently be working cost outlay. This argument applies to rock-breaker spare parts, the wearing parts of any type of milling or grinding machine, and the original cloths or bags sent with vacuum-filters or filter-presses. The probable life of these can always be estimated with fair accuracy until actual data is available. In any case, a faulty approximation is preferable to a faulty system, and less difficult to rectify in the event of error.

Continental Type of Glacial Deposits in Alaska

By Lawrence Martin

*The glaciation of the interior of Alaska forms a striking contrast with the coast, where glacial erosion forms predominate, the deposits being largely under water, except for (1) 1600 square miles east of Yakutat bay, (2) 16,000 square miles in the Cook Inlet-Susitna Valley region, and smaller areas. The interior, between the coast ranges and the Endicott-Rocky Mountain system, where the National Geographic Society's party made some studies in 1911, has extensive glacial deposits of the continental type, previously described in part by I. C. Russell, A. H. Brooks, and others and similar to those of the United States. These include at least (*a*) 15,000 square miles in the Copper River basin, (*b*) 27,000 square miles in the Tanana and Kuskokwim valleys, (*c*) 17,000 square miles in the Yukon flats, (*d*) several thousand square miles on the upper Yukon region in Canada, and smaller areas. The dominant material is outwash, and this extends long distances outside the country actually glaciated. In places, there is windblown loess associated with this. In some localities it is still being deposited, and in the Copper River basin it has been accumulating during the time required for the growth of six or seven generations of trees. There is also some till, but this is largely buried beneath outwash. Lake deposits, eskers, kames, and buried vegetation are also found, but thus far no one has found drumlins. In thickness, some of these deposits rival those of the Middle West, one instance being known of probably 800 ft. of gravel and sand grading out from the mountains to less than 100 ft. fifty miles away. The presence or absence of these drift deposits seems to be chiefly a matter of favorable topography and existing deglaciation, a process much like that formerly in progress throughout the northeastern and central United States.

Filtration With Alundum Plates

Filtration of large volumes of liquids containing very fine precipitates, by means of asbestos fibre and the Witte plate, has been found very inconvenient at times. As substitutes for filter plates and asbestos, disks made of 'alundum' (fused aluminum oxide)* have shown great efficiency. An ordinary flat rubber band stretched around the filter disk or plate makes it fit snugly to the funnel, when suction is applied by means of the filter pump. These plates may be had in several grades with pores of different sizes, those with the smallest pores retaining the finest precipitates perfectly. Their use saves the trouble of preparing asbestos and also makes it possible to stir the precipitates without danger of dislodging the filtering material as when asbestos is used.—*Jour. Amer. Chem. Society.*

*Abstract of paper read before the Geological Society of America.

Tube-Mill Practice and Liners

By F. C. Brown

It is well known that the tube-mill came into the mining industry from the cement industry, and in adapting the machine for the wet-grinding of ores very little change was made in it, considering the very different class of work it was called upon to perform. In cement work the mills are usually of large diameter and the thick silex lining used does not take up an unreasonably large percentage of the working area. This type of lining has a very long life in dry grinding, and the danger of silex blocks working loose is not great.

In wet grinding the conditions under which tube-mills are operated vary tremendously, and the mills and their method of operation require modification accordingly. In some cases the feed is very coarse, and medium or very fine grinding is required, while in other cases the feed is already very fine and the tube-mill is required to produce slime. Some mills are operated with a large quantity of material passing through them, the coarse, or not sufficiently ground particles, being continuously returned to the feed for further grinding; while other mills have a small feed and the material only passes through the mill. One would naturally infer that, in order to meet such a variety of conditions, the following factors in tube-mill practice would have to be carefully considered:

a. Diameter of the mill.
b. Length of the mill.
c. Speed of the mill.
d. Size of the pebbles.
e. Load of pebbles.
f. Percentage of moisture in material being ground.
g. Lining of the mill.

a. Diameter of the Mill.—I have made careful tests with regard to this, and have come to the conclusion that it is a waste of power to use mills of large diameter when the material to be ground is already fine; my idea being that a mill of small diameter and small pebbles are the most economical for such work. For grinding the pulp coming from stamps crushing through wire screens having, say, six holes per linear inch, I have found mills of 4 ft. diameter inside the liners suitable. When finer crushing is done by the stamps, smaller diameter mills would answer as far as economy in grinding is concerned, but such small mills are inconvenient when it comes to relining and repairs. If it is a question of grinding a very coarse feed, say particles up to ⅓-in. diameter, I prefer a fairly large diameter mill, but even for this work a diameter of 5 ft. inside the liners is large enough, provided there is a suitable arrangement for returning coarse particles to the mill for further grinding.

b. Length of the Mill.—For grinding 6-mesh pulp from stamps so that it will pass 200 mesh, mills of 4 ft. diameter and 16 ft. long answer well. At the Broken Hill Proprietary mine of New South Wales, mills 4 by 13 ft. are doing good work in re-grinding tailing that will pass 10 mesh and leave 60% on 40 mesh; the finished product being of a fineness of about 10% on 40 mesh. One of the main objects in this case is to produce a minimum quantity of slime, and it is quite likely that mills of less than 13 ft. in length would do even better work.

Speaking generally, the length of the mill should be determined by the nature of the finished product required. If the object is to slime everything, the mills should be long, but if a granular or sandy product is required, they should be short; and in all cases they should be operated in conjunction with some efficient system of returning insufficiently ground particles to the feed. Two mills run in tandem with a classifying device between them will do better work than one mill of the same diameter with a length equal to the combined lengths of the two mills.

c. Speed of the Mill.—This is one of the most important factors in operating tube-mills, and depends upon the diameter of the mill and the type of lining used. With thick

lining like silex blocks it cannot possibly be correct during the whole life of the lining, as, in a 4 ft. diam. mill, these blocks when new take up 16 to 20% of the cubic content of the mill, according to their thickness. The usual speed for a mill 4 ft. in diam., lined with a smooth liner such as silex blocks or metal plates, is 32 r.p.m., and for a 5 ft. mill, 27 r.p.m. If these mills are lined with metal plates it means taking off 2 in. from the diameter to arrive at the working diameter, which would be 3 ft. 10 in. and 4 ft. 10 in., respectively, giving peripheral speeds of 382 and 407 ft. per minute. With silex liners these speeds would be considerably less, depending on how much the liners are worn. In an article by H. Standish Ball, 'Economics of Tube-Milling,' (*Mining and Scientific Press*, September 23, 1911), the most efficient peripheral speed for a mill 2 ft. 10 in. diam. inside the liners is given at 333 ft. per min (37 r.p.m.), and in the same article he gives the speed of the standard tube-mill used in the Transvaal, which is 5 ft. 6 in. diam. inside the shell, at 31 to 32 r.p.m. Such a mill lined with silex blocks would have a working diameter of 4 ft. 6 in. when the liners are new, and 5 ft. when they are worn and ready to be replaced, giving peripheral speeds of 445 ft. and 494 ft., respectively. In my opinion, this mill is running at too high a speed and the variation of speed due to the wear of the liners shows the unsuitability of silex blocks as liners.

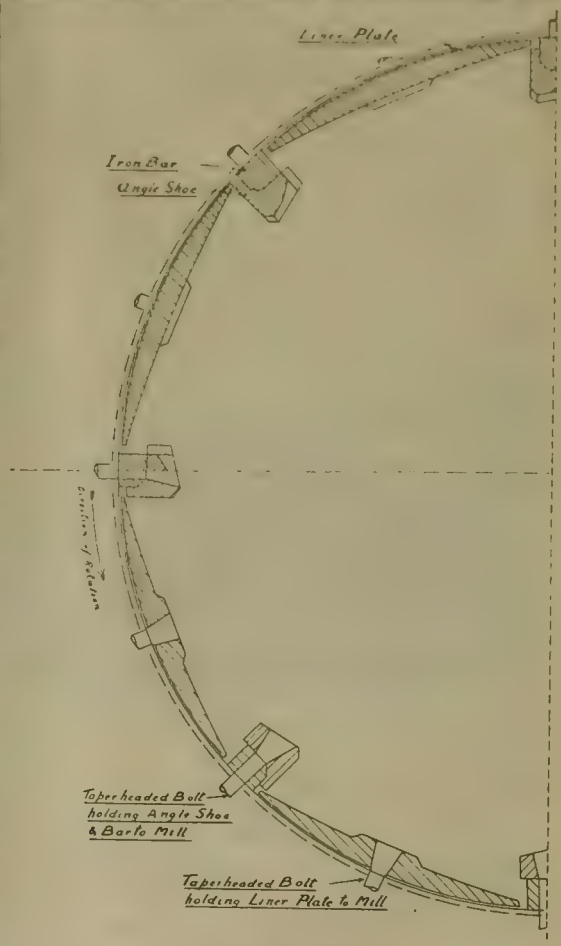
d. Size of the Pebbles.—This should bear some ratio to the diameter of the mill and the kind of grinding to be performed. A mill that has been in operation for some time contains a good percentage of small pebbles, so the pebbles being fed to the mill can be larger than would be correct for a full charge. Pebbles ranging from 2 to 3 in. diam. answer for the usual grinding of pulp coming from stamps. For grinding coarse material, pebbles up to 5 in. diam. are suitable.

e. Load of Pebbles.—There is a great variety of opinion regarding this, but the usual practice is to keep it about up to the axis of rotation when smooth liners are used, although it appears that in the Transvaal the pebble-load for a mill 5 ft. 6 in. diam. is kept at 3 in. above the axis of rotation, according to Ball.

f. Percentage of Moisture.—This is a factor that is influenced by so many conditions that each mine has to find out by experiment what answers best. The percentage of moisture should range from about 38 to 50%, and depends on the specific gravity, coarseness, and nature of the material to be ground. The percentage of moisture has a very marked influence on the grinding, and the eliminating of slime from the feed is also of great importance.

g. Lining of the Mill.—The first mills used for ore were lined with either silex blocks or smooth metal plates, both of which fall far short of being an ideal lining, as the former takes up too much space in the mill, and the later allows the pebbles too much back slip. The improved liners are the Honeycomb, the El Oro, and the various forms of corrugated metal liners, all of which have their distinctive feature of merit, and I have recently introduced in this country a ribbed liner known as the 'Komata' liner (named from the Komata Reefs mine of New Zealand, where it was first used). This liner is now used by most of the mines in New Zealand and has been adopted by the Goldfield Consolidated Mines Co. of Nevada, the Tonopah Extension Mining Co. of Tonopah, and the Associated Milling Co. of Manhattan, Nevada. It has the very important feature of only slightly altering as regards thickness and shape during its whole life, is easily and quickly put in place, has a remarkably long life, and shows a greater grinding efficiency and decreased consumption of pebbles compared with other liners. The nature of this liner is shown by the accompanying sketch. Its adoption requires an alteration in the speed of the mill and also in the load of pebbles. The former should be about 330 ft. per min., peripheral speed, for mills of 4 to 5 ft. diam., and the latter should be 5 to 7 in. below the axis of rotation, repending on the diameter of the mill. These figures are deduced from New Zealand experience, and it will be interesting to see what the results are from tests made in this country. The Edgar Allen American Manganese Steel Co. has the manufacturing and selling rights for the Komata liner.

There are several theories regarding the exact action of the pebbles in a tube-mill which produces the grinding of the sand or ore, some claiming direct impact or impingement as being the most important factor, while others lay stress upon the rubbing or abrasive action. In my opinion, it is difficult to come to any exact conclusion, but viewing the matter from a strictly practical standpoint, I lay the greatest stress upon the *movement* of the pebbles, my experience being the more movement the more grinding; hence



KOMATA LINER.

the advantage of the Komata liner, as this permits of no 'dead' place in the mass of pebbles and ore.

Direct impact is certainly not the only factor in grinding, as I have fed ⅓-in. diam. particles of hard quartz to a 4-ft. diam. mill and they were discharged slightly rounded after the first passage through the mill, but being several times returned, they gradually become converted into slime, and no doubt very fine slime, just what is required with some ores for high extraction. This might be an explanation of the fact that the addition of tube-mills to a plant, even if the ultimate fineness of the grinding, ascertained by sieve tests, is about the same as before the tube-mills were used, often shows a remarkable increase in extraction. It has always seemed good practice, from my experience, to have a certain amount of very coarse sand continuously going to a tube-mill along with the feed, as this materially increases the grinding efficiency.

DANISH pebbles were exclusively used when tube-mills were introduced in America. In fact, the pebbles came from Iceland, being merely distributed from Copenhagen. Now pebbles from many localities are available, and hard ore is commonly used for grinding.

Alamos District, Sonora, Mexico

By G. L. Sheldon

This district is situated in the most southerly part of the State of Sonora, and is reached by a branch railroad from the main Southern Pacific line at Navajoa. Ramon Carral, the former vice-president, was a native of Alamos, and when the concession was given to the Southern Pacific company he insisted that the main line or a branch must be built to Alamos. The surveyors found that they could not get a 1% grade through Alamos, and the branch was therefore built. The altitude of the town is 1300 ft. It is in the foothills on the east side at the base of Alamos mountain, which is 5100 ft. high. This insures a good climate, the best, in fact, enjoyed by any town on the West Coast. The population is 12,000 to 14,000. Alamos is a rather pretty town, clean and with a water system. There is considerable wealth. It is the main supply point for a large agricultural and mining territory. The town is a little over 100 years old. About forty years ago the lower portions next to a creek, which is generally dry and heads six or seven miles above, was swept clean by a winter flood, only leaving the few large *alamos* (poplar) trees, 4 to 6 ft. in diameter that mark the place.

The district contains many mines. West of the town about five miles, on the north side of Alamos mountain, which stands practically alone, are several silver mines. The old Promontorio has been worked, practically continuously, for over 200 years. A *higuera* (wild fig) tree, 2½ ft. diam., can be seen growing in the old mine dumps. These dumps are immense and contain easily one-half million tons. They are sufficiently valuable to warrant re-treatment. It is claimed that the mine has produced 100 millions, but this is probably exaggerated. An English company purchased and worked it for many years, finally selling it to Clemente Ibarra for $14,000; one-half being in goods in the company store, taken at wholesale price some fifteen years ago. Sr. Ibarra tells me, and this is confirmed by his bankers who handled the bullion, that he took out more than $500,000 from the old works without doing a foot of new work. The mine is 800 ft. deep and makes considerable water, which, however, is needed for milling. There are three veins, each 30 to 40 ft. wide, in a width of 200 ft. In depth copper is found. Six or seven years ago Ibarra sold the mine to Texas people for ₱100,000. About three years ago they in turn bonded it with a cash payment, to Los Angeles men, for $100,000. This appears to have been more of a stock promotion than a legitimate mining enterprise, and the property reverted to the Texas owners.

Adjoining the Promontorio, on the north, is the Quintera. Some forty or fifty years ago a Frenchman owned it and the Rosario, a lead-silver property on Rosario mountain where the States of Sonora, Sinaloa, and Chihuahua touch. He had worked the Rosario extensively, the ore being a lead carbonate containing much silver. He finally went to Paris and mortgaged both properties to the Egyptian-Paris Bank for $250,000 and skipped out to South America. He has never been heard from since. After the bank acquired the properties, for many years they sent out each year engineers to examine and report on the property. Finally, about thirty years ago, after several had reported favorably upon the Quintera, work was commenced. The vein is strong on the surface, 18 to 20 ft. wide, and has granite on the east and a dark andesite on the west. It showed low silver values on the surface and 2 to 3% lead. With depth the value of the ore improved, and, under the efficient mine management of Tom Clark, a Cornishman, the mine for years paid $50,000 to $100,000 in dividends, notwithstanding that the general mill management was expensive. The mine is on a hill 700 ft. above the mill. An aerial tram was put in to bring the ore to the mill and a shaft 500 ft. deep sunk at the north end of the property. From this a drift was driven 1300 ft. south, and a winze sunk, ultimately 1000 ft. All of the ore was thus hoisted twice and trammed 1300 ft., when an adit from the mill 2000 to 2500 ft. long would have tapped the winze 200 ft. below the long drift, and the ore could have been trammed in cars direct to the mill. Even when a new shaft was sunk from the surface, this was done near the old one, instead of raising from the winze on the 500-ft. level. The vein at depth, for 20 to 30 ft. in width, would assay 40 to 50 oz. in silver. Lead gave out and copper came in to the amount of 8 to 9%. The copper ore was sorted out and smelted on the ground, using mesquit charcoal at a cost of ½c. per pound. At the 1500-ft. level the vein split. One branch was followed to the east in the granite. It contains no ore of value, and the mine has been idle for years. A few hundred feet north of the shaft the vein enters the granite on both sides and becomes barren. At the south end of the property the ore-shoot appears to be dipping into the Promontorio.

About 3000 ft. north of the Quintera is the old San Domingo mine, with a record of two or three million pesos production. It is 250 ft. deep. This had been idle for many years. Eight or nine years ago Chicago men purchased it for ₱5000. Under the management of J. R. Hendra, a nephew of Tom Clark, it has been well developed and a mill has been erected. This ran last year until the political disturbances shut things down. A good grade of concentrate containing silver, lead, and gold was made. Cement pillars were found in the old mine. The San Domingo is entirely in andesite, which extends for 1000 ft. south. North of the San Domingo for 1½ miles, the vein is also in andesite. There it has been worked little and to no great depth. At the north end is the Minas Nuevos, better known as the Zamboni. It is entirely in the andesite. This was purchased several years ago from Zamboni by California men. A complete up-to-date plant with Pachuca tanks is in operation. The company is treating old tailing together with ore from the mine. The latter is about 400 ft. deep. The vein is 20 to 30 ft. wide and contains on an average 24 oz. silver, with some lead and lime. The latter makes it difficult to obtain good results with cyanide. Gold bonds have been placed upon the property, to the extent of $250,000, for its development and for building the plant. The mill and mine are within a few hundred yards of the railroad with a switch to it. North of this the vein runs into the granite, and is barren.

Three miles south, at Minetas, on the same 'mother lode', is an old mine idle for many years. Within the last three years several discoveries and many locations have been made to the north, connecting the work with Bacauri. The La Junta mine, a recent discovery on the flat, is owned by a dozen Mexicans, and during the first six months shipped $65,000 worth of ore. It is developed to a depth of 100 ft. At this level one breast, sampled by people who had an option, was found to assay $700 per ton. When, however, the men having the option had made up their minds to take the property and presented a certified check for $20,000 as first payment, the owners refused to accept it, the option having expired at midnight previous, and doubled the price. No one has been able to buy the mine and the owners divide the ore on the dump. Recently C. W. Smith, who has a 10-stamp mill within a few hundred yards, has been milling second-class ore on shares; with very satisfactory results. Mr. Smith, representing Chicago men, is developing a 75-ft. vein by shafts and hoists. The vein is somewhat split up in this vicinity.

Two miles north, McCarthy and Wilson are developing a promising prospect at 200 ft. in depth. They have 12 ft. of 1-oz. gold ore and have made arrangements to put on a mill. Near them is a prospect that sampled on the surface only $2, but which at 20 ft. in depth shows $10 ore. It appears more than probable that a nice gold belt will be developed here.

Thirty-five miles north of Bacauri, on the Cedros river, is the town of Cedros. Two miles west is a large iron property, the ore being exposed in a small hill 250 to 300 ft. high, and the outcrop being several hundred feet wide. It can be traced for over three-fourths of a mile and shows heavy black oxide, high-grade, and said to contain $4 in gold. Fifteen miles north of Alamos on the

main wagon road is the Piedras Verdes copper property which has been examined by many engineers. It makes a great showing of oxides and carbonates on the surface. Soon after location twelve years ago several tons of high grade boulders of copper oxide was picked up from the surface and shipped. The vein can be traced for several miles and some 1200 *pertenencias* were located upon it. The Mexican owners went half a mile east of the main best surface showing and sank a shaft 347 ft. deep. Off from the vein several hundred feet north a shaft 250 ft. deep was also sunk on the best showing. They did a good deal of gophering on the high-grade oxide streaks underground. Later some Boston people drove an adit in on the west part, finding a body of iron pyrite. Three years ago Seeley W. Mudd drilled several holes on the property, but did not take up his option.

Two miles further north is the Copper Queen. It is in the schist with a conglomerate and porphyry nearby. The deposit is 90 ft. wide and about 500 ft. long. Some high-grade ore has been shipped from the surface, but no development to any depth has been undertaken. The property was examined eight years ago by a prominent mining engineer and strongly recommended, but satisfactory terms could not be made with the owner. A few miles east of this

CHURCH BUILT IN 1531 AT QUEIRAGO, ALAMOS DISTRICT.

FREIGHT TRAINS ON THE CHIAPAS ROAD, NORTH OF ALAMOS.

is a group of other copper prospects in the porphyry. Nine miles north of Minas Nuevos and within three or four miles of the railroad station Victoria is an iron property in the limestone. The Quintera company obtained iron for flux from this. It contained sufficient silver to pay the cost of working. There are places in the deposit showing considerable copper, but the iron is dense and heavy.

Northeast of Alamos, sixty miles on the road to Chinipas, not far from San Bernardino and near the State line of Chihuahua, has been discovered during the past year and a half, a large low-grade gold and silver prospect. One hundred claims have been located upon it, extending for several hundred feet in width. It is claimed to contain $5 to $7. About twenty miles east of Alamos, near Plomitas, are several old lead-silver mines in which a little development has been done in recent years. Ten miles farther east is the El Cobre mine, worked by Frederic Erbe twenty to thirty years ago. He put up a small furnace and shipped considerable matte. The vein is entirely in the porphyry. During recent years some work has been done to a depth of 150 ft., at which depth a stringer from the main vein showing copper sulphides was cut. Six to seven miles southeast is the Copper Iron King property with a large hematite gossan impregnated with copper. This contains small amounts of gold and silver. The property is practically undeveloped and apparently lies in porphyry, but it has the marks of a copper mine. At about the same distance southwest, at La Mina, is another copper prospect which makes a good surface showing. A small limestone mountain 500 ft. high and about the same distance in diameter is covered with a burnt, honey-combed iron gossan containing a little copper carbonate. Not a shot has been put in it. On the south side, however, a shaft has been sunk 100 ft. in the porphyry on a 4 to 6 ft. vein, probably only an offshoot from the main deposit. This shows good ore with 6 to 20% of copper sulphide. A long cross-cut run 350 ft. below on the south side has never reached the vein or deposit. The company ran out of funds and quit before this was completed.

Ten to twelve miles still further east of this place, at Piechi Cuata and Sabina Cuata (the latter named from two *sabina* or savin trees which at 40 ft. in height unite) is a small gold district, that extends over into Sinaloa. The Arendia gold mine, after producing $12,000, was sold to Denver people for $20,000. They put up a 10-stamp mill, but never developed the ore-shoot from which the former owner took ore. The mill has been idle several years. At Sabina Cuata during the past fifteen years some desultory work has been done on several prospects but not sufficient to determine their value. This side of Piechi Cuata is the Babahuahua creek which, for twenty miles including its left-hand fork, carries placer gold. I had a zone on the upper portion of it prospected fourteen years ago, but would not locate it, since at that time there had been several hundred thousand dollars spent on the creek without result. Expensive machinery had been brought in and long bedrock ditches run. One Belgian company, after spending $30,000 for machinery, sent a California placer expert to examine the property, and after receiving his report they quit. A Kansas City company put in a centrifugal pump and cleaned up bedrock in several places, obtaining $1200 worth of gold at a cost of $28,000. A Cripple Creek company sold stock all over the United States and in the City of Mexico and did some ditch work in order to clean bedrock. They never made a dollar except from the sale of stock. There is a little gold everywhere. The natives have worked it for hundreds of years. What is left is only what they could not get on account of water. The grade of the creek is too light for sluicing or hydraulicking. As to dredging, the bedrock is a rough ragged diorite, with many large boulders. It is doubtful if any profit can be made here. So far the source of the gold has not been recognized. The country rock is granite, quartzite, diorite, and andesite. A few small gash veins in the granite have been found.

There are numerous copper veins in Alamos district, mostly in the porphyry. These generally show good surface value, and some small lots have been shipped and others sold to the Quintera company. None have been sufficiently developed to determine their permanence, or their value in the sulphide zone. There are a few iron gossan deposits that ought to make copper mines. It is certain if they were in Arizona the showing would be sufficient and they would have been proved long before this. There are many other prospects in the district, some that I have seen, many others which I have not. This is only an outline. Practically all of the production of the district has come from the 'mother' vein. There is a nitrate of soda deposit which possibly with development may prove of commercial value.

Alunite Near Marysvale, Utah

By B. S. Butler and Hoyt S. Gale

*An important deposit of alunite, which has but recently been discovered in Utah, is now being developed with so favorable a showing that it promises to afford one source of the much desired class of materials commonly referred to as potash. Although a large vein of 'pink spar' in the hills southwest of Marysvale had long been known to prospectors and had been repeatedly located for small metal content said to exist in the silicious wall rock of the vein, it was not until 1910 that the true nature of the spar was discovered. Specimens sent to the United States Assay Office at Salt Lake City in November 1910 were later forwarded to an Eastern chemist, who is said to have recognized the real value of the material. On January 1, 1911, the claims that had been allowed to lapse were relocated for the sake of the newly recognized deposit.

The Deposit as a Source of Potash

Alunite has long been used abroad as a source of potash alum, which it resembles in chemical composition. The alunite contains a relatively larger proportion of alumina that the common potash alum. It is insoluble, but is readily converted to either the soluble potash alum or potassium sulphate by a comparatively simple process of heating, or calcination. A process that has long been established commercially may doubtless be adapted to the American deposits. The Marysvale deposit, so far as now known, is not of such magnitude as to afford a source of all the potash salts now consumed in the United States, but it may prove to be an important factor in providing an American supply that will perhaps be especially available to local and Western markets, particularly in meeting the demand for higher-grade salts. Possibly also the greatest importance of the commercial development of this deposit will be in the added stimulus it may afford to exploration for other similar deposits of this mineral, especially in this general region, and it is on the discovery of such other deposits that the provision of a home supply from this source must depend.

The newly discovered deposit of alunite is situated near the head of Little Cottonwood canyon, about 7 miles due southwest of Marysvale, Piute county, Utah. It is situated in and near Sec. 16, T. 28 S., R. 4 W., and so far as known is covered by mining-claim locations. Marysvale is the present terminus of the San Pete & Sevier branch of the Denver & Rio Grande railroad. The deposit lies high in the Tushar range, outcropping near the top of the ridge separating North Fork of Little Cottonwood creek from the main branches of Little Cottonwood canyon. The vein and silicious wall rocks form the crest of the high ridge leading up to the main divide. The deposit ranges in elevation from approximately 11,000 ft. above sea-level to about 9900 ft. at its present recognized lower end, which is about 4000 ft. above the railroad at the Marysvale station.

Character of the Vein

The alunite of the Marysvale deposit lies principally in a large banded vein, cutting at steep inclination the volcanic rock (dacite or andesite) which forms the greater part of the Tushar range. The large vein is evidently a fissure filling and not a replacement of the country rock, as the main body of the deposit is remarkably pure, and has the banded or crusted structure of a typical fissure vein. That replacement has not produced the larger bodies of alunite is further attested by the fact that the main vein contains but little silica, while in the wall rock where replacement has occurred the quartz phenocrysts remain practically unaltered, and silica that has been set free from the decomposition of other minerals has not been removed.

Character of the Alunite

The larger bodies of the Marysvale alunite are of unusual size and notably free from foreign material. The mineral occurs in massive form, being in part a fine-grained compact rock, breaking with conchoidal fracture, and having a porcelain-like appearance, but containing also considerable masses with a distinctly crystalline structure. A considerable part of the vein material at the outcrop, however, is more or less of an amorphous texture and commonly sheared to a foliated or schistose structure. The crystalline material is generally clear pink to reddish in color, and the finer-grained rock varies from a white to a decided pink. The fine porcelain-like material, in which analysis shows the presence of 9.7% K_2O, is seen under the microscope to be a granular mass composed of irregular crystals of alunite. Through this fine-grained material are scattered small veinlets of more coarsely crystalline alunite. The coarsely crystalline portion of the deposit, which contains 10.46% K_2O, shows the more distinct crusted structure. The crystals are subtransparent, show a distinct cleavage, and are of a rather coarse granular or tabular form, yielding a splintery fracture in the mass of the rock. The elongation of the crystals, though showing a tendency toward radiation in tufts, is, however, roughly parallel and is normal to the vein banding and the walls.

Extent of the Marysvale Deposit

The principal claims located on the Marysvale alunite deposit are the Custer group, shown by the accompanying figure. The group of claims adjoins patented mineral ground and recorded claims both to the northwest and southeast, as is indicated on the map. The Custer group covers the greater part of the alunite deposit as now recognized, the first location made expressly for the alunite having been staked January 1, 1911. Property to the northwest of the Custer claims is said to be covered by mineral locations under the control of the Florence Mining & Milling Co., lessee of the Utah Gold Mountain Mining Co., including the so-called Log Cabin property and also the patented ground known as the Bradburn property. Southeast of the Custer claims is the patented ground of the Clyde property.

A conservative estimate of the tonnage in this deposit may be had by assuming an average width of 10 ft. in the principal vein for a total length of 3500 ft., and neglecting the rest of the deposit as not sufficiently proved to be taken into consideration at present. If the recoverable potassa or potash (as K_2O) is estimated at 10% of this total, such a deposit would yield 30,000 tons of potash for each 100 ft. in depth. This is approximately one-sixth to one-seventh of the total annual consumption of potash in the United States.

Suggestions as to Prospecting for Alunite

Until recently there has been no incentive to search for alunite, and most of the known occurrences in this country have been noted by geologists who were making studies of the areas where it occurs. There is little doubt that if prospectors had searched for alunite with the same diligence that they have shown in their search for the metallic ores, a far greater number of occurrences would be known. Since it was shown by F. L. Ransome that alunite is associated with the rich gold ores of Goldfield, Nevada, it has attracted more attention, and if the mineral itself proves to be of commercial value the search for it will be still further stimulated.

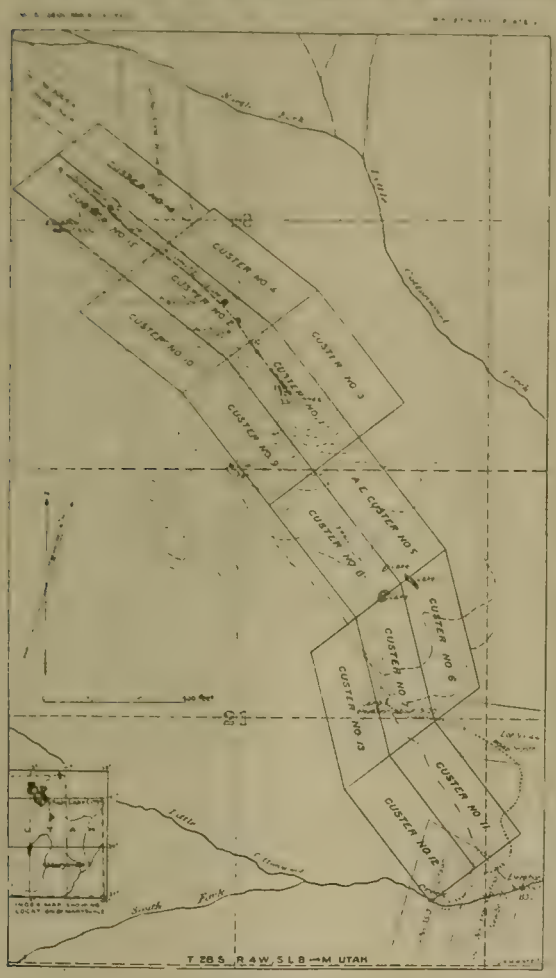
In the case of a mineral whose occurrence has been studied in so few places, it is impossible to give a definite and positive statement of the conditions under which it may be expected to be found; or if such a statement were made it would probably be modified by future discoveries. The study of the occurrences thus far described, however, does point rather definitely to certain conditions under which the mineral may form, and the conclusions derived from this study may therefore aid in a further search for it. There are at least two distinct conditions under which the mineral is deposited:

1. It may be formed by the action of descending acid solutions, derived from the oxidation of sulphides, on potassium-aluminum silicates (feldspars or micas). Several occurrences have been noted where the mineral is thus asso-

*From Bull. 511, U. S. Geol. Survey.

ciated with oxidized ores, usually in or close to feldspathic rocks, and a more careful examination of material that has been called kaolin and talc will doubtless show some of it to be alunite. As yet no body of this type that promises to be of commercial importance has been discovered, but it is by no means impossible that such bodies exist, and large bodies now described as kaolin and talc, but not definitely known to be such, may well be tested to determine whether they are not alunite. It may be stated in this connection also that the closely allied mineral jarosite has been noted in the oxidized zone of several orebodies, and this mineral, too, may in some places occur in considerable abundance.

2. The deposits that at present give the greatest promise



PRINCIPAL GROUP OF CLAIMS, MARYSVALE, UTAH.

of commercial importance have resulted either from the action of hot waters carrying sulphuric acid on rocks containing potassium-aluminum silicates or from the deposition in veins from ascending thermal solutions. In the former type the resulting alunite is largely disseminated through the altered rock, though small veins of nearly pure material are not uncommon; in the latter type, as shown in the Marysvale deposit, it has been carried in the solutions and deposited as a large vein. The deposits of these types thus far discovered have been in or closely associated with the extensive bodies of Tertiary igneous rocks that are abundant in the Great Basin and Rocky Mountain region. In connection with the alteration that has produced the alunite, there has been a silicification of the rock which has rendered it resistant to weathering, and the outcrops are usually rugged, standing above the surrounding rocks. Pyrite is also commonly formed in the wall rock during the alteration, and in places the oxidation of this mineral at the surface imparts an iron stain to the outcrop.

As has been pointed out, it is believed that the Marysvale deposit is closely associated with metallic veins of a type widely distributed through the Western states. It is certain that in some of the districts where such veins occur alunite is not present, at least not in important amounts, but it is by no means improbable that it may be found in other districts, and an examination of supposed 'spar', 'talc', or 'kaolin' veins may show the presence of the mineral. Although it may be expected to occur in districts with metal veins and is believed to be closely related to them in origin, the alunite deposits themselves may not contain important metal values, as is indicated by the Marysvale deposit and the two Colorado deposits that are known. On the other hand, as at Goldfield, it may be closely associated with the metallic deposits. In the Tushar and neighboring ranges there are reported to be numerous silicified vein outcrops described as 'geysers', which on examination may prove to carry alunite or other salts of commercial importance.

Field Test for Alunite

The following field test for the mineral alunite has been suggested by W. T. Schaller: Boil the powdered sample with water or with hydrochloric acid for several minutes; after allowing the powder to settle, pour off the liquid and repeat the operation to insure the removal of all soluble sulphates. Dry the powder and heat to a dull red. Again boil in water and, after settling, pour off some of the clear liquid. To this add a small fragment or a solution of barium chloride. If the mineral is alunite a heavy white precipitate will form. To be sure that the water used in this test does not contain sulphates in solution, it should be tested with barium chloride, and if it gives a marked precipitate it cannot be used. For this test, all that is required that is not included in a miner's or prospector's outfit is a little barium chloride, which can be carried in a small bottle or cartridge.

Warning to Investors

Deposits may exist on ground adjoining the claims already located and partly developed, but it should be borne in mind that the present developments have not yet proved the continuity either in depth or even with certainty for a very great distance on the surface. Prospective investors should understand that until the true character and commercial availability of a deposit of this type has been demonstrated, they are taking chances in investing in the stock of any company professing to be about to develop such a deposit. The Geological Survey has been assured on reliable authority that the property covering the best-known part of the alunite deposit which is described in the foregoing pages is not for sale, and its owners are not in need of assistance, financial, technical, or otherwise, for the development of the property to its best advantage. It should be unnecessary to say to anyone who is familiar with the usual procedure in such an enterprise that if responsible persons have secured control of a deposit which offers large and unusual promise but whose actual commercial value is not wholly proved, it will not be necessary for them to advertise widely for contributions or express a willingness to distribute large quantities of stock, if they actually intend to develop the property on a commercial basis. Such a procedure should of itself be a warning to any who may be contemplating an investment of this character.

Growth of the copper industry in the United States has been notable, according to the figures of the United States Geological Survey. In 1850 the production was 1,456,000 lb.; in 1890 it was 259,763,092 lb.; in 1900 it had increased to 606,117,166 lb.; in 1905 it was 901,907,843 lb.; and in 1909 it had passed the billion mark with 1,092,951,624 lb., decreasing in 1910, however, to 1,080,159,509 lb. The price has decreased from over 46c. per pound in Civil War times to an average of 12.7c. per pound in 1910. The United States is by far the largest copper producer in the world; in fact, it produces more than all the rest of the world together.

Labor Conditions in Arizona Smelters

B. W. J. Lauck

Only about three-tenths of the employees in smelters in Arizona are native Americans. Six out of every ten are Mexicans. The remaining one-tenth is composed of immigrant workmen from Great Britain and northern Europe, the English, Irish, and Scotch being represented in largest numbers. Such is the racial classification of employees of smelters in Arizona disclosed by the recent investigations of the United States Immigration Commission.

Almost one-half of the Mexicans employed in the Arizona smelters have been in the United States less than five years, and three-fourths have a residence in this country under ten years. The majority of the English, Irish, German, Scotch, and Swedish wage-earners, on the other hand, have been here ten years or over, and a considerable proportion for a longer period than ten years. Unlike the southern and eastern European employees in Colorado and other states, the foreign-born workers in the Arizona smelters, due to the preponderance of the Mexicans and the presence of the British and northern European immigrant, have, as a rule, their wives with them and maintain an independent form of family life. Practically all of the German and Swedish employees of foreign birth speak and read English. On the other hand, only 8% of the Mexicans speak English, and less than 5% read and write the language. In the same connection it may be stated that only 5 out of a total of 208 Mexican smelter workers for whom information was received by the Immigration Commission, had become citizens of the United States.

Of the native white American workers in the Arizona smelters about one-tenth were foremen, one-fourth were engineers or mechanics, and only about three-fifths were general laborers. Considerable numbers of the English-speaking immigrant employees were foremen or mechanics. One out of every ten Mexican employees who had been born in the United States were engineers or engaged in mechanical work. All of the foreign-born Mexicans as well as the native negroes were unskilled laborers. The hours of labor at the smelters ranged from 8 to 12 per day. The furnacemen, feeders, tappers, punchers, vanner and jigmen, and helpers worked 8 hours, as did the engineers, motormen, and firemen. Some mechanics worked 8 hours, some nine hours, and others 10. General laborers worked from 8 to 12 hours, but most commonly 8 or 9 hours.

Wages ranged from $1.50 per day, the rate received by over 40% of the Mexicans, to more than $8 per day, which was paid to a few of the foremen. General laborers were paid wages varying from the lower rate named to $4.32 per day. Few, however, received more than $3.50. Of the Mexicans employed as general laborers, 87% were paid less than $2.50 per day; while of the foreign-born other than Mexicans in this occupation group, 85% received more than $2.50 per day. The great majority of the general laborers of the native American and the north European races received from $2.50 to $3.50 per day. The differences in the wages paid the Mexicans and those paid native-born and north Europeans employed as general laborers are partly due to differences in the places held by individuals of these races as general laborers, but they are largely accounted for by discrimination against the Mexicans in the payment of wages. The wages paid engineers and mechanics ranged from $2.55 per day paid car-repairers, to $4.75 paid some of the engineers. Blacksmiths, as a rule, received $3.50 per day; boiler-makers, $3.75; carpenters, machinists, cranemen, and bricklayers, $4; tinsmiths and iron-molders, $4.25. Foreman received from $2.75 per day paid to the foreman of the re-lining pit at one smelter, to more than $8 per day paid the foreman of the concentrator at another.

The grand total of excavation for the Panama Canal to January 1 was 158,092,940 cu. yd., leaving 37,230,439 cu. yd., one-fifth the entire amount for the completed canal.

Peruvian Mining News

Chucuitambo Gold Mines.—The cyanide plant for the mines of this company at La Quinua, Peru, was expected to be ready for operation by the middle of January. It is of 120 tons daily capacity, and it is believed that ore can be supplied at present up to 75% of this, as development has been going on steadily while the plant was being constructed, shipments having been reduced below the figures of a few months ago in consequence. The saving of 85% which is counted upon in place of the 66% previously made, together with the known richness of the ore, should make this a steady dividend payer.

Ferrobamba.—The whole of the resources of the Ferrobamba company are being concentrated on proving the property as quickly as possible. Prospecting work is being carried on more vigorously than ever, and some fifteen faces are being driven. At the present rate it should not be long before the owners can arrive at a determination as to the building of the railway to connect with the Southern, and in general as to the future operations to be conducted. This property has aroused more discussion than any developed in Peru since the Cerro de Pasco Mining Co. was organized.

Andaray-Posco.—The Sociedad Aurifera Andaray-Posco, Ltd., operating in the Province of Condesuyos, with a paid-up capital of £50,000, is now making very good prgress under the able management of Robert P. F. Prain. In November the president of the company, Don Gil Galté, and another director visited the property and were pleased with its present condition. The 3-kilometre canal is practically finished, so also is the dam and intake. The new plant which lay in Chira for close on four years, is now at the mines, and erection work will be started as soon as the necessary timber arrives, which will be in about a month's time. Since January 1911 the probable ore reserves have been increased by about 5000 tons.

Cerro de Pasco.—The Cerro de Pasco M. Co. has now had in operation for some months its new 20-ft. long Pierce-Smith basic-lined converter, and the basic-lined ball-type converter designed by the late Charles F. Shelby while superintendent of the smelter. These two modern converters take the place and do the work of the battery of six acid-lined bessemer converters formerly in use, with marked economy. In the new types the lining remains good over several months of use, and when it is burned out it is readily renewed.

Moquegua is an old Spanish city in the heart of a rich olive and grape country, and the terminus of the Ilo-Moquegua railway recently acquired under a 25-year lease by the Peruvian Corporation. The city is situated among the coast hills about 100 kilometres from the port. A spur of the main range of the Andes rises abruptly from the low coast range some 10 kilometres east of Moquegua, whence very rough and mountainous country continues back into the interior. A considerable amount of Bolivian trade passes through this region, taking two months for the journey with llamas. Forty-five kilometres to the northeast of Moquegua lies the promising mineralized region of Sipincallani, where vein mines have been worked extensively by miners of the Spanish colonial period. Important deposits of pure native sulphur in this same region indicate great volcanic activity at some past time. A bed of volcanic tufa at one time has covered the entire district, but exists today only on the hilltops. There appears to be an extensive low-grade copper deposit in sandstone, the value of which, however, is problematical, considering the topography of the country. Beautiful stalagmites and stalactites are found in caves, and the stream beds show the effect of much leaching. It is a field which justifies the prospector's attention.—*Peru Today.*

Production of antimonial lead in the United States in 1910 was 14,069 short tons, valued at $1,338,000, as against 12,896 short tons, valued at $1,231,019 in 1900; and 13,629 short tons, valued at $1,264,771, in 1908.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Central American Mines in 1911

The Editor:

Sir—In an article by T. Lane Carter on Nicaragua, in your issue of January 6, speaking of the dip of the vein, he says that the title to deep-level claims is uncertain, but that it is probable that the Government will change the law in this regard. Let me point out that the revised (Sept. 26, 1911) mining laws of Nicaragua were published in your issue of November 4, 1911, where the changes made relating to the dip are given.

SYDNEY ADLER.

New Orleans, January 15.

Costs at Arco, Idaho

The Editor:

Sir—The correspondence from Arco, Idaho, on page 116 of your issue of January 13 interests me: I cannot, however, make the figures check out, and as I have a prospect containing similar ore, I would be greatly obliged if you can enlighten me.

23% lead (@ 4½c (N. Y. price)	$20.70	
With 2 oz. silver and 15c. gold	1.15	
Gives gross value of ore, as stated, of	$21.85	
80% recovery equals		$17.31
The concentrate, running 50% lead and 5 to 6 oz. silver, figures a concentration of about 3 into 1.		
Cost of mining and milling 3 tons (@ $1.50	$ 4.50	
Cost of freighting 1 ton (@ $3.25, plus 25c. for moisture	3.50	
Cost of smelting 1 ton	5.80	
Total cost on 3 tons ore	$13.80	
Or say $14.89 as given, or say $15.00, gives cost *per ton of ore*		5.00
Leaving a profit per ton of ore of		$12.31

It is plain that $21.85 gross value less $14.89 total cost leaves $6.96 as profit (your correspondent's figures), but this does not seem to solve the problem.

The pickings from the belt of the high-grade ore may account for the difference between my conclusion, $12.31, and that of your correspondent, $6.96 per ton; but, on the other hand, the average value of the ore is apparently the basis of his figures, as it is of mine. I am inclined to believe the $6.96, as the lower figure, more nearly the correct net value of the ore, as the lead is figured rather high—though not too high, perhaps, seeing there is a smelting charge made for an ore that smelters will treat free of charge if an allowance is made on the price of the lead for getting it to the New York market.

GURDON BRADLEY.

Berkeley, California, January 19.

Precipitation of Copper From Mine Waters

The Editor.

Sir—The article, 'Precipitation of Copper from Mine Waters', contained in your issue of November 18, invites comment and correction—certainly here in Spain, the 'home' of the ancient process. Important matters are referred to in it in a didactic yet incorrect manner, and it is abundantly evident that the lapses have been occasioned through the ignorance of the writer of the article in question of certain well known and recorded facts of historical mining science, both in America and in Europe. I say America advisedly, because those facts were current there in the seventeenth century. An equally public correction of such erroneous statements is certainly due to the public in the interests of technical journalism and of proper record, more particularly as they have appeared in such a valuable means of distributing information and of important scientific knowledge as the *Mining and Scientific Press*.

The second paragraph of the article under estimation has it: "*Twenty three years ago* 1888) the making of copper *through* the employment of mine-water (*sic*) *was unheard of*, and it is difficult to say how much copper went to waste in the early days through failure to use this method. *A Welshman named Morgan was the discoverer.* In 1880 while living near the gulch through which ran the waters from the Anaconda and St. Lawrence mines, he noticed that tin cans thrown into the water disappeared, leaving a dark-red sediment in their place." Quite an observant person, but that simple fact had also been observed and reported by one Diego Delgado, elsewhere, in the year 1556!

The third paragraph makes manifest that William Ledford, in *1901*, "was the first to put copper precipitation on a business basis"! This is the class of 'scientific-historic' rubbish served up to us by Floyd Bushnell, of California [!] in his 'dichoso' article. It may be advantageous, if not interesting, to your readers to know what the records of Spain, of mining science, have to say about this same "production of copper by precipitation" through the employment of 'mine-water', or vitriolous liquors. It is to be surmised that the writer of that article does not make reference only to California [!] for the ultimate paragraph contains a more or less detailed notice about the precipitation or *cementacion* of copper liquors at Rio Tinto, in Spain.

It is sufficiently well known in Europe that this process of the precipitation—in Spanish *cementacion*—of copper contained in vitriolous waters was patented and practiced at Rio Tinto as early as the sixteenth century. And yet we are now told through the medium and substantial authority of the estimable and widely read *Mining and Scientific Press* that it was *discovered* by a *Welshman* a few years ago in *North America!*

[1]According to the Official Record, the following operations took place at Rio Tinto on the 9th of May, 1752, and following days (translated):

"Note of iron placed in the *canales* or cementation tanks on that day at 12 o'clock noon and on the following days:

		Arrobras.	*Libras.*
'Planchuela de Viscaya.'	Sheet iron	24	1
'Hierro Viejo.'	Scrap iron	6	21
Dia 10, á las 11 del dia		2	7
" 15, á las 7 de la tarde (p.m.).	Sheet iron	49	2
" 16, á las 7 de la mañana (a.m.).	*idem*	3	14
" 19, á las 7 de la mañana (a.m.).	*idem*	23	24"

The well recorded history of this process may be recapitulated thus: Basil Valentine, who wrote about 1500, in his instructive *Currus Triumphalis Antimonii*, indicates this method of the extraction of copper.

It was in practice in the Lower Hartz until the middle of the sixteenth century, when it was substituted by another process, as took place at the Mines of Rammelsberg on the banks of the Oker.[2]

Alonzo Barba[3] describes this process as it was in operation in Peru before the year 1637.

In 1661 a *licencia* was granted by the Crown[4], at Madrid, to Alvaro Alonso de Garfias; whilst in the year 1695 a similar privilege was conceded by the same authority to Rogue Salas y Ulloa: to extract the copper from the vitriolous waters of Rio Tinto.

The same process, or the precipitation of the copper contents of 'mine-water' by placing iron in it, has also been treated of and described by Hermann, Figueroa, Heron de Villapose, Guenyvean, and others.

[1]Figuier, *'L'alchimie et les alchimistes.'*
[2]Schlutter, *'De la fonte des Mines,'* Vol. 2.
[3]Alonzo Barba, *'Arts de Met,'* I, 121.
[4]Nash, 'Hist. of the Rio Tinto Mines,' p. 140.

And now we are informed, in *1911*, bluntly and dryly, that a *Welshman* was the *discoverer* of the process of precipitation of copper by iron, in California [!] in the year *1880!* And as to Ledford's being "the first person to put copper precipitation on a business basis", from 1788 to 1799 some 185 tons of copper precipitate were produced at Rio Tinto; from 1800 to 1828, 497 tons; and from 1829 to 1849, 3166 tons of precipitate, by this same process. At the same place the product of the years 1849 to 1862 was 5104 tons of precipitate, and from 1862 to 1872, about 10,193 tons. The last paragraph of this article contains the very venturesome affirmation "that the water (of Rio Tinto) runs as high as 0.2 and 0.3% of copper." But if that implies a distinction of class of cupriferous waters, then to what two classes does he allude? There necessarily are various classes of copper liquors—'mine-water' is the happy phrase of Mr. Bushnell—all of various grades of percentage of copper.

But what is equally surprising is the allegation made also in the last paragraph of the article under examination, that "the water from the Rio Tinto mines, *after* having run through the precipitating plants, is as strong as the water coming from the Butte mines." Presumably he means us to infer, as to these latter, in their untreated state. This is quite in harmony with the other allegations. But if that actually is so, then the shareholders of the Rio Tinto company can with good reason charge the local management with a wicked waste of copper: for the inference is that a certain quantity of copper is daily being lost because of unskillful treatment and of wasteful supervision! But fortunately for their pockets, and, too, for the credit of those engaged in the huge work of *cementacion* or precipitation as at Rio Tinto is performed, *that is not so.* The final passage: "that the water (at Butte) after it passes the last precipitating plant, shows the exceedingly small percentage of 0.0002 of copper", should be very satisfactory to the Butte interests—*if that actually is the case.*

W. G. NASH.

Minas de Rio Tinto, Spain.

[Our correspondent's letter is of so much interest and contains statements of so much value that it can scarcely be regretted that the limitations of his knowledge of American geography and local history have led him into some misconceptions regarding the article in question. Mr. Bushnell's opening paragraph disclosed the fact that he was discussing copper cementation at Butte (a place which, we may add for the benefit of our correspondent, is in Montana, as far from California as Rio Tinto from London). There, strange as it may seem, the cementation process was for some time actually unknown, though it had been so long practised elsewhere. The history of the early mining and metallurgical development of American mining districts is, in many cases, only preserved in the memories of the pioneers, who frequently disagree as to details, but there seems little doubt a citizen of Butte, knowing that copper could be precipitated from its solutions by the use of metallic iron, actually discovered the feasibility of precipitating metallic copper from the water which had for years been pumped from the mines of the Butte district and allowed to escape. The apparent analogy between this and the work at Rio Tinto dissolves upon close examination: in the latter case the operator is dealing with a comparatively strong liquor resulting from metallurgical operations, while in the former a dilute natural solution, relatively free from the arsenic, antimony, and bismuth which interfere with complete precipitation at Rio Tinto, is employed. It is well known that the *salida* which is allowed to run to waste at Rio Tinto contains an appreciable percentage of copper, and it should be equally obvious that it is thus allowed to escape because, under the local conditions, it is uneconomical to attempt a more complete precipitation. Mr. Bushnell's paper is of much value because of the quantitative statements regarding Butte practice it contains, and we hope that those of our readers who are in possession of such data will correct any errors of fact, if such exist.—EDITOR.]

[5] *Ibid*, appendix.

Conservation of Investments in Gold Mines

The Editor:

Sir—I have read the criticism by Charles Janin in your issue of December 16 on my article which appeared in the issue of December 9. In the criticism the conservation of dividends in the protection of capital by a mining directorate is deprecated; in fact, Mr. Janin states that such a policy is usurping the function of those authorized by the laws of the land for the protection of imbeciles. The substance of the criticism is evidently the idea that an investor in a mining company has the right to look after his own money and the profits therefrom. Such an idea is theoretically ideal, but, like innumerable other theoretical ideals, it is sadly wanting in practical application. A mining company is not a mechanical collection of units in the shape of shareholders; it is a unit in itself and a policy that conserves the welfare of this unit will likewise conserve the interests of the component parts. Without presuming on the space of your serious paper, by the use of such sarcasm as Mr. Janin employs, I might briefly point out that our viewpoints are far from coincident. That of Mr. Janin is evidently from the little shareholder, thence to the public company. I believe the welfare of the company is primary, and if competently managed and its capital amortized the industry from a broad viewpoint is benefited and, as a *sine qua non*, the collective and individual interests of shareholders.

The Oroya Brownhill during its productive life built up a cash reserve of over $2,000,000. This property, as those interested in English mining companies will know, was one of the most famous gold producers in Australia. When its ore resources became curtailed, these funds were applied to the purchase and development of two other properties, the Oroya Black Range and the Oroya Links. The success of these latter enterprises can be substantiated by a little investigation. The exhaustion of the orebodies of the parent mine was, therefore, countered by the substitution of two other mines of present earning power and indications of future life. The Camp Bird mine is now practically exhausted, but the prospect of the successful continuance of the company, Camp Bird, Ltd., is excellent; the large cash reserve being utilized in the purchase of the Santa Gertrudis mine. Instead of the shares being quoted as worthless, as is usual with most mining enterprises when their ore resources are exhausted, or nearly so, the present market valuation of the enterprise is well over 50% premium. The book value of the holding of Camp Bird, Ltd., in the Santa Gertrudis Company, Ltd., is estimated at approximately $5,700,000. The Progress Mines of New Zealand have pursued a similar policy, having re-invested in the well known Blackwater mine, together with other successful investments.

Such a policy of capital conservation has many significant features of attraction. The existence of an experienced directorate and a tried engineering staff is a point that will appeal to any business man. The efficiency of the engineering staff in starting up new work, when expensive mistakes are frequently made, is paramount. When new work is started by a newly-organized staff, the personal equation of each member of which is unknown to the others, efficiency is almost impossible and the liability of expensive mistakes is in proportion to the gravity of the work to be undertaken. There is also a great disproportion of the time required to obtain results, irrespective of the question of mistakes. I believe this is one of the prime causes of mining failures, and its significance cannot be overestimated. On the other hand, new work under an experienced general manager who is in harmony with his directorate and who knows the relative capability of the members of his staff from previous experience, is started and completed with a minimum of time and expenditure producing maximum results. In a word, the organization, collectively and individually, is efficient, having numerous experiences and precedents to guide it successfully.

Mr. Janin then goes on to discuss the relative difference in issuing stock at its par value with the common practice

in the United States of issuing at a discount depending on risk. I fail to see what bearing this subject has on my article, which was on capital amortization. Which is the better is evidently pretty much a question of the relative features of salesmanship and has nothing to do with the subject. I regret that, owing to my absence in Europe, I have been unable to reply at an earlier date.

MORTON WEBBER.

New York City, January 12.

The Editor:

SIR—Mr. Webber contends that while the right of the investor in mining companies to look after his own money is theoretically ideal, his ability to do so is sadly wanting in practical application. He criticizes me for suggesting that even if this is so it is not the special function of a mining directorate to usurp the right to become guardians to the incompetent shareholders, yet he implies that once an investor puts his money in mining shares he should become the ward by adoption of the directors. Also, Mr. Webber evidently believes that a distinction should be drawn between the small shareholder and one more heavily interested; whereas one of the fundamental principles of a corporation is that each share shall be on an equality with all the other shares, and that each shareholder shall benefit equally with all other shareholders in proportion to his holdings. Of the relative advantages to be gained by investing in those mining operations which are under competent technical direction as compared to those in the hands of the inexperienced discussion is unnecessary. It is obvious even to the sarcastic. On the other hand, an incompetent directorate is hard to oust, especially in a paying company, and the same applies to the staff. The experience of an efficient staff can, however, be utilized in new ventures by those who wish to participate in those ventures. The basis of contention in this discussion is whether when on becoming a shareholder in a mining company, the investor does so with the idea of securing the resultant profits from its operations, if any, or if he is simply subscribing in a blind pool, the profits from which may be used for the purpose of perpetuating the company as a whole, and for the possible benefit of those in control of the management.

The investor in a mining company often invests solely upon his own judgment as to the physical valuation of its holdings, or upon the judgment of some one upon whom he professionally relies. He assumes that the property in question will be as skillfully handled as at the time of his investigation, and that the profits will be distributed to the shareholders, and it is upon this assumption that he bases his valuation of the shares. Chance may have favored the company, yet he may place no reliance in the judgment of those in control to acquire other property, and be unwilling to participate in an exploration company carried on under their direction. And Mr. Webber's proposal is tantamount to making each mining company an exploration company. The primary idea of a mining company is a body of adventurers joined together for some specific purpose, upon the completion of which the company is resolved into its constituent parts with division of assets, if any exist. Mr. Webber's scheme is to keep a successful company going. This would certainly appeal to the promoters and directors of a successful company, who could then have their good fortune as a tangible asset in future promotions.

As to the examples cited by Mr. Webber, I fail to see in any instance that he has demonstrated that the directors have invested the profits of their respective companies more wisely than the shareholder could have done on his own account if they had been distributed in the first instance. The articles of incorporation of one of these companies provided for a high rate of remuneration to the directors, and they were no doubt not averse to benefiting by this clause by investing their shareholders' money, in order to continue participating in the profits, where they could not hope to get so favorable a clause in the articles of incorporation of any new company formed. The recent criticism of the method of financing the new holdings of another of these companies would seem to indicate that had the certain persons holding fiduciary relationship to the holding company participated by taking intermediate profits, the purchase price of the new property might have been substantially less than the price paid.

CHARLES JANIN.

San Francisco, January 30.

Gyratory v. Jaw Crushers

The Editor

SIR—Can you refer me to any reliable comparisons between the two types of ore or rock crushers, gyratory and jaw? I cannot find anything comprehensive along this line.

ENGINEER.

San Francisco, January 25.

[The best data on the two types of crushers available may be found in Richards 'Ore Dressing', Volume I. There is room, however, for much additional data. It is difficult to get a direct comparison, for the reason that both types of crushers are not generally used in the same mill and under the same conditions. The best chance for comparison is where in rebuilding, one type has been replaced by the other. Summarizing the experience of three engineers, each having used both styles of crusher, it may be said that for large capacities the gyratory has the advantage of a lower capital cost for actual tonnage handled; ordinary renewals are not greatly dissimilar; extraordinary repairs on the gyratory may offset largely, if not entirely, its other advantages. The trouble arises from broken spindles. It is difficult to secure steel shafting of the quality needed for this use, and breakage is markedly irregular. A given spindle may last a long time, only to be replaced, when finally broken, by a rapid succession of imperfect ones. On this account, costs averaged over a short period only may well be especially deceptive. It is none the less significant that practically all of the large new plants include gyratory crushers.—EDITOR.]

Mount Boppy Gold Mine, N. S. W.

The Mount Boppy mine is well known as the premier gold producer of New South Wales, but it is common knowledge that the treatment methods in use for many years have been hopelessly out of date, and very wasteful. Although the lode is large, it has contained some rich oreshoots of gold. The oxidized portion of the lode is free-milling, and fairly well adapted to amalgamation and cyanidation by sliming. The sand, when treated by the cyanide process, never gave a really good extraction, the residue always having a fairly high gold content, and was used for filling up the stopes. The slime always gave a good extraction when consisting of oxidized ore only. Sand containing $2 to $2.50 per ton is said to have been freely used for stope-filling. The sulphide portion of the vein contains a small amount of free gold, but it has not yielded a good extraction by cyanide treatment, either in the form of sand or slime, especially when the original value was high. The company is now busily engaged with the erection of an all-sliming plant on the Moore vacuum system. It is understood a royalty of 6d. per ton has to be paid, but, notwithstanding this, it is hoped that the results will show a considerable improvement.—*Mining and Engineering Review.*

AS THE oxygen in air diminishes, the flame of a candle or lamp is affected in two ways. In the first place, the light emitted steadily diminishes. Roughly speaking, the light of a candle or lamp diminishes by 30% with a fall of 1% in the oxygen content, and the flame will no longer burn when the oxygen has fallen from the normal (20.93%) to about 17.5%. A further effect is that the flame becomes less and less stable and it is more and more easily blown out by any chance draft or movement.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

DAHLLITE is a mineral, found in Norway, approximating apatite in composition, but containing small amounts of CO_2 and water. The formula $2Ca_3P_2O_8.CaCO_3.\frac{1}{2}H_2O$ has been assigned to it.

A FREQUENT cause of explosions in compressed air discharge pipes and receivers is an accumulation of carbon in the pipes or of oil in the receiver. Oil should be drawn off from all air receivers at frequent intervals.

THE first census of the Panama Canal Zone was taken from March 3 to June 23, 1908, and showed the population ot be 50,003, of whom 24,296 were employed on the Canal or railroad work. This did not include the employees living in Panama and Colon. The whites numbered 14,635, the blacks 34,785, and the yellow 583.

OBJECTIONS to the use of reinforced concrete for certain classes of buildings are that where it is necessary to make frequent changes, alterations, and repairs, and in fact in any structure that is not intended to be permanent for many years, it becomes very costly. When it has outlived its usefulness, it is expensive to remove and the materials have little or no value.

ALTHOUGH many beds of gravel are found where suitable clean material for concrete work may be obtained, it is more often the case that clay and loam are mixed with the gravel in excessive proportions. These substances form a coating on the stones and pebbles which prevents the cement from forming an intimate bond with the stone. The strength of the concrete thus has only the strength of the cement, losing a great deal of the value of the aggregate.

UNTIL recently, with rare exceptions, shaft bottoms have been lined with timber only. Such mine timbers, if of white oak, last five to eight years, depending on whether the natural conditions foster dry rot, and if of black oak or white pine, shorter periods. As the cost of replacing such timbers is greater than their first cost, when a mine lasts over twenty years it is manifest that wood timbering is in the long run more expensive than reinforced concrete and there is always the great danger of its taking fire.

LEAD, when present in bullion, is best oxidized by nitre or sal-ammoniae; tin, by means of potassium carbonate; antimony and arsenic, by means of nitre or stirring with an iron rod. Sodium carbonate is to be avoided unless there is silicious matter present; still, a little of it with nitre seems to work well, even if the bullion is quite pure. Bone-ash and silica save the crucible from the action of the oxides, and are especially useful in thickening slags in case thickening is necessary. If bullion is poured together with slag, it should be perfectly liquid.

SULPHUR is of use both directly and indirectly to almost every individual, for it touches vitally the fertilizing industry in an indirect way, and fruit growing more directly. In the form of pyrite it is extensively employed in the manufacture of sulphuric acid, which is largely used in the manufacture of phosphate fertilizer. An immense quantity of sulphur is used in bleaching wood pulp, the chief raw material of our newspapers. Match manufacturers, powder makers, sugar refiners, and makers of rubber goods all use it, and as a drug it is well known.

THE 'Cassel Gold-Extracting Process' depended on the solvent action of chlorine generated electrolytically in an alkaline solution. It was found, however, that such solvents attacked the base metals in the ore in preference to the gold. Attempts were made to dissolve the gold and limit the action on base metals by adding chlorine or bromine, without the electric current, and introducing a salt which would neither absorb Cl or Br, nor precipitate gold, but which would precipitate base-metal compounds. The process was investigated in 1886 by a research syndicate, which directed its efforts toward finding a gold solvent which would not dissolve base metals, and the MacArthur-Forrest cyanide process was the outcome of their efforts.

MONUMENTS and markings of a claim in the field will control over the stated courses and distances in the location notice when the two disagree. If the claim as monumented conforms with the requirements of the law to the size and shape and marking of a claim, it is entirely valid. Thus, where the location notice calls for given distances "easterly" and "westerly" from the point of discovery, but the monuments define an L-shaped claim, if the claim as marked conforms to the requirements of the law, it is entirely valid, as against any subsequent locators.

RIGHT of one stockholder in a corporation to access to a list of his fellow-stockholders with their registered addresses, has been affirmed by the Supreme Court of Maine. The Maine statute requires corporations organized under the laws of Maine to keep such a list upon file in the clerk's office in Maine. The San Toy Mining Co., it is complained, first filed a list without addresses, and later when the addresses had been supplied, ordered its clerk to refuse access to the list. This right of access was enforced by mandamus. State statutes on this point differ. New Jersey assesses a fine against any corporation official refusing the information when duly requested.

STANDARD screens, according to the recommendation of the committee appointed for that purpose by the Institution of Mining and Metallurgy, should have a screening area of 25%. This cannot exactly be attained in practice, because of the mechanical difficulties of manufacture, and because the standard sizes of wire do not exactly fit these specifications. Thus a 20-mesh screen, with 0.025-in. wire and an opening of the same size, has exactly 25% screening area, as has a 100-mesh screen with 0.005-in. wire and opening. But a standard 30-mesh screen, with 0.0167-in. wire and 0.0166-in. opening has 24.8% screening area, and an 80-mesh, with 0.0063-in. wire and 0.0062-in. opening has 24.6% screening area. But these differences are much smaller than the experimental errors which occur even in the most careful screening work. Standard screens, which can easily be obtained, should always be used in screening tests.

THE states which are spoken of as the mining-law states, for the reason that the mining law is in daily use in them and that they are generally assumed to be the whole field of American mining law, are California, Oregon, Washington, Idaho, Montana, North Dakota, South Dakota, Wyoming, Colorado, Utah, Nevada, Arizona, New Mexico, and the District of Alaska. It will be noticed that they include, besides the Rocky Mountain and Pacific Coast States, the Dakotas and Alaska. Of the remaining states, many never had any public domain; to others the mining laws were not extended or were subsequently repealed. The law has some force and utility in Arkansas, Florida, Louisiana, Mississippi, and parts of Oklahoma, but owing to the almost total absence of public mineral land in those states, they need not be considered. Texas having joined the United States as a sovereign power, retained possession of her unoccupied unclaimed land, enacting a state code of mining laws to govern them. For the Philippine Islands special mining laws have been provided. The possessions of the United States outside of Alaska and the Philippines have no mining laws.

Special Correspondence

MEXICO

HEAVY FOREIGN INVESTMENT EXPECTED IN MEXICO. DOS ESTRELLAS HEADS LIST OF COPPER PRODUCERS FOR 1911. GENERAL NOTES.

Mining men generally are optimistic concerning the immediate future of the mining industry in Mexico. The present favorable prices of silver and copper encourage mining activity, and it is believed that the danger of serious disturbances has passed. Plans that were delayed by the political upheaval of a year ago will be carried out this year, and the investment of much foreign capital is expected. Several deals of importance are pending.

The Dos Estrellas mine in the Thalpujahua district of Michoacan—generally referred to as an El Oro property—continued to hold first place among Mexican producers during 1911. The year's production was about ₱11,000,000, and the dividends paid in the twelve months totaled ₱6,000,000. Figures covering 11 months show a production of

MEXICO MINES OF EL ORO.

₱10,067,698 from 435,317 tons of ore milled, and profits of ₱5,563,488. The best monthly record was in June, when the revenue from 47,705 tons of ore milled was ₱1,175,121 and the profit ₱675,051. In March and September, also, the revenue was over a million pesos. The four principal concerns of the El Oro section—Dos Estrellas, El Oro M. & R., Esperanza, and Mexico Mines of El Oro—had a total production in 1911 of about ₱20,000,000.

Greene-Cananea closed the year with a December production of 3,706,000 lb. of copper, a slight increase over the production in November. According to a Cananea report, L. D. Ricketts, general manager, has announced that arrangements are being made for the early payment of a dividend, but the proposed rate is not stated. Greene-Cananea now is producing copper at about 9c. per lb., and at its present rate of production and the present price of the metal the earnings are sufficient for a substantial disbursement. The issued stock of Greene-Cananea amounts to 2,500,000 shares, par value $20. The 1911 production of the Moctezuma Copper Co. (Phelps-Dodge) was 25,512,558 lb. of copper, as against 22,659,651 lb. in 1910. The December output, 2,864,464 lb., was the largest of the year. An important announcement in connection with copper production in Mexico is that the railroad to be built from Balsas, the terminus of the Cuernavaca division of the National Railways, to the Pacific ports of Zihuatenejo and Acapulco will include a branch to the Inguaran copper mines in Michoacan, and that a smelter will be built. These mines are controlled by the Paris Rothschilds, who also control the Boleo copper mines in Lower California, and they have been extensively developed. The concession for the railroad was recently granted the Mexican Pacific Co., of Seattle, Wash., whose headquarters between Acapulco and Zihuatenejo under a previous concession. When the time for production is reached, it is expected that the Inguaran mines will contribute substantially to the copper output of Mexico.

Announcement is made that the Doheny oil interests have entered into contracts covering the sale for future delivery of about 55,000,000 bbl. of Mexican oil, and that it is expected to receive an average price of 48c. per bbl. Deliveries under contracts during the present year will average 24,000 bbl. of oil per day, and the gross earnings from these deliveries are expected to total $4,200,000. The Doheny interests have storage for about 8,000,000 bbl. of oil, and this will be increased to at least 10,000,000 bbl. The possible production of the present wells is estimated at from 60,000 to 70,000 bbl. per day. The Doheny holdings aggregate about 600,000 acres of land, 75% of which is owned, and the remainder held under leases. The investments to date total about $7,500,000. The principal Doheny companies are the Mexican Petroleum Co., Ltd., of Delaware, a parent organization, and the Mexican Petroleum Co. of California, and the Huasteca Petroleum Company.

NEW YORK

HAS THE 'COPPER MERGER' BEEN ACCOMPLISHED?—GREENE-CANANEA DIVIDEND.—PORPHYRY AND PLACER NOTES.—ENGLISH SHARES POPULAR.

The possibilities which lie in the coming together of the larger banking interests that are interested in leading copper properties has formed one of the chief topics of interest among mining men during the past fortnight. Many profess to see in the underwriting of the bonds and stock of the Inspiration Consolidated Mines Co. by J. P. Morgan & Co., and in the grouping of factors in the copper world around the directors' table of that company, the practical achievement of the much-talked-of copper merger. If this is what has in reality been accomplished, it is truly a most important, even epochal, movement in copper mining. From a Wall Street point of view such a substitute for a flotation which was to do for copper what the United States Steel Corporation has done for steel, is by no means satisfactory. The share markets in the East have for a long time needed a new leader, and such a leader as would appeal to that general public which has forsaken the Street very largely. Wall Street has for some time been in a frame of mind where it would give its kingdom—not for a horse——but for a lead mule. The course of events since the first of the year has marked even more emphatically the prevailing lack of public support. During the latter half of December and through the holiday season there was an obvious marking up of goods upon the shelves, prices were advanced, and a generally brisk business air assumed as far as possible, all in preparation for the semi-annual distribution of dividends. The latter half of January discloses the market dropping once more into dullness such as is supposed to come only in hottest midsummer. If into the prevailing stagnation there could be brought a new leader, especially one with which people at large are as familiar as they are with copper, it would be most welcome. If copper interests are to get together without any fanfare of trumpets, without any big distribution of securities, the financial centres will count it an opportunity lost.

The Greene-Cananea dividend has been announced; 25c. per share is to be paid March 1. The Greene-Cananea is purely a holding company, and the payment of the present dividend is made possible by dividend payments upon the part of the old Greene Consolidated Copper and the Cananea Central Copper Co., the two subsidiaries of the Greene-Cananea. Each of the operating companies is paying 60c. per share, making a total distribution of about $960,000. Of this amount, some $30,000 goes to those rebellious holders of Greene Consolidated who have refused to exchange the old stock for that of the holding company. The Greene-Cananea company will in its turn

distribute some $606,000 and retain some $320,000 in its treasury. The present dividend will be the first payment made to Greene Consolidated shareholders since 1907. W. E. Corey, former president of the United States Steel Corporation, has been elected a director of the Greene-Cananea, to fill the vacancy created by the resignation of "Cap'n Jim" Hoatson.

The final meeting of the shareholders of the Butte Coalition was held in New Jersey last week, and the certificate of dissolution has been filed at Trenton, New Jersey. The Butte Coalition Co. was one of the most important stepping stones in the path of John D. Ryan and Thomas F. Cole, and its formation was the direct result of the efforts of Messrs. Cole and Ryan to patch up peace with Heinze and terminate the appalling snarl of litigation, which involved nearly every important and many unimportant properties in Butte and had so far passed beyond the control of the courts as to almost preclude the possibility of adjustment by such tribunals. All of the Butte Coalition assets except the Anaconda stock and the cash in the treasury having been already administered upon, there remains for distribution some 52 shares of Anaconda and some $441 in cash to go to each holder of 100 shares of Butte Coalition.

The Lake copper country is enjoying increased interest in developments at two or three properties. At the Victoria, which is the oldest of all the Lake properties, the first work, by white men, having been done on that ground in 1771, operations are pointing to the opening up of a large territory heretofore considered as of no particular value as mining ground. The Mayflower and the Old Colony are looked upon as large possibilities in the near future, perhaps to furnish material for market operations similar to that which followed the opening of the amygdaloidal bed in the ground of the Lake Copper Co. The upset suffered in the plan to consolidate all the subsidiaries of the Calumet & Hecla had a depressing effect upon the Boston market for copper shares, and some new live issues with attractive speculative possibilities will be heartily welcomed by Boston traders.

The underwriting which J. P. Morgan & Co. has assumed for the Inspiration Consolidated Copper Co. consists of $30,000,000 in stock and $6,000,000 in convertible bonds. The shares of the old Inspiration company are being exchanged for the shares of the new company, on the basis of two shares of old stock for one of new, and Live Oak is being exchanged on the basis of two shares of the new company for one share of Live Oak. This is calculated on a basis of $10 for Inspiration and $40 for Live Oak, and shareholders are given the privilege of making sale of the stock at these prices instead of exchanging if they so desire. Notwithstanding the importance of the announcement and concerted action recently put forth to make a boom in copper metal, and indirectly in copper shares, the upward turn seems to have reached its utmost height, and prices of both the metal and the shares are inclined to sag. The shareholders of the Ray Central Copper Co. have approved the issue of $1,800,000 convertible 6% bonds.

The La Grange Placer Mining Co. has been organized to take over the La Grange M. Co., a hydraulic property in Trinity county, California. The La Grange M. Co. was operated as a close corporation and is claimed to have been one of the largest hydraulic mines in the world. The late Robert S. Mather, head of the Chicago, Rock Island & Pacific railway, was president of the company. The shares of the new company are to seek an active market on the New York curb.

One of the features of the mining market in New York is the activity in American mining properties which are under English management and which are traded in on the London Stock Exchange. These shares enjoy a strong following on this side of the water, due in no small part to the fact that investors can keep closely in touch with mining operations and can see a monthly report without having to invoke extreme legal proceedings to learn what is going on. The recent rapid rise in Esperanza, due to some favorable developments on the eleventh level, created quite a little interest and a fair volume of business. There is a constantly growing body of investors who like the speculative feature of mining enterprises, but who are no longer willing to go into 'get-rich-quick' and doubtful schemes, and who have learned to like the English method of mining operations.

The collapse of the Porcupine excitement is a patent illustration of how far the public has become educated in mining finance. Canadian business has suffered so far as to cause the temporary closing of the exchange in Toronto, and it is quite evident that whatever remains to be done in the Canadian gold district that has been so much in the public prints, is to be done without any support from the outside investor.

The trial of George Graham Rice, in the Federal court, charged with conducting a bucket shop and using the mails for fraudulent purposes, drags along without further incident than the rupture between the principal defendant, Rice, and the attorneys in charge of the case, and the attempt by Rice, who is nothing if not versatile, to conduct his own defense. It was found necessary, in the interest of expediency, to appoint counsel for the defendant, and the case resumed its slow progress.

BLACK HILLS, SOUTH DAKOTA

DEVELOPMENT NOTES.—GRUBSTAKING CONCERN INCORPORATED.—HOMESTAKE MAKES NEW RECORD FOR PRODUCTION.—ANNUAL REPORT.

Wood brothers, of Montreal, have secured options on the Hidden Fortune and Columbus properties, and a systematic examination of the orebodies is now well under way. The unwatering of the two shafts has been started, at the Hidden Fortune by means of pumping, and at the Columbus by skips. The first-named shaft is 300 ft. deep, and the latter 500 ft. At the Columbus the workings are extensive on the 200 and 500-ft. levels. In addition, drifts, test pits, and shallow shafts are being sampled. Further development work is planned for both big shafts in mining and diamond-drilling. Two diamond-drills have been delivered, one at each shaft, and several thousand feet of drilling will be done. Both shafts are equipped with good steam plants; each has a double-drum hoist, air-compressor, and shop. The samples are being handled in an assay office which was fitted up in Deadwood. It will be necessary to make several thousand assays in the course of the work. The work is in charge of A. M. Howat, of Los Angeles, who is assisted by John Muir and Roy H. Clarke, who are taking the samples, and H. D. Whitehouse, who has charge of the assay office. The property under examination totals about 1000 acres and adjoins the Homestake on the west and north.

After several months work, sinking is to be discontinued and lateral work undertaken, at the North Homestake shaft, at Maitland. A station now being cut is at a depth of 620 ft. below the surface, or 400 ft. below the point where sinking was commenced last summer. A deep sump and good-sized station will be cut, and cross-cuts will be driven east and west to intersect veins disclosed in diamond-drilling. The Golden Crest company has levied an assessment of 10c. per share upon the stock issued. A movement is on foot among the stockholders to reduce the capitalization and get the affairs in shape for financing the property, so that operations can be undertaken at the mine. The property is equipped with a 40-stamp mill, thoroughly modern, and one of the best plants in the Black Hills, but internal difficulties arose about the time the mill was completed, and it has never handled any ore whatever. Earnest efforts are now being made to straighten out the difficulties, and to raise money to take care of indebtedness and judgments.

The Black Hills Smelting Co., owner of the new smelter being completed at Galena, has taken a lease from the Golden Flat company on the Hardin mine in Two Bit gulch. This mine contains a large body of pyritic ore, some of which carries much gold, and it is planned to haul the

ore in wagons to the Gilt Edge Mand spur, in Strawberry gulch, and ship by rail the remaining three miles to the smelter. The shaft will be unwatered as fast as possible. Good progress is being made toward completion of the smelter, and since the middle of January weather conditions have moderated so that it is possible to expedite construction. The Black Hills Grubstaking Concern has been incorporated, and it is proposed to raise locally $20,000, which will be enough to grubstake 100 prospectors for one year. The commercial clubs of Lead, Deadwood, and Rapid City are interested, and will receive and act upon applications for grubstakes from the prospectors in their respective localities.

Homestake produced bullion valued at $6,040,000 during the year 1911, the largest year's production in its history. During the same period it paid dividends amounting to $1,310,400, making a total to and including December 25, of $27,539,040. Ore milled during the year amounted to 1,514,035 tons, so that the average recovery was $3.92 per ton, and dividends $0.865 per ton. Besides these large dividend disbursements, the Spearfish hydro-electric plant and other improvements cost a great deal of money, so that the actual profits were considerably above the dividend requirements. In order to conform to the Government corporation tax law, a report must be made at the close of the calendar year, so the fiscal year of the corporation was changed to close on that date instead of June 1. The report to stockholders, which will soon be issued, will cover the period from June 1, 1911, to December 31, 1911.

BUTTE, MONTANA

ANACONDA NOTES.—BUTTE & ELY ELECTION.—DEVELOPMENT AT THE STEWART.—PROGRESS AT PILOT BUTTE.

From present appearances it would seem that practically every branch of the Anaconda Copper Mining Co.'s industry will be operated by electricity within the next twelve months. The latest announcement is that the company road running between this city and Anaconda is to be operated by electricity. It is estimated that the expense of changing the Butte, Anaconda & Pacific railroad from steam to electricity will be about $1,000,000. Including side-tracks and lines running in and around the mines, the railroad has 114 miles of track, and the whole system will be ready for operation in about one year. Seventeen motors will be required to operate the passenger and ore trains, and the only difference in them will be that those employed in the freight hauling will be geared differently from those engaged in running the passenger trains. Before deciding on the system to be used, much time was devoted to an investigation of the trolley and storage-battery systems, and the trolley system was adopted. The power for operating will come from the Great Falls line, which was built to this city for the purpose of supplying the mines and the smelter at Anaconda with power. A thorough test was made and the conclusion was reached that there was enough power going to waste to more than meet all that was required to operate the railway.

The Duluth men won out in the annual meeting of the Butte & Ely Copper Co. which was held in this city a few days ago. There was some apparent friction between the Butte directors and those from outside, but it was only over a question of policy, and everything was adjusted later. J. B. Cotton, of Duluth, president of the company, was unable to come to the meeting, and he sent John W. Neukom, an attorney, with full power to represent him and armed with proxies sufficient to carry out an arranged program. This seemed rather objectionable to the local men, and they wanted to delay matters for some purpose or other. This Mr. Neukom was not disposed to concede, so when a motion to adjourn for a week was proposed, he protested, but in spite of his protest the local man in the chair declared the meeting adjourned. Then Mr. Neukom got busy and called the gathering to order again. The majority of the Butte men retired, but a few remained. John D. Pope, general manager for the North Butte company, was named as chairman, and as soon as the meeting was organized Mr. Neukom proceeded to do business. He elected John B. Cotton, J. W. Neukom, and Edward Maney, of Duluth, and John D. Pope and T. B. Moore, of this city, directors. The directors afterward met and elected Mr. Cotton president, Mr. Pope vice president, Mr. Maney treasurer, and Mr. Neukom secretary. Previous to this Roy S. Alley, private secretary to John D. Ryan, was secretary for the company. Among the matters to have been considered at the meeting was the removal of the office of the company to Duluth, but the new directors thought that this was not advisable, and held that while all the officers would be in Duluth except the vice president, there should be an assistant secretary here, and one of the clerks in Mr. Pope's office was selected for this position. The annual report of Mr. Cotton was read at the meeting and to this a majority of the Butte stockholders took exception, inasmuch as it did not contain any definite statement as to the future development of the property. It was contended that it should have outlined some positive policy, rather than make the statement that if certain conditions were found correct, something must be done. The report showed that on January 1 of this year there was in the treasury something over $240,000, but that since then it developed that $100,000 had been transferred from a bank in this city to Duluth.

IN THE CENTRAL BLACK HILLS

The ore discovered in the new adit of the Stewart mine is said to be rich and, inasmuch as the mill at Wallace is being taxed to its capacity in handling the present output of between 450 and 500 tons per day, there is talk of securing the Tiger mill at Burke, Idaho. F. Augustus Heinze, who has the controlling interest in the Stewart property, has wired that he will be in this city in a few days, and that he will proceed to the Coeur d'Alene to investigate the situation. E. J. Carter, one of the directors of the company, says that the company has been entirely out of

debt for some months and that he sees no reason why there should not be a substantial dividend paid in the near future. The Pilot Butte company has completed a station on the 900-ft. level and a cross-cut is being driven to intersect the Berlin vein. The shaft will be carried to a depth of 1300 ft. to meet the cross-cut from the Black Rock mine of the Butte & Superior company. Delay in the arrival of some of the guys for the new Tuolumne surface plant has prevented the new equipment being put in commission before this. The steam was turned on and everything found to be in good order, but it will be near the middle of the month before the plant will be in active operation. A fire which had its origin in the old St. Lawrence mine in 1889 and which has been burning ever since, got away from the fire-fighters for a short time the other day and destroyed the air-shaft of the Mollie Murphy mine. There was no other damage.

KALGOORLIE, WESTERN AUSTRALIA

LABOR GOVERNMENT ENDS ENGINEERS' SOCIETY STRIKE.—PHTHISIS COMMISSION REPORT.—WATER PRICES.—GENERAL NOTES.

In my last notes, mention was made of impending trouble with the Engineers' Society, which embraces fitters, tinsmiths, blacksmiths, and other skilled men on the mines. There are about 130 of them all told, and they practically tried to hold up the mining industry of Kalgoorlie by demanding time and a half for overtime, double rates for Sundays and certain holidays, and partly new schedule for all, and new agreements about apprentices. The Union would not go to arbitration, as it should have, and all simply stopped working. It was, and it was not a strike. They had no sympathy from the Chamber of Mines, the other unions, and the community generally. They were easily led out, and their demands quite out of place at the present time. The men stood out for two weeks, during which time efforts were made to come to an understanding, with little success, until a member of the present Labor Government took a hand in the matter and, it is said, practically forced the men to return to work and abide by the arbitration award when given later on. It was a case of the mines gradually closing down if repairs could not be made to machinery, although most of them could have worked on for a considerable time. By this action 130 men held up an industry employing nearly 6000 and supporting a community of 30,000 persons. The Chamber of Mines met the men in good spirit, and agreed to make any award retrospective to November 20. Such a business as this, with the recent stupid strike at Mr. Lyell, in Tasmania, the trouble at the Lithgow Iron Works in New South Wales, and other trifling disputes in which men are badly advised, makes one a trifle tired of Labor at times.

The Miners' Phthisis Commission has presented its report to Parliament. It recommends that, within three months of any Act being passed, all men employed on mines in Western Australia should be medically examined for tuberculosis, and, if all right, granted certificate to that effect, while, at intervals of not more than six months, similar examinations are to take place. If any are affected, the sufferer, the management, and the authorities are to be notified, and the first excluded from working in or about mines. A Miners' Claim Board is to be formed by the appointment of Government officials and representatives of the employers and men. This board is to deal with men excluded from mines, and from a fund, on the lines of the National Insurance scheme in England, whereby the employer, employee, and Government contribute one-third each to an insurance fund, these men are to be paid certain amounts, given hospital and medical attention while necessary, and their dependents are to be kept also, in the meantime. It is suggested that affected men be placed on the land, in parts selected by the Government. The commission did not recommend that the New Zealand system be adopted at all. Regarding underground work and ventilation it remarked that where development is of temporary character, or on unprofitable orebodies, ventilating appliances are only necessary, but where along pay ore winzes should be sunk at the usual intervals for a natural draft. It is quite understood that forcing the mines to install a lot of machinery, or sink unnecessarily, would probably be too expensive and result in some closing down, and others cutting the profits unreasonably. The men are to be protected, yet this can be overdone.

At this time of the year, the Mines Department grants exemptions from working mining leases for from 19 to 30 days, depending on the remoteness of goldfields, to enable all to take their Christmas and New Year's holidays down at the coast or in other districts.

Some rather interesting tables were recently placed before the Minister for Works, by a deputation asking for a reduction in the price of water for low-grade mines within the scope of supply from the water scheme. At present, the big mines in the water trust pay $1.68 for 1000 gal., for ordinary purposes, and 36c. for sluicing away residue; and low-grade outcrops around here yield 84c. profit, of course taking all their water from the Government. This, they wish reduced to 48c. per 1000 gal. to stimulate the working of more low-grade mines, which are mostly small. The Minister said that the scheme must be run on business lines, and was doubtful about granting the request, as, in the past, reductions to certain parties had not resulted in any increase of consumption. The water main was capable of carrying 5,600,000 gal. per day, but, owing to internal corrosion, its capacity was now only 3,000,000 gal., which was all being sold. The table referred to above showed the following:

Company.	Huntington mills.	Men employed.	Tons monthly.	Value per ton.	Water used, gal.	Cost per ton treated, cents.	Rate per 1000, cents.	Ore in sight, tons.
Golden Dream	1	20	1,243	$1.80	318,000	27	84	150,000
Lone Hand	1	7	1,000	1.32	200,000	17	84	50,000
Hannans Consols	2	27	1,300	1.78	200,000	13	84	30,000
Hidden Secret	..	15	500	4.32	200,000	35	84	37,000
Hadden Bros.	3	18	800	....	160,000	20	96	.....

The above includes representative low-grade mines, all being profitable. As we are having such a dry and hot season (in fact, the past 18 months has been so) water supplies are low or run out, so the Government is doing its best to supply all mining districts near the water scheme, and sink wells and dams for parts remote from this supply.

Glancing through the reports from mines generally, I have noted satisfactory development work in the Bullfinch, Mountain Queen, and Marvel Loch near Southern Cross; the group generally at Meekatharra; the Yuanmi and Morning Star in the East Murchison; at the group on the new find at Paynesville; the Lancefield at Laverton; the Sons of Gwalia and district; Ora Banda; and the usual yields from Kalgoorlie. The Government is erecting five stamps at Mt. Egerton, sending it by way of Peak Hill; improving the battery at Marble Bar, and is making new regulations for the payment of sand and slime at public mills. A 5-stamp mill has been erected at Paynesville, the mill near Mt. Magnet has been leased and will be improved, the Yuanmi and Mountain Queen mills are almost ready, and the Associated Northern is to erect a large plant at Ora Banda on its Gimlet South Extended mine. The latter plant is practically planned out and will consist of the following, all

driven by suction gas engines, a rock breaker for 5-ft. Huntington mills delivering pulp to a classifier, the underflow back to two 5-ft. pans, all the slime to four thickeners, then to four ordinary agitators, the agitated slime to three vacuum machines, probably of the new Ridgway type. The trials at the mine on ore Hunt...gton mill gave 6 tons per hour through a 30 by 30 screen. Of course, the ore is very soft to run through like this. The new Ridgway machine is working well at the Great Boulder, and another is to be added, having them entirely supersede the first style of filter. The gold output for November from all mines was valued at $2,515,000, and the yields from the chief mines were as follows:

Name.	Tonnage.	Value.	Profit.
Associated	10,105	$67,000	$600
Associated Northern	1,602	25,000	.....
Burbanks Main Lode	1,734	18,000	.....
Golden Horse-Shoe	24,490	150,600	3,000
Golden Ridge	2,664	27,300	8,700
Great Boulder Perseverance	20,050	119,000	13,500
Great Boulder Proprietary	16,815	240,000	131,000
Great Fingall	5,882	64,000	11,500
Hannault	5,150	32,500	10
Ivanhoe	20,019	200,000	90,000
Kalgurli	10,740	108,500	62,900
Lake View & Star	17,525	105,500	18,000
Lake View & Oroya Explorat'n	7,830*	8,900	2,900
Oroya Black Range	4,610	46,000	16,900
Oroya Links	10,010	59,300	9,800
Sons of Gwalia	13,715	132,200	48,000
Sons of Gwalia South	2,334	16,100	5,300
South Kalgurli	9,410	60,000	11,300

*From old residue.

LONDON

PROFITS OF THE CORNISH TAILINGS CO.—G. C. KLUG'S REPORT ON THE BROKEN HILL MINE.—TASMANIA GOLD M. CO. AFFAIRS.

A few months ago I gave in these columns some particulars of the work of the Cornish Tailings Co., which was formed a year and a half ago for the purpose of re-treating the tailing dumps belonging to the Carn Brea & Tincroft mines. These dumps are practically the only ones in the Camborne district, for it has been almost the universal custom to discharge the tailing into the Red river and other streams, much to the advantage of those who re-worked the sand and slime between the mines and the sea. The tailing from Carn Brea & Tincroft was not disposed of in the same way, for the simple and sole reason that no convenient water-course passes the mines. Many people have thought of tackling these great piles, but various difficulties have stood in the way. The Carn Brea & Tincroft company has always been so short of money that it has not been able to introduce the desired improvements into the mine operations themselves, let alone provide capital for the necessary plant for re-treating the dumps. Another difficulty is that there is no site available on the spot for the plant, and in addition it has hitherto been impossible to find a suitable place to which a right of way could be obtained. The absence of a supply of water for the dressing plant has also been an obstacle. The present ventures belong to the Baillieu group, identified with Broken Hill and other mines in Australia, and Arthur Richards is the manager. The treatment plant has been erected at Wheal Agar, between Camborne and Redruth, about a mile away. The first part of the journey is made by tram, but this has not been allowed to cross the high-road, so the remainder of the journey has to be done in carts. This double transfer, of course, increases costs. The plan now is to dispense with the carting and to perform the rest of the transfer by pipe-line. The first unit of the plant was designed for the treatment of 200 tons per day, but since then an additional unit has been erected, and within three or four months the capacity will be raised to 400 tons per day. The re-grinding is done in tube-mills, to which the fourth is now to be erected. The dump material assays 19 lb. metallic tin per ton, so that the content is equal to the yield at many mines in the district. But we never have known in Cornwall how these assays are made, and the fact that only 40% of the assay value is recovered in the plant goes to show that the assay is the theoretical one, while the estimates at the other mines are more often done by the vanning shovel. The 200-ton plant cost £4500 to erect. The results for the year 1911 have just been published, and I give them in tabular form herewith:

Month.	Tailing treated. Tons.	Black tin produced. Tons.	Value. £	Total working costs. £	Cost per ton. s.	d.	Profit. £
January	3,566	12.9	1,257	610	3	5	647
February	4,470	14.4	1,472	630	2	10	842
March	4,405	16.45	1,601	672	3	0	929
April	4,890	17.75	1,705	687	2	10	1,018
May	4,314	19.55	1,902	738	3	5	1,164
June	4,954	26.75	2,408	832	3	4¼	1,574
July	4,845	25.20	2,160	846	3	6	1,314
August	4,843	23.00	2,337	878	3	7½	1,459
September	5,085	24.20	2,310	892	3	6	1,418
October	6,117	24.50	2,418	945	3	1	1,472
November	6,236	26.0	2,519	1,181	3	9¼	1,338
December	6,130	27.1	2,625	1,171	3	9¾	1,454

By referring to the tables of output during 1911 it will be seen that this company is one of the substantial producers of black tin and can compare with such a mine as the Levant. The profit, of course, is far higher than at any mine, and it is obvious that with a capital of only £40,000 the venture is relatively far more profitable than any other tin venture in the county. I have not been able to give you figures for the divisible profit, as the accounts are not complete. These will follow later, when I shall be able to give still further information. The dumps are estimated to contain 1,250,000 tons, which with the increased plant will last ten years or so.

One of the most important recent events at Broken Hill has been the discovery of another lode on the property of the British Broken Hill mine. Your Australian correspondent has already given particulars of this, but unfortunately the information published locally has been meagre, for the reason that the control and offices of the company are in London, and the directors do not as a rule publish such news. There was so much agitation in Australia in connection with this matter, and so many adverse rumors were circulated, that the directors decided to obtain independent advice, and not to rely solely on the views and statements of the manager, W. H. Woodhead. Accordingly the services of George C. Klug were requisitioned. Mr. Klug some years ago was connected with the Broken Hill Proprietary, so he is conversant with local conditions; and since then he has won his spurs in Western Australia as a mine manager. A cable summary of Mr. Klug's report was issued this week, and his views confirm those of Mr. Woodhead. When first published, his figures appeared to be much lower than those given by Mr. Woodhead last November, and there was an inclination on the market to consider his report unfavorable. On closer examination, however, it was found that his figures referred solely to the new lode, while Mr. Woodhead's were those of the total reserve in the mine, two very different things. Mr. Klug considers a million tons of ore as a reasonable estimate of the available ore in the new lode as far as developments have disclosed, and he quotes the average content of 15.8% lead, 12.5% zinc, and 8.2 oz. silver in the ore so far treated as likely to be maintained. People acquainted with Broken Hill conditions estimate the shareholders' profit on this ore at £1 per ton, though the editorial authorities of the financial papers here are inclined to think this figure optimistic.

General Mining News

ALASKA

Ketchikan

The vein on the Londevan property has been penetrated for 10 ft., and it is reported that the ore, which is silver-lead and contains some gold, will average about $25 per ton. E. F. Moore is manager for the company.

The Tanana

Messrs. Martin, Walters, and Sandstrom, laymen on 2 Below, left-limit bench claim, discovered ore averaging $2.50 per pan, according to a recent report from Fairbanks.

ARIZONA

Cochise County

Mike Hannon has secured an option on the Higgins mine, says a recent report, and will start development in the near future. He is negotiating for the removal of the ore through the Copper Queen property.

Gila County

Thomas Tate and associates have secured a lease on the Warrior mine. The boarding-house has been closed, and the commissary store operated by the company also will be closed.

Maricopa County

A steam-hoist is to be erected at the main shaft of the Monte Cristo property near Wickenburg. The present equipment will be moved about 1500 ft. up the hill, where another deep shaft will be sunk. Newspaper reports state that ore from the mine occurring in 'kidneys', assays over 50oz. silver. Steven Loncar is driving an adit on a group of eight claims just south of the Monte Cristo.

Mohave County

It is reported that the Calumet & Arizona M. Co. is taking options on all properties in the Silver creek part of the San Francisco district, where it is acquiring water-power for both milling and mining. The claims under option are gold properties.

Press reports from Kingman state that J. F. Carter and Ed Schottmiller are skimming off the crust from the seepage waters that flow on their property from the tailing-pit of the Tom Reed mill. They recently shipped their first carload to the smelter, and estimate the value of the shipment as about $200 per ton. The Tom Reed company has tried ineffectually to retain the water by dams.

CALIFORNIA

Nevada County

(Special Correspondence.)—The Pennsylvania M. Co. is preparing to install an electric pump on the 1100-ft. level. The machine has a capacity of 500 gal. per min., with a vertical lift of 600 ft. It will be operated by a 150-hp. motor. The working force has been recently increased. The mill now comprises 20 stamps, including the 10 recently purchased and installed. It is currently rumored that considerable bonanza ore is being mined from the 1100-ft. workings of the Empire mine. The North Star Mines Co. has commenced the unwatering of the Champion and Providence shafts at the Champion group. The Worthington hoist will shortly be replaced by an electric pump, to be placed in the 1800-ft. level of the Champion, and as soon as the bottom of the 2400-ft. shaft is drained, active development from this point will be started. The north drift from the 500-ft. level of the Champion mine has been reopened. The new 5-stamp mill of the Oakman M. Co., operating near Washington, will go into commission early in February. The 500-ft. adit has opened a strong body of ore ranging from 5 to 35 ft. wide. Values average around $4.50 per ton in gold and silver. Springfield, Massachusetts, people are chiefly interested. The same interests have developed promising orebodies at the Sunshine and other claims in this district. The shaft at the Mare Antony is being sent to the 160-ft. point, whence a drift will be sent to intersect the vein. Peter Bradshaw is manager of the property, which is near Smartsville.

Grass Valley, January 29.

Plumas County

The Gold Queen group of placer claims, Nelson Creek district, will be sold at sheriff's sale February 16 to satisfy a judgment amounting to almost $6000. The property is owned by the Continental M. Company.

Tuolumne County

(Special Correspondence.)—Experts are making an examination of the Jim Lyons mine, near Confidence. A 90-ft. shaft and a 70-ft. drift expose a 4-ft. vein of good-grade ore. A streak along the foot-wall assays $72 to $187 per ton.

The mill at the Republican mine, near Jacksonville, will be started by the middle of February. The ore will come from the McDougall and Mammoth claims, at both of which development work has been in progress for several weeks. Eight tons of rails just received at the property will be used in the construction of a track from the former to the latter claim. A wagon-road also is being built to the McDougall claim. Provisions, tools, and camp equipment have just been taken to the Montana King, a claim situated in the Basin district, which has three gold-bearing veins. The property is owned by James Diamond, G. G. Jahn, and Richard Whipple, all of Tuolumne. The miners from Nome who are prospecting on the Shine ranch, northwest of Sonora, have uncovered rich gravel. A rumor has it that the Confidence mine has been sold. The Sam Williams mine has been purchased by John Cassey, who proposes to develop the property.

The Trent Engineering Co., which secured the contract to remodel, improve, and enlarge the Black Oak mine plant, has this work well under way. An electric transmission line is being constructed to the property from Phoenix lake, a distance, by direct line, of about four miles. The improvements will cost about $50,000.

Tuolumne, January 27.

COLORADO

Clear Creek County

(Special Correspondence.)—The Capital M. & T. Co. is making ready to enlarge operations. The adit, now in 5850 ft., is to be driven 1200 ft. to intersect a number of veins lying ahead of the present breast. E. Bauman is manager. L. Chairi & Co., lessees on the Paymaster mine in East Argentine, are shipping four tons per day of smelting ore that mills $60 per ton in silver and lead. The Wisconsin and Corry City mines on Sherman mountain have been sold to H. C. Reno, representing a syndicate of capitalists. The consideration is given at $175,000, a cash payment having been made. The 150-ton mill is to be remodeled and the machinery will be fed upon ore from the Diamond adit dump. A streak of ore 6 in. wide has been uncovered on the fourth level of the Smuggler mine that assays 761 oz. silver per ton. B. C. Catren is manager of the property. Rosenberg & Just, lessees on the Mendota, have opened a 10-in. streak of smelting ore that contains 128 oz. silver per ton. A body of ore 16 in. wide has been intersected in the west drift of the Mendota vein. Operations are through the Victoria adit. Stephens Bros. are operating under lease.

Georgetown, January 27.

(Special Correspondence.)—At the Kitty Clyde mine, G. W. Ford & Co., lessees, are making ready to repair the shaft below the adit level, where a big body of $30 ore is exposed. It is stated that work will soon be put under way on the Seemann adit, the portal of which is situated at the base of James peak. The bore is now in 3000 ft. The Stanley L. Co. has awarded a 300-ft. contract for the extension of the fifth level westward. Within this distance the rich shoot formerly worked on the level above will be undercut at a depth of 100 ft. Work has been resumed on the Cascade property. C. Barbour is manager.

A. August & Co., who have a lease on the White vein through the Commodore adit, made a shipment of seven tons of ore last week that netted 220 oz. silver. Stoping is under way on a 6-in. streak of gray copper. Work has been resumed on the Centennial mine, at Alice, of which Fred Morse is manager. Work is to be resumed on the Bonnie Briar property up Fall river, where machinery was recently installed. Henry Nimmo is manager.

Idaho Springs, January 20.

GILPIN COUNTY

A carload of ore recently shipped from the Pittsburg mine yielded 12.15 oz. gold, 15.23 oz. silver, and 13.5% copper per ton, the average value of a ton being about $207, according to a late report. A streak of ore averaging $50 per ton has been found in the Tyrol mine, Willis gulch, it is rumored. The main shaft on the property is down 100 ft. Operation has been resumed at the Hughes mine, Bellevue mountain, of which R. Hughes is manager. The ore is sent to the Iron City mill.

Ore yielding about $50 per ton has been found in the Black Jack mine, Silver gulch. The shaft has been retimbered. E. Perley is superintendent of the Black Jack. A shipment of ore which yielded $20 to $80 per ton recently was made from the Coley mine, Silver gulch.

CAMP BIRD MINE.

LAKE COUNTY (LEADVILLE DISTRICT)

To promote operation of the mines on Fryer hill, the Leadville Mines Pumping Co., a quasi-public corporation, is endeavoring to finance a proposed single pumping system, relying on its income for a royalty on all ore mined from the area drained. The royalty is to be not less than 5 nor more than 10% of the net smelter returns, according to the grade of the ore. The company seeks to form 10-year contracts with all operators in that part of the district, the contracts to become void if the signatures of a large majority of the operators are not obtained within a reasonable time.

The Ibex M. Co. is shipping ore at the rate of about 3000 tons per month. Recently the zinc smelters shut down on carbonate of zinc shipments from the mine, which curtailed its production, but it now is said that by March the smelter will be in a position to increase shipments of calamine from the district.

OURAY COUNTY

High-grade ore recently was found in the east extension of the Camp Bird mine, and some miners believe that the discovery indicates that the east extension reaches the Red Mountain district.

The Jonathan dike has been intersected at the Bright Diamond claim and the ore is of good grade, according to a recent report from Ouray. Machinery has been ordered in Denver to equip the mill for grinding.

TELLER COUNTY (CRIPPLE CREEK)

The Aloha Gold M. Co. has been formed to develop the Coriolanus claim, which it has purchased, on Battle mountain. The main office will be at Cripple Creek. T. B. Burbridge is president of the company. Settlement made on a carload of ore shipped by Gus Johnson from the 500 ft. level of the South Burris mine of the Acacia G. M. Co. shows a return of $36 per ton from the screenings and $21 per ton from the coarse ore.

The Mary McKinney M. Co. has intersected the vein 132 ft. below the previous lowest, the seventh, level. J. N. Beaty has issued a call for proxies for the El Paso Con. G. M. Co. in the coming struggle for control of the company at the annual meeting on March 14. S. S. Bernard, former president of the company, and A. L. Burris, the incumbent, are other entries.

The Roosevelt deep drainage adit has passed the western boundary line of the Requa Savage group, and the flow of water is increasing steadily.

IDAHO

IDAHO COUNTY

The Elk City Mines Corporation will enlarge the 5-stamp mill on its South Fork mine, near Elk City, by the addition of 10 stamps. J. T. Ono, of Spokane, a director of the company, stated that the mill has been producing $4000 in gold bullion per month since last spring.

LEMHI COUNTY

W. J. Orr, general manager for the Deer Creek M. & M. Co., announces that a reduction plant will be built on its holdings on Deer creek in the Salmon river district.

The Gilmore M. Co. has been organized, with headquarters at Salt Lake City, Utah, to take over the 12 claims formerly owned by the Allie M. Company.

SHOSHONE COUNTY

The new lower adit of the Stewart M. Co. intersected an orebody after penetrating through the Osburn fault. Importance is attached to the discovery, as indicating that the Stewart vein persists in depth. The ore was found 850 ft. from the surface.

The Hecla M. Co. has paid dividend No. 103, amounting to $20,000, at the rate of 2c. per share. Its payment brings the total of dividend disbursements by the company up to date to $2,370,000. The company's capital is $250,000.

Arrangements have been completed to erect an air-compressor and a small mill on the Moonshine property at Wallace this spring. It is expected to begin shipping before the end of the year.

The Jack Waite and Black Horse mining companies, operating mines near Murray, have given a 3-year contract for their output of lead ore and concentrate to the International S. & R. Co., of Tooele, Utah.

MONTANA

FLATHEAD COUNTY

(Special Correspondence.)—Thomas D. Long, an attorney, recently filed a water right for 10,000 cu. ft. per second at the Kootenai falls. For the past three weeks engineers have been working at the falls, investigating the plan for supplying the Coeur d'Alene with power, and they will soon make their report. It is stated that $6,000,000 will be spent in the development of the falls and that something over 70,000 hp. can be generated. Joseph A. Coram, of Boston, is interested in the undertaking.

Libby, January 29.

LINCOLN COUNTY

(Special Correspondence.)—The Montana Smelting Co., the organization which recently purchased the Snowshoe mine and other properties, now has an adit in 80 ft. on the Cherry creek side of the mountain in which the Snowshoe vein is located. This adit has been started about 100 ft. above the level of Cherry creek, and the object is to extend it until it intersects the vein under where the shaft is now being sunk on Snowshoe creek. The distance to be run is about 4000 ft. It is the intention to put in an air-compressor and power drills as soon as they can be taken into the adit.

Libby, January 24.

Silverbow County

The Butte Central Copper Co. has let a contract for the construction of its new concentrator to the Colorado Iron Works. The plant is to be ready for operation by June 1. The 300-ft. level orebody has been blocked out sufficiently to provide for many months' shipments.

The new compressor of the Raven Copper Co. is now in operation, and it is reported that the shaft is unwatered about to its lowest, the 1500-ft., level. Active development will be started and the property either will be placed in the producing class or, failing that, will be abandoned.

NEVADA

Churchill County

The Nevada Hills and the Nevada Wonder mills have been shut down, owing to the cold weather, which interfered with the water power for the plants. Operation will be resumed, it is reported, within 60 days.

Clark County

The Gold Legion Consolidated company has been organized to take over the four claims of the Gold Legion M. Co. and three adjoining claims owned by John Anderson. A. G. Hillen is manager for the company, which has its office at Searchlight.

The shaft of what formerly was the Black Hawk property, but which now is owned by the Rand M. Co., will be sunk to a depth of 600 ft. in the near future. A pump is to be installed. Robert Dunbar is general manager for the company.

After a shut-down of several months, operation has been resumed at the Quartette mill, of which Robert Mockbee is in charge. According to J. H. Taylor, of San Jose, California, who was sent out by J. F. More, principal owner, operation will be resumed in a short time at the Santa Barbara-Searchlight property in Eldorado canyon, including the smelter there.

Esmeralda County

For the quarter ended November 30, 1911, the Round Mountain M. Co. mined and milled 15,936 tons of ore at a total cost of $65,710, or $4.12 per ton. From the 15,936 tons milled, which was of a gross value of $90,576, or $5.68 per ton, the yield was $80,558, or $5.05 per ton. The gross earning was $81,034, and the net operating profit $14,848. The operating cost of $4.12 per ton includes a depreciation charge of 27c. On November 30 the company had cash on hand of $107,566.15. A crusher, trommel, and conveyor are to be installed in the 451 cross-cut to handle the ore above the 450-ft. level from the foot-wall section. This machinery, it is reported, is all at the mine and will be in operation within the next two months.

M. J. Jordan, one of the owners of the first claim in the Antelope district, stated that the first carload of ore from the district, recently shipped from his property, yielded an average of $230 per ton, as shown by the returns of the Western Ore Purchasing Company.

Humboldt County

It is reported that the dispute between the Mammoth National company and J. L. Workman, which has retarded development of the properties concerned, has been adjusted, and that operation will be resumed. The details of the agreement have not been made public.

The Humboldt Con. Mines Co.'s adit is now in 285 ft., and it is believed that it will intersect the vein by next month. The company owns eight claims four miles from Rye Patch.

Lyon County

S. Delzappo and P. Maionchi, lessees of the Wild Horse mine, Mt. Grant district, have discovered a 4-ft. vein of ore running $15 to $20 per ton, says a report from Yerington. The property is developed by a shaft 135 ft. deep.

Nye County

(Special Correspondence.)—It is stated that Bullfrog West Extension company will be reorganized and operations resumed at the mine. William Teague, W. T. Cochran, and J. Sheppard, Jr., of Fresno, together with Thomas K. Code, of Rhyolite, have taken over the property and acquired the Eclipse mill. A first payment on the mill is said to have been made. The capacity of the plant will probably be increased. It is understood a large quantity of good-grade ore is on the dumps and exposed in the mine workings. The Poak-Steen-Cicila lease is operating the Lemon mill on a 3000-ton shipment of ore, said to average about $22 per ton. The plant is treating 50 tons per day. On the 400-ft. level the lease has proved the orebody for over 75 ft., and it is said to be about 30 ft. wide and to assay $22 per ton. The lease is the principal one operating on the Big Four. The Mineral Hill Consolidated is sacking high-grade ore which is claimed to assay $240 per ton. The adit is expected to intersect the vein within three or four weeks. A 3-ft. orebody opened on the 165-ft. level of the White Caps is estimated to average $100 to $140 per ton. The new machinery being installed at the War Eagle mill will increase its capacity to 85 tons per day. With the completion of the Associated plant and additions to the War Eagle, the capacity of Manhattan's custom mills will be 200 tons per day. The development of a large vein on the 800-ft. level of the MacNamara is about to be started. The mill is running on ore averaging around $12 per ton, with a considerable quantity available. It is reported the Tonopah Extension company plans to sink a 3-compartment shaft during the coming summer. It will be about 1200 ft. west of the present shaft. A new shoot of rich ore has been opened on the 400-ft. level.

Tonopah, January 27.

J. A. Thatcher, of Pueblo, Colorado, in reply to a rumor that he and Mahon D. Thatcher had secured an option on the Manhattan Big Four property, recently stated that he was not interested in getting control of the mine. Other rumors concerning the property were to the effect that some of the lessees were unable to cope with the heavy flow of water, and that the parent company would not help the lessees, but would itself attempt development by caving.

(Special Correspondence.)—Placer mining in the main gulch is progressing steadily, the cold weather having little effect on activities. 'Dry Wash' Wilson, the largest operator, has a force of 30 men employed, and several companies are shipping bullion. Several new leases have been recently taken and increased activity will set in with spring.

Manhattan, January 26.

Storey County

The Ophir mine last week produced 327 tons of ore, averaging $25.46 per ton, the lowest figure for some time. The Mexican mill crushed 478 tons of ore averaging $12.35 per ton. The Crown Point produced ore valued at $3000, including shipments of 335 tons from the Yellow Jacket shaft to the Gloryhole and 556 tons to the mill, which resumed operation January 25. The repairs to the east half of the mill have been completed.

At the recent annual meeting of the Crown Point company the board of directors was reëlected, with G. S. Sturges as president and manager for the company. The mine produced $67,778 during the year. The company ended the period practically free from debt, it is reported. During the year two 10c. assessments were levied.

The Comstock Pumping Association has the situation well in hand at both the C. & C. and Ward shafts. A flow of water has been developed on the 2450-ft. level of the Ward in what is known as the Combination connecting drift. The water is handled adequately by the pumps on the 2475-ft. level. The object of the drift is to effect better drainage and ventilation through connecting the Ward and Combination shafts.

White Pine County

The Steptoe Valley M. & S. Co. is planning to add two units to the concentrator at McGill, preparatory to handling the low-grade ore from the Giroux property, says a recent report. The addition will cost between $80,000 and $100,000. The annual meeting of the Giroux Con.

Mines Co. has been called for February 6 at Duluth, Minnesota. Whether or not the McGill concentrator will be used or the concentration at Kimberley will be enlarged will be determined then.

The Eastern M. Co. will equip its property with an air compressor and drills, says a report from Ely. The force of men in the adit will be enlarged. W. A. Douglas is in charge for the company, which was organized recently to take over the property, formerly known as the Nuckols Borchert group. The property is in the Cocomongo district.

NEW MEXICO

Santa Fe County

The Santa Fe Gold & Copper M. Co. on January 1 had in the treasury $27,984, as compared with $38,842 on the same date last year. The stockholders at their annual meeting in Jersey City reelected directors. Both smelter and mine have been idle during the year, as it was not deemed advisable to start operations on account of the high cost of coke and supplies. Ore reserves are ample for four years. Expenses during the past year amounted to $13,280.

Socorro County

(Special Correspondence.)—The Ernestine M. Co.'s new power-plant is now in full commission, using fuel oil.

OREGON.

The mill treated 740 tons of ore the past week, producing 45 sacks of high-grade concentrate. Development work on the third level of the Deadwood Mines is showing good results. During the week 45 ft. of driving was done. The mill handled 250 tons of ore the past 7 days, with a concentrate product of 15 tons. Practically all the machinery for the Socorro Mines' new power-plant, some single parts of which weighed over seven tons, has been delivered and is being set up as rapidly as possible. No date has been announced for the operation of the equipment. The mill is handling upward of 200 tons of ore per day.

Work continues steadily in The Oaks Co.'s main drainage and transportation adit. Development on the Pacific is showing good results, ore having been found in the adit, the face of which is now in 210 ft. A hoist for the South shaft is in transit and is expected to be in commission early in February. On account of the recent extremely cold weather, the Treasure M. & R. Co.'s mine has had a shortage of power generated by water, and hand-steel has been employed in ore breaking. The mill is running up to capacity again since the condition of the road permitted regular hauling of ore from the mine, a distance of about three miles.

Mogollon, January 26.

OREGON

Baker County

Production at the North Pole mine, according to a recent announcement, is to be maintained at the rate of 10 tons per day. The ore is shipped to the Oregon Idaho Investment Co. at Baker, where it is sampled and sent to the Tacoma smelter.

Crook County

A rush is on toward the Deschutes river near Lower Bridge owing to the discovery of gold-bearing sand there. Samples sent to Portland by M. Robinson, of Redmond, assayed $1.50 to $18 per ton. More than one hundred claims have been staked.

Josephine County

The Oriole G. M. Co. is planning to build a 50-ton mill as soon as the roads are passable, says a report from Grants Pass, where the annual meeting of the corporation recently was held. The mill is to cost, it is said, about $70,000. O. S. Blanchard, Grants Pass, is secretary of the company.

UTAH

Beaver County

Willard Pehrson and J. H. Erickson, lessees of the Golden Reef property, near Frisco, plan to sink the main shaft to a depth of about 400 ft. and to drive an adit to tap the upper vein of the property. They last December secured a three-year lease on the mine from the Golden Reef M. Co. under which they agreed to do the annual assessment work and to pay a royalty of 15% of the net value of the ore produced.

Juab County

A newspaper report states that the J. C. S. M. Co. has voted to sell its three claims at the mouth of Rock canyon to the Hiawatha M. Co., a Knight company, for 17,500 shares of the latter corporation's stock.

Salt Lake County

Ore assaying as high as 245 oz. silver per ton has been discovered in the winze below the 900-ft. level of the Utah Mines Coalition property, in the Big Cottonwood district, according to a recent press report. Valuable ore also is reported to have been found in the raise, about 50 ft. above the 800-ft. or adit level.

Summit County

There has been little activity at the Daly West mine and mill recently, owing to the burning of the loading station on January 20. The platform has been replaced and a new building is being erected.

F. V. Bodfish, general manager of the American Flag mine at Park City, recently stated that the prospecting work carried on by the company has had encouraging results. The prospecting is being done to develop sufficient ore to justify the erection of a large mill. No ore has been shipped since last April, although from the preceding November to the time shipping was stopped about 1000 tons of $22 ore was sent to the A. S. & R. Company.

Shipments from the Park City district for last week are reported as follows: Silver King, 1,400,760 tons; Daly-Judge, 960,000; New York, 165,000; total, 2,525,760 tons of ore.

WASHINGTON

Chelan County

The Wenatchee M. & M. Co., operating at Entiat, announces a dividend of ½c. per share. This is the second monthly payment.

Ferry County

The Quilp Mining Co., operating at Republic, has paid its fifth dividend of 1c. per share, or $15,000, bringing the total paid in dividends to $67,500. The company's income is from royalties on ore shipments made by the Imperator-Quilp company, which has a lease and bond on the property. J. L. Harper is general manager for the operating company.

CANADA

British Columbia

The zinc smelter to treat the Lucky Jim ore, in the Slocan

district, probably will be situated at Medicine Hat, according to a recent report, as gas and clay needed for smelting are available there.

The International Lead & Iron Co. will erect two blast-furnaces, with a capacity of 500 tons per day for the manufacture of pig iron and cast-iron pipe within ten miles of Spokane, Washington, this year, according to H. H. Shallenberger. The company owns 800 acres fifteen miles south of Salmon, north of the boundary and nine miles from a railroad, but the extension of the Idaho & Washington Northern railroad from Trail to the boundary line will afford a through rail route to Spokane. The mining company's properties and reduction plant will amount to more than $2,000,000. Mr. Shallenberger announces that work on the furnaces will begin within 90 days. The ore will be mined with steam-shovels.

The Kootenai Bonanza Mines, Ltd., recently incorporated with a capital stock of $3,000,000, has secured 40 claims on Toad mountain, near Nelson. Among the properties is the Silver King mine. The company plans to build a plant for treating its ore. The directors are R. S. Lennie, A. E. Rand, and J. A. Hendry, of Vancouver, and W. F. Page and A. C. Burdick, of Victoria.

Ontario

The Dome Mines Co. has just made its first report covering the year ended November 30, 1911, showing gross income of $1,313,483, of which $999,970 was derived from the sale of 99,997 shares of stock at par; $309,236 insurance recoveries, and $4277 from the sale of gold. The property is now being equipped in the most permanent and substantial manner. The mill, which is now nearly completed, consists of 40 stamps, with tube-mills and cyanide equipment, and is expected to handle from 350 to 400 tons per day. Operation is to begin during the latter part of February.

The North Dome-Temiskaming fight is still on, and a contest for proxies is under way. The next meeting is scheduled to be held at Toronto on February 24, when a further effort will be made to oust the Burr Cartwright management. There is a recent story to the effect that the Nipissing interests would step in as peacemakers and by acquiring control of the Temiskaming take over both that company and the North Dome. The Temiskaming management brought down the wrath of the shareholders upon its head by passing the 3% quarterly dividend and diverting the funds for the purchase of the North Dome on a basis of $229,000 for a controlling interest. The Nipissing rumor probably grows out of the fact that E. P. Earle, of the Nipissing directorate and the president of the company, has recently acquired an option on the Tommy Burns property in Porcupine, which allows some development work to be done and carries a right to acquire control if the showing is satisfactory.

Electrical equipment, including a 100-hp. motor, has been ordered for the Moneta mine, Porcupine district. Material for 16 cyanide vats for the Hollinger plant has been ordered also. The Toronto Iron Works has the contract for the cyanide plant.

Yukon

L. B. Burwash, a Government mining engineer, is quoted in the *Dawson News* of January 12 as stating that he saw three pans washed in the new Sixtymile river district which yielded 40c. per pan. He stated that only the shaft 'on discovery' had reached bedrock. When he was there 357 claims had been staked, but the staking had been poorly done and in some places the claims are off the creek.

E. Chesworth, of Steele creek, recently sent a letter, with an affidavit attached, to the *Dawson News* to the effect that there are two distinct channels, one coarse and the other fine gold, on Discovery bench, Fortymile River district. In the coarse-gold channel he states he made $2 per cu. yd., and that the district will be opened next summer. He closes his letter with an offer to pay a salary and all expenses in addition to a bonus to any "honest geological engineer if he proves this statement is not true."

MEXICO

Chihuahua

The *Chihuahua Enterprise* reports that the state officials have been preparing, through secret agents, to coöperate with the large mining companies to put a stop to 'high-grading.' The principal districts where the officials have made investigations are Cusihuiriachic, Santa Barbara, Santa Rosalia, and Parral.

The North-Western railroad recently put into effect graduated ore tariffs based on the smelter assay value of the ore shipped. Under the new schedule the charges on first or low-grade ore from Cusihuiriachic district to Chihuahua is ₱2.40 per ton, for second-grade ore ₱3.50 per ton, and for the higher grades proportionate amounts, up to ₱100 per ton. The plan was copied from that of the Canadian Pacific railroad. The North-Western is the first Mexican road to adopt the schedule.

Sonora

The Mina Mexico is planning to substitute auto trucks for burros in the transportation of supplies, and to that end is improving the road to the property.

Among the Copper Mines

Sinking at the Wolverine shaft in the Lake district, on the Osceola vein, has reached a depth of about 340 ft. It has been decided to continue sinking an additional 100 ft. or so before commencing driving.

According to cable advices received last week, the second unit of the Braden concentrator has been placed in commission. When its concentrator is completed the company is expected to produce at the rate of about 35,000,000 lb. of copper per year.

Tennessee Copper has declared a dividend of $1.50 per share, payable February 20 to stockholders of record January 31. This is the first dividend declared since January 1911, when a similar amount was paid. During the six years 1906 to 1911, the company has paid a total in dividends of $9.75, or an average of $1.62, per share per year.

It is rumored that the Utah Consolidated is considering purchasing the Yampa property. The Yampa ore has an excess of iron, making it valuable for smelting in connection with silicious ore. The Consolidated is shipping about 500 tons per day of 3% copper ore and 75 to 100 tons of high-grade lead ore to the International S. & R. Co. smelter at Tooele.

The rumor that Wolverine was seeking control of Centennial and that the strength of the latter was thus accounted for was quickly dispelled by John Stanton, according to a recent report. It is very doubtful if anyone took the story seriously, at least among those familiar with the relations between these companies. The tendency at Centennial is toward improvement, meanwhile production is rather secondary to development work, which is being pushed vigorously to the end of increased shipments at the earliest possible date. That current operations are showing a profit is due largely to the advance in price of the metal.

The current week witnessed the initial dividend declaration of the Greene-Cananea, being 25c. per share, payable March 1 to stock of record February 10. Accompanying the declaration was an estimate of the results for 1911, in which production is placed at 45,247,218 lb.; and costs at 10$\frac{1}{4}$c. per pound, the latter including an item of 5$\frac{3}{4}$c. per pound for new construction. Net profits are placed at $1,140,000, equal to about 46c. per share. This points to an average selling price of about 12$\frac{5}{8}$c. For 1910 this company reported a production of 45,680,145 lb. of copper, and costs of 11.5c. per pound, while for the year previous the figures of production reached 44,547,689 lb. and the costs 11.9 cents.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

GEORGE F. KUNZ is in San Francisco.

A. C. VEATCH was in San Francisco this week.

V. R. GARFIAS is at Stanford University temporarily.

SUMNER S. SMITH has gone to Chitina from Cordova, Alaska.

M. K. ROGERS has returned from Mexico and gone to Seattle.

RALPH ARNOLD will return from New York to Los Angeles tomorrow.

FREDERICK G. CLAPP is in the Gulf Coast oilfields of Louisiana and Texas.

Z. CUSHING was in San Francisco this week and has gone to Chihuahua, Mexico.

HENRY GANNETT, who has been in Mexico for some weeks, has gone to Washington.

J. C. WEIR has been in Nevada for some time, and has returned to San Francisco.

FRED T. WILLIAMS has been in the northern part of Utah on professional business.

J. W. MALCOLMSON passed through San Francisco from Sonora, Mexico, to Winnemucca, Nevada.

M. F. SIMONDS, of Simonds & Burns, is on his way to the Rawley mine, Bonanza, Saguache county, Colorado.

HOWARD R. STEWART was in Barbados and Trinidad recently and expects to be in San Francisco during the month.

E. A. JULIAN, general manager for the Nevada Hills Mining Co., is ill at the Adler sanitarium in San Francisco.

GEORGE A. LAIRD, GEORGE W. RITER, and MILNOR ROBERTS have been elected members of the Mining and Metallurgical Society of America.

E. V. BRAY has left San Francisco to take charge of the all-sliming plant of the Exploratie en Exploitatie Maatschippij, Dutch East Indies.

GERALD M. BROWNE, of Pearse, Kingston & Browne, London, has completed examination of the Lucky Tiger mine in Sonora, Mexico, for London clients.

FRANK H. PROBERT is in New York in consultation with officers of the Ray Central and Proprietary Mines companies. He expects to return to Los Angeles on February 10.

N. F. DRAKE will lecture before the Mining Association, University of California, on the coalfields and coal-mining in China, February 8, at 8 p.m., Room 200, Mining building, Berkeley. The public is cordially invited to attend.

W. L. BOWRON has resigned as superintendent for the Gold Hill & Iowa Mines Co., at Quartzburg, Idaho, and will make a short study of mining and milling methods in and around Bingham, and then go to California for a vacation.

PHILIP ARGALL, H. F. BAIN, F. W. BRADLEY, H. M. CHANCE, F. L. GARRISON, C. W. GOODALE, J. F. KEMP, T. H. LEGGETT, WALDEMAR LINDGREN, S. W. MUDD, H. S. MUNROE, and H. V. WINCHELL have been elected to the Council of the Mining and Metallurgical Society of America, and J. PARKE CHANNING, J. R. FINLAY, W. R. INGALLS, H. M. CHANCE, and H. S. MUNROE constitute the Executive Committee.

GRACE M. BUCKLEY, widow of E. R. Buckley, died January 24 at Wilmette, Illinois, of pneumonia, following her husband, whose death from the same disease January 19 was announced last week.

CHARLES L. HILL, one of the pioneer mine operators of Colorado, died at Santa Maria, California, January 20, at the age of 83. Mr. Hill mined at various times in Gilpin, Lake, Park, and other counties in Colorado, and did much to develop the mineral resources of that state.

Recent Publications

SCHOOL OF MINES AND METALLURGY, UNIVERSITY OF MISSOURI. BULLETIN. 49 pp. Rolla, 1911.

ANNUAL REPORT, BUREAU OF MANUFACTURES. Fiscal year ended June 30, 1911. Washington, 1911.

THE USES OF PEAT. By Charles A. Davis. 214 pp. Bulletin 16, Bureau of Mines. Washington, D. C., 1911.

AMERICAN MINING CONGRESS. REPORT OF PROCEEDINGS, FOURTEENTH ANNUAL SESSION. 397 pp. Denver, 1911.

SURFACE WATER-SUPPLY OF THE UNITED STATES. PART VII, LOWER MISSISSIPPI BASIN. By W. B. Freeman and J. G. Mathers. 90 pp.; ill. Washington, D. C., 1911.

BULLETIN OF THE ARCHEOLOGICAL INSTITUTE OF AMERICA, Vol. III, No. 1. ANNUAL REPORT. 80 pp. Norwood, Mass., 1911.

ELASTIC REBOUND THEORY OF EARTHQUAKES. By H. F. Reid. 30 pp.; ill. University of California Publications, Vol. 6, No. 19, Berkeley, 1911.

NOTES ON THE MINERAL DEPOSITS OF THE ANGLO-EGYPTIAN SUDAN. Sudan Government Bulletin No. 1. By Stanley C. Dunn. 70 pp.; ill., maps. Khartoum, 1911.

MINERAL RESOURCES OF ALASKA. REPORT OF PROGRESS IN 1910. A. ADMINISTRATIVE REPORT. By A. H. Brooks. 20 pp. Bull. 480-A, U. S. G. S. Washington, D. C., 1911.

COALS AVAILABLE FOR THE MANUFACTURE OF ILLUMINATING GAS. By A. H. White and Perry Barker. 77 pp.; ill. Bulletin 6, Bureau of Mines. Washington, D. C., 1911.

SUMMARY OF THE MINERAL PRODUCTION OF THE UNITED STATES IN 1910. By W. T. Thom. 62 pp. Extract from 'Mineral Resources of the United States for 1910.' Washington, D. C., 1912.

NOTES ON THE LATER CENOZOIC HISTORY OF THE MOHAVE DESERT REGION IN SOUTHEASTERN CALIFORNIA. By C. D. Baker. 49 pp.; ill. University of California Publications, Vol. 6, No. 15, Berkeley, 1911.

SURFACE WATER-SUPPLY OF THE UNITED STATES. PART VI, MISSOURI RIVER BASIN. By M. O. Leighton, W. A. Lamb, W. B. Freeman, Raymond Richards, and R. C. Rice. 308 pp.; ill. Washington, D. C., 1911.

WASHINGTON GEOLOGICAL SURVEY, BULLETIN No. 5. PART I, GEOLOGY AND ORE DEPOSITS OF THE MEYERS CREEK MINING DISTRICT. PART II, GEOLOGY OF THE OROVILLE-NIGHTHAWK MINING DISTRICT. By Jos. B. Umpleby. 112 pp.; ill., maps. Olympia, 1911.

The following publications of the COLORADO SCIENTIFIC SOCIETY have recently been received:

THE SUPERFICIAL APPEARANCE AND ALTERATION OF ORE DEPOSITS, by George J. Bancroft; 15 pp. THE 105TH MERIDIAN IN DENVER, by H. A. Howe; 9 pp. UTILIZATION OF THE ZINC CARBONATES AND SILICATES OF LEADVILLE, COLO., by F. L. Clerc; 13 pp. OCCURRENCE AND ORIGIN OF NITRATES IN COLORADO SOILS, by W. P. Headden; 23 pp.

The following publications of the MINES BRANCH OF THE DEPARTMENT OF MINES, Canada, have been received:

PRODUCTION OF CEMENT, LIME, CLAY PRODUCTS, STONE, AND OTHER STRUCTURAL MATERIALS DURING 1911, by John McLeish; 60 pp. PRODUCTION OF IRON AND STEEL DURING 1910, by John McLeish; 38 pp. THE PRODUCTION OF COAL AND COKE DURING 1910, by John McLeish; 31 pp. GENERAL SUMMARY OF MINERAL PRODUCTION OF CANADA DURING 1910, by John McLeish; 37 pp.

Market Reports

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, Feb. 1.		Closing Prices Feb. 1.
Adventure	6	Mohawk	$ 50
Allouez	38½	North Butte	24½
Calumet & Arizona	58½	Old Dominion	44
Calumet & Hecla	300	Osceola	105
Centennial	17½	Parrot	
Copper Range	50	Shannon	9
Daly West	5	Superior & Boston	4⅛
Franklin	11⅞	Tamarack	25
Granby	31	Trinity	5¼
Greene Cananea, ctf.	8	Utah Con	14½
Isle-Royale	21⅞	Victoria	4½
La Salle	4⅜	Winona	6½
Mass Copper	7½	Wolverine	96

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, February 1.

Atlanta	$ .17	Mayflower	$ .02
Belcher	.50	Mexican	3.80
Belmont	8.80	Midway	.28
B. & B.	.18	Montana-Tonopah	1.00
Booth	.06	Nevada Hills	2.20
Chollar	.14	Ophir	1.45
Combination Fraction	.14	Pittsburg Silver Peak	1.25
Con. Virgina	.77	Round Mountain	.48
Florence	.53	Savage	.14
Goldfield Con.	4.42	Tonopah Extension	1.45
Gould & Curry	.08	Tonopah of Nevada	7.00
Jim Butler	.31	Union	1.12
Jumbo Extension	.21	Vernal	.15
MacNamara	.26	West End	.75

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, February 1.

Associated Oil	$42.75	Peerless	$ 4.50
Brookshire	.52	Pinal	3.50
Caribou (New Stock)	1.25	Premier	.40
Claremont	.75	P. S. Petroleum	.17
Coalinga National	.13	Republic	.33
Con. Midway	.02	Silver Tip	.95
Empire	.97	Sterling	1.47
Enos	.03	S. W. & B.	.20
Maricopa 36	.85	Turner	1.10
Midway Premier	.27	Union	90.50
Monte Cristo	1.37	United Oil	.34
Palmer	.73	W. K. Oil	2.25

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. Jan. 31.		Closing Prices. Jan. 31.
Amalgamated Copper	$ 62½	Kerr Lake	$ 2⅛
A. S. & R. Co.	70½	La Rose	3⅛
Braden Copper	5¼	Mason Valley	11⅛
B. C. Copper Co.	4	Miami Copper	23⅜
Butte Coalition	22½	Mines Co. of America	3⅞
Chino	25⅜	Nevada Con	18½
Davis Daly	⅜	Nevada Utah	1/16
Dobie	⅜	Nipissing	7½
Dolores	4	Ohio Copper	⅞
First National	2⅜	Ray Central	1⅛
Foley O'Brien	¼	Ray Con	16⅜
Giroux	4½	South Utah	⅞
Goldfield Con.	4½	Superior & Pittsburg	18
Greene-Cananea	8½	Trinity	6
Guanajuato Con.	⅜	Tuolumne Copper	4½
Hollinger	12	United Copper	1½
Inspiration	10½	Yukon Gold	3⅜

ASSESSMENTS ON COMSTOCK MINES.

Company.	No.	Del. Board.	Sale Day.	Amt.
Confidence	58	Jan. 12	Feb. 6	0.20
Con. Imperial	74	Jan. 13	Feb. 7	0.01
Utah	14	Jan. 15	Feb. 9	0.05
Brunswick C. Va.	3	.....	Feb. 2	0.02
Sierra Nevada	28	Jan. 18	Feb. 13	0.10
Gould & Curry	21	Jan. 18	Feb. 13	0.05
Alta	81	Jan. 22	Feb. 16	0.05
Yellow Jacket	40	Jan. 29	Mar. 6	0.10
Andes	75	Feb. 3	Feb. 28	0.05
Savage	23	Feb. 8	Mar. 7	0.10
Exchequer	21	Feb. 10	Mar. 6	0.05
Union Con.	28	Feb. 15	Mar. 12	0.15
Alpha Con.	17	Feb. 18	Mar. 13	0.05
Kentuck	1	Feb. 25	Mar. 19	0.05

LOCAL METAL PRICES

San Francisco February 1.

San Francisco is not a primary market for the common metals except quicksilver. The prices quoted below therefore represent sales of small lots and are not such as an ore-producer could expect to realize. Ore contracts usually call for settlements on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksilver, which is quoted in dollars per flask of 75 pounds.

Antimony	11—11½c	Quicksilver (flask)	43.50
Electrolytic Copper	15—16½c	Tin	47—48½c
Pig Lead	4.50—5.45c	Spelter	7½—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

Average daily prices in cents per pound, based on wholesale transactions, standard brands.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Jan. 25	14.05	4.45	6.45	57⅜
" 26	13.92	4.45	6.45	57⅜
" 27	13.85	4.45	6.45	57⅜
" 28	Sunday.	No market.		
" 29	13.85	4.45	6.45	58¼
" 30	13.80	4.25	6.45	58¼
" 31	13.85	4.25	6.45	58¼

SILVER

Below is given the average New York quotation, in cents per ounce, of fine silver for the months indicated:

	1911.	1912.		1911.	1912.
Jan.	54.33	57.64	July	52.57	....
Feb.	52.23	....	Aug.	52.17	....
Mch.	52.76	....	Sept.	52.43	....
Apr.	52.32	....	Oct.	53.37	....
May	53.31	....	Nov.	55.77	....
June	53.04	....	Dec.	54.45	....

LEAD

Lead is quoted ordinarily in cents per pound or dollars per hundred pounds delivered at St. Louis or New York. The difference is normally 15c. per hundred pounds, and any larger or smaller difference is promptly met by sales. The daily price in New York is published each week in this column. Below are the average quotations by months:

	1911.	1912.		1911.	1912.
Jan.	4.49	4.39	July	4.50	....
Feb.	4.44	....	Aug.	4.50	....
Mch.	4.39	....	Sept.	4.48	....
Apr.	4.41	....	Oct.	4.27	....
May	4.37	....	Nov.	4.30	....
June	4.34	....	Dec.	4.45	....

ZINC

Zinc is quoted as spelter, standard Western brands, and based upon St. Louis or New York delivery. While New York quotations, as a matter of convenience, are commonly used, relatively little spelter actually goes to or comes from New York. The bulk is shipped direct from the plants in the Mississippi Valley to manufacturers, due allowance being made for freight. New York daily quotations are published in this column each week. Below are given averages by months:

	1911.	1912.		1911.	1912.
Jan.	5.47	6.44	July	5.70	....
Feb.	5.52	....	Aug.	5.95	....
Mch.	5.56	....	Sept.	5.86	....
Apr.	5.40	....	Oct.	6.10	....
May	5.35	....	Nov.	6.38	....
June	5.50	....	Dec.	6.30	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average monthly quotations in dollars per flask of 75 lb., are given below:

	1911.	1912.		1911.	1912.
Jan.	44.60	43.50	July	48.00	....
Feb.	48.40	....	Aug.	50.00	....
Mch.	52.50	....	Sept.	47.50	....
Apr.	50.90	....	Oct.	46.12	....
May	46.50	....	Nov.	45.50	....
June	46.50	....	Dec.	44.50	....

TIN

New York prices quoted in the American market for tin since the metal is almost entirely imported. San Francisco quotations averaging about 2 per lb higher than New York are quoted weeks in the future. Below are given average monthly New York quotations in cents per pound.

	1911	1912		1911	1912
Jan.	41.25	42.25	July	42.10	
Feb.	41.61		Aug.	41.32	
Mch.	40.16		Sept.	39.75	
Apr.	42.18		Oct.	41.18	
May	43.11		Nov.	43.12	
June	44.61		Dec.	43.00	

COPPER

Daily quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-8 to 1-4c per lb more. Below are average monthly quotations in cents per pound.

	1911	1912		1911	1912
Jan.	12.59	13.02	July	12.47	
Feb.	12.59		Aug.	12.41	
Mch.	12.44		Sept.	12.20	
Apr.	12.02		Oct.	12.19	
May	11.99		Nov.	12.61	
June	12.39		Dec.	13.89	

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months.

	U. S.	Foreign.	World.
January 1909	122,357,266	124,716,480	247,073,476
January 1910	141,766,111	244,204,800	385,970,911
July "	168,276,017	232,863,680	401,139,697
January 1911	122,030,195	187,705,280	309,735,475
July "	157,434,164	157,184,280	314,618,444
August "	137,738,858	152,376,000	290,114,858
September "	133,441,501	149,887,360	283,328,861
October "	140,894,856	150,841,600	291,736,456
November "	134,997,642	138,512,640	273,510,282
December "	111,785,188	131,447,680	243,232,868
January 1912	89,040,695	158,323,200	247,777,895

UNITED STATES PRODUCTION AND CONSUMPTION

(Compiled from reports of the Copper Producers' Association)

	Production.	Domestic deliveries.	Exports.
January	115,969,591	42,078,557	53,208,739
February	109,828,297	50,518,998	45,111,019
March	130,532,080	66,080,789	59,081,127
April	118,185,223	52,107,650	62,129,599
May	126,962,541	64,543,963	61,078,557
June	124,551,312	61,655,561	71,460,519
July	112,167,934	56,982,582	74,880,658
August	125,493,667	59,935,364	69,885,660
September	115,588,950	57,311,584	50,824,011
October	118,255,142	64,068,656	60,084,349
November	111,876,601	68,039,776	67,049,279
December	122,896,697	65,988,474	79,238,716
Total	1,431,938,338	709,611,954	754,932,733

Current Prices For Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ₱ 100 lb	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ₱ 100 lb	1.00	1.50
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ₱ lb	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ₱ lb	0.09½	0.12
Acid, muriatic, com'l, carboy, ₱ 100 lb	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ₱ lb	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ₱ lb	0.10½	0.15
Acid, nitric, com'l, carboy, ₱ 100 lb	5.25	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ₱ lb	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ₱ lb	0.12½	0.15
Argols, ground, bbl., ₱ lb	0.20	0.25
Borax, cryst. and conc., bags, ₱ 100 lb	2.75	3.85
Borax, powdered, bbl., ₱ 100 lb	3.00	4.00
Borax glass, gd., 60 mesh, cases, tin lined, ₱ 100 lb	10.00	13.00
Lime, ash (98 to 99) mesh, bbl., ₱ 100 lb	4.50	5.50
Bromine, 1-lb. bottle, ₱ lb	0.55	0.65
Candles, adamantine, 12 oz., 40 sets, ₱ case	3.70	4.15
Candles, adamantine, 14 oz., 40 sets, ₱ case	4.30	4.55
Candles, Stearic, 12 oz., 40 sets, ₱ case	4.95	5.50
Candles, Stearic, 14 oz., 40 sets, ₱ case	4.65	5.20
Clay, domestic fire, sack, ₱ 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, ₱ lb	0.29½	0.24½
Cyanide, 98 to 100%, 30-lb. case, ₱ lb	0.30	0.24
Cyanide, 128%, 100-lb. case, ₱ lb	0.27½	0.28½
Cyanide, 128%, 30-lb. case, ₱ lb	0.29½	0.27½
Lead acetate, brown, broken casks, ₱ 100 lb	8.75	9.00
Lead acetate, white, broken casks, ₱ 100 lb	10.00	10.25
Lead acetate, white, crystals, ₱ 100 lb	11.75	12.25
Lead, C. P., test., gran., ₱ 100 lb	13.00	15.00
Lead, C. P., sheet, ₱ 100 lb	15.00	18.00
Litharge, C. P., silver free, ₱ 100 lb	10.50	13.00
Litharge, com'l, ₱ 100 lb	7.50	9.00
Manganese ox., blk., dom. in bags, ₱ ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ₱ ton (85% MnO_2—½ Fe)	42.50	50.00
Nitre, double ref'd, small cryst., bbl., ₱ 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., ₱ 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., ₱ 100 lb	7.25	8.00
Potassium bicarbonate, cryst., ₱ 100 lb	12.00	15.00
Potassium carbonate, calcined, ₱ 100 lb	15.00	18.00
Potassium permanganate, drum, ₱ lb	0.11	0.12½
Silica, powdered, bags, ₱ lb	0.03	0.05
Soda, carbonate (ash), bbl., ₱ 100 lb	1.50	1.75
Soda, bicarbonate, bbl., ₱ 100 lb	2.00	2.50
Soda, caustic, ground, 98%, bbl., ₱ 100 lb	3.15	3.50
Soda, caustic, solid, 98%, drums, ₱ 100 lb	2.65	2.85
Zinc shavings, 850 fine, bbl., ₱ 100 lb	11.25	12.00
Zinc sheet, No. 9—18 by 84, drum, ₱ 100 lb	9.75	11.00

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

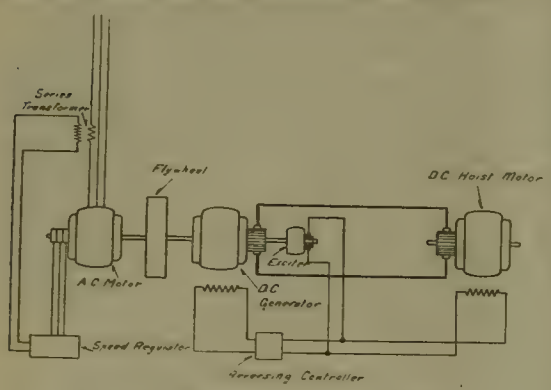
	Min.	Max.
Antimony ore, 50%, ₱ ton	*$20.00	$25.00
Arsenic, white, refined, ₱ lb	0.02	0.02½
Arsenic, red, refined, ₱ lb	0.07½	0.08½
Asbestos, according to length and quality of fibre, ₱ ton	100.00	350.00
Asbestos, lower grades, ₱ ton	10.00	100.00
Asphaltum, refined, ₱ ton	15.00	20.00
Barium carbonate, precipitated, ₱ ton	42.50	45.00
Barium chloride, commercial, ₱ ton	42.50	45.00
Barium sulphate (barytes), prepared, ₱ ton	20.00	30.00
Bismuth ore, 10% upward, ₱ ton	*75.00	upward
Chrome ore, according to quality, ₱ ton	10.00	12.50
China clay, English, levigated, ₱ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ₱ lb	2.50	
Coke, foundry, ₱ 2240 lb	13.50	15.00
Diamonds:		
Borts, according to size and quality, ₱ carat	2.00	15.00
Carbons, according to size and quality, ₱ carat	75.00	100.00
Feldspar, ₱ ton	5.00	25.00
Firebrick:		
Bauxite, ₱ M	175.00	
Magnesite, ₱ M	190.00	275.00
Silica, ₱ M	42.50	47.50
Flint pebbles for tube-mills, ₱ 2240 lb	16.50	22.50
Fluorspar, ₱ ton	10.00	15.00
Fullers earth, according to quality, ₱ ton	20.00	30.00
Gilsonite, ₱ ton	35.00	40.00
Graphite:		
Amorphous, ₱ lb	0.01½	0.02½
Crystalline, ₱ lb	0.04	0.13
Gypsum, ₱ ton	7.50	10.00
Infusorial earth, ₱ ton	10.00	15.00
Magnesite, crude, ₱ ton	7.50	10.00
Magnesite, dead calcined, ₱ ton	23.50	27.50
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ₱ ton	10.00	25.00
Manganese, prepared, according to quality, ₱ ton	30.00	70.00
Mica, according to size and quality, ₱ lb	0.05	0.30
Molybdenite, 95% MoS_2, ₱ ton	400.00	500.00
Monazite sand (5% thoria), ₱ ton	150.00	200.00
Nickel metal, refined, ₱ lb	0.45	0.60
Ochre, extra strength, levigated, ₱ 100 lb	2.25	3.25
Platinum, native, crude, ₱ oz	30.00	40.00
Sulphur, crude, ₱ ton	15.00	25.00
Sulphur, powdered, ₱ ton	40.00	45.00
Talc, prepared, according to quality, ₱ ton	20.00	50.00
Tin ore, 60%, ₱ ton	450.00	475.00
Tungsten ore, 65%	455.00	500.00
Vanadium ore, 15%, ₱ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, ₱ ton	*15.00	20.00

The Westinghouse Equalizer Hoist

The Calumet & Arizona Mining Co. has recently completed an elaborate set of tests on the electric hoisting system which has been in operation since the latter part of September 1909 at its mine in Bisbee, Arizona. The equipment has been proved satisfactory in every respect and particularly in the ease with which it is handled and the complete control which the operator has. Tests have shown that, even under severe operating conditions where the hoist is running a great portion of the time, the average input to the system over a day's run will not exceed more than about 20 or 25% of the maximum load, and that the rate of input is practically constant.

The increased use of long-distance, high-tension transmission lines has brought electric power to even the more remote mining districts. With small hoists, it has been found satisfactory to use alternating-current induction motors directly applied, but where heavy loads are to be handled, and at high speed, the peak due to the acceleration of the rapidly moving parts is always greatly in excess of the average requirements of the hoist. If the current is obtained from a line also carrying a lighting load, the resulting fluctuations of voltage prove most objectionable. In most cases the hoist is at the end of a long transmission line, and so an excessive amount of copper must be used to prevent drop in the voltage during maximum demand. The result is that the line must be equipped for peak instead of average load and at a greatly increased expense.

The above undesirable conditions have been overcome by the Westinghouse equalizer system hoisting plant, the essentials of which are diagrammatically shown below. It



C. & A. EQUALIZER HOISTING SYSTEM.

consists of a direct-current motor, direct-connected to the hoist drum, and a fly-wheel motor-generator set which includes a direct-current generator, a laminated fly-wheel, an alternating-current induction motor, and an exciter. The equipment also includes a reversing controller for the generator field, a speed regulator, a series transformer, and a switchboard. The hoist proper was built by the Denver Engineering Works, and has a normal duty of 6000 lb. unbalanced load. Its speed is 1000 ft. per minute. The ultimate depth of the shaft is to be 1200 ft. The armature of the generator and the hoist motor are electrically connected direct. The field of each machine is excited separately, constant full field being maintained in the motor. The hoist is started by gradually increasing the field of the generator and so delivering a proportional voltage to the hoist motor. When the load on the alternating-current motor reaches a certain point, resistance is automatically applied to its secondary circuit, reducing the speed of the set, and the energy stored in the fly-wheel is used to overcome the peak of the hoisting cycle. Thus there is a minimum use of current. The hoist is stopped by gradually weakening the generator field and thus allowing all excess in the descending cage, the rotating hoist motor, and the drums, to be returned to the fly-wheel through the generator, which momentarily acts as a motor, receiving energy from the hoist motor, which for the moment acts as a generator.

The over-all efficiencies of hoists of this type are generally from 50 to 60% when operated under normal operating conditions. Because of the ease of control and the general characteristics of the set, it is a simple matter to devise reliable safety appliances which do not depend on mechanical brakes. Such devices have been put in practice in Germany, where the Government allows men to be hoisted at a speed of 2500 ft. per minute with this type of hoist, whereas with steam-hoists provided with the best available safety devices, the maximum speed allowed is but 1200 ft. per minute. The success with which this Westinghouse system has operated in this country and abroad has been such that a great increase in its use is anticipated as it becomes known. The first cost is somewhat greater than a small motor hoist with rheostat control, but the reduction of power-cost due to the equalization of the load is so great that the initial expenditure becomes a secondary matter, especially when power is purchased on a maximum demand system.

California Mineral Statistics

The recently appointed State Mineralogist of California, W. H. Storms, is now collecting data relative to mineral production for 1911, as required by law. The result of this work, published in an annual report, helps greatly in advancing the varied mineral interests in the state. The greater part of the information required is obtained by corresponding with the owners and operators of mineral property. Those who have received inquiry blanks from the State Mining Bureau regarding the output and progress of work in the year 1911 are urged to answer them at once, and any who have only recently engaged in business, or who for any other reason are not on the lists of the State Mining Bureau, will be doing a public service by sending to the Statistician, State Mining Bureau, Ferry building, San Francisco, California, their names and addresses, together with a statement of the amount and value of the minerals they may have produced in 1911, or are now developing. The State Mining Bureau should not be confused with either the U. S. Geological Survey, or the Federal Bureau of Mines.

Commercial Paragraphs

R. J. CHAPMAN, who has been general manager for the Fowler Utilities Co., Fowler, Indiana, has resigned to become associated with J. W. Swaren in San Francisco.

RALPH ARNOLD announces the removal of his offices from the Herman W. Hellman building to suite 917-932 Union Oil building, Seventh and Spring streets, Los Angeles, California.

The ORENSTEIN-ARTHUR KOPPEL CO. has moved its Pacific Coast office from the Chronicle building to the Rialto building, San Francisco. The management of the company is now in the hands of D. W. Dodge and Arthur A. Prausnitz.

MEESE & GOTTFRIED CO., San Francisco, is distributing an attractive combination blotter and calendar, the latter being available for ten years by means of dial arrangement. It is in keeping with the excellent literature of this company.

As an appreciation of the hospitality accorded by THE LUNKENHEIMER CO. to the delegates attending the last convention of the National Association of Stationary Engineers, a testimonial has been presented to the Lunkenheimer Co. by that organization.

THE DETROIT TOOL CO. of Detroit, Mich., has opened a branch office at 578 Monadnock building, San Francisco. This company has placed on the market a tool that combines on a single base a rotary-blower forge, an anvil, vise, pipe vise, emery wheel, and drill press. Such a device is especially valuable for shops that are isolated, and, as the outfit weighs less than 200 lb., it can be lowered into a mine and moved about easily. An attractive booklet will be sent on request.

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EDITORIAL

PRELIMINARY estimates of the January production from the Goldfield Consolidated mines indicate a total for the month of 28,870 tons, with a gross value recovered of $683,000. The operating expense was $220,000, leaving a realization for the month of $463,000. In January 1911 the gross production was $798,177.

NOMINATION of Mr. J. F. Kemp for the presidency of the American Institute of Mining Engineers, will meet the enthusiastic support of all members of the Institute. A better choice could not have been made. A list of the official nominations is given on another page. There has been some dissatisfaction in the matter of the secretaryship, but whether this will culminate in a rival ticket remains to be seen. Proxies are being solicited by a committee opposed to the proposed amendments to the constitution, as noted in the Discussion department.

LOS ANGELES mining engineers have taken steps toward the organization of a local technical society. Whether it will be affiliated with one of the national organizations is uncertain. Certain difficulties that have arisen in practice in connection with the conduct of local sections of the Mining and Metallurgical Society have caused the Los Angeles engineers to raise questions in advance of application for affiliation with the American Institute of Mining Engineers which had been proposed. Details are given elsewhere.

TECHNICAL societies for students are an excellent feature of many American engineering schools. One phase of this work that has been especially well developed by the Mining Association of the University of California, is the holding of meetings at which addresses are delivered by engineers in active practice. Such informal talks serve the useful purpose of keeping engineers and students in touch and give the latter glimpses of the every-day problems they must prepare to meet. We have published several of these addresses and have the pleasure of presenting another this week, this time by Mr. S. E. Bretherton, whose experience in copper smelting gives especial weight to his words.

GEOLOGISTS are now in high favor and their work secures them larger recognition than at any time in the past. As Mr. A. H. Brooks suggests, this recognition brings with it responsibilities, and if they are to retain their present position they must look well to the character of their work. Deep, fundamental, scientific research must be kept up as a prime means toward further application of their science to the wants of men. It is said that German development of the internal combustion engine, by decreasing dead weight on ships, is about to give the Germans control of the sea. If it prove so, their supremacy will have been fairly won, for, as Mr. Brooks points out, the present lead of Germany in technical progress rests on that leadership in research that all of us freely recognized a quarter of a century ago. America set herself to the task of advancing science and is already reaping a reward in advancement of industry, but it will not do to forget that any impulse shortly runs its

course unless it be renewed. Research is fundamental to progress.

COMSTOCK mines have made and have marred many reputations. It is an open secret that for years operations along the great lode have been conducted with a view mainly to stock market manipulation. Mr. Whitman Symmes, in a series of articles printed in the *Mining and Scientific Press* in October 1908, told the whole sordid tale. His recital attracted the attention of the better element among those in control, and, as a result, he was placed in charge of the more important work under way. Against many difficulties he has struggled to a measure of success, finding real ore and introducing real mining. At the last annual meeting of the companies involved, certain of the old directors who had been receiving commissions on supplies sold to the company, were thrown out of office, though a clean sweep of old directors was not made. Revenge is sweet, and now those who lost office have succeeded in securing the dismissal of Mr. Symmes as a sequel to a disagreement between him and the president of the company. A determined effort, it is said, will be made by Mr. Symmes' friends to re-secure control of the Union Consolidated and Sierra Nevada, and a storm on Bush street impends. We doubt if the game is worth the fight. Something might be made of the Comstock if ownership could be consolidated in the hands of those who cared for mines rather than shares, but the prospect for that does not seem particularly bright. In the meantime Mr. C. E. Julihn, who has been appointed superintendent, is said to be an experienced and capable engineer. Doubtless both Mr. Julihn and Mr. Symmes are well prepared to manage mines, but managing Bush street brokers is decidedly different.

Free Assays and Government Metallurgical Investigations

Several bills have been introduced into Congress this winter providing for modifications in the law governing the Bureau of Mines. We print this week the one introduced by Mr. M. D. Foster, chairman of the House Committee on Mines and Mining, and which, while doubtless not in final form, may be taken as the basis for discussion. The work which the Bureau is now doing has the enthusiastic support of all who have come into contact with its operations. There is a widespread feeling that it has demonstrated its usefulness and has shown that more duties may safely be entrusted to it. There have been numerous suggestions as to proper fields for expansion of its activities. Some of these are good and some decidedly bad. It is time for the real friends of the work to make their influence felt to protect the Bureau, not only from the unfriendly, but from unwise friends. The whole matter was carefully considered first by the various sections of the Mining and Metallurgical Society, and later by the Society itself. As a result, the following general principles that should control any rewriting of the law were formulated:

1. That the scope of the Bureau of Mines should be enlarged so that its function will certainly cover the preservation of health in mining as well as safety.

2. That the functions of the Bureau of Mines should be limited to the elucidation of fundamental principles and the study of questions broadly affecting the mining industry.

3. That governmental encroachment upon private enterprises should be prevented by the organic law.

4. That the engagement in private work by employees of the Bureau of Mines should be prohibited by the organic law.

A bill for an act was drawn embodying these principles and was submitted to Congress. To those unfamiliar with Congressional practice, to whom it may seem that the law passed in 1910 adequately provides for all these matters, it may be stated that, so long as any one member of either House objects, no appropriation can be made by Congress to a Bureau, except for an object clearly designated by the organic act. If, therefore, there is a question regarding any item in an appropriation bill, any single member can prevent the money being appropriated. It goes without saying also that neither the Director of the Bureau nor the Secretary of the Interior can authorize expenditure for any purpose not specifically authorized by law. It is necessary, therefore, to have definite authority for everything the Bureau is to do. Good work and ability to economically answer needs as they arise, require a law framed on the basis of broad principles. Further limitation is possible at any time through control of appropriations. In modifying the law, however, there should be limitations as well as extensions. For example, we subscribe absolutely to the third and fourth principles enunciated by the Mining and Metallurgical Society which are sound, and the demand for free assay offices, which arises perennially, is ill founded. Such offices would be mischievous rather than useful. Among other proposals is one made by Mr. J. E. Raker of California to establish an experiment station at Auburn, at which assays, analyses, and tests are to be made at nominal charge. We believe thoroughly in experiment stations for engineering as well as for agriculture, but we see no good that can be accomplished by this particular proposal and are in hearty sympathy with the protest already made by the assayers and metallurgists of San Francisco and published on another page. Similar proposals for a Government ore-testing plant in Colorado have been made. We do not believe any such plants are needed. There are plenty of places now where anyone having ores for assay or test can at reasonable charge learn promptly and accurately their value and also their amenability to any known metallurgical process. For the Government to enter this field of work would serve no good purpose and would put it into unfair competition with established private business. Such work is not a study of the "fundamental principles" and of "questions broadly affecting the mining industry." Neither do we agree with those who seem to hold that everything possible toward improvement of metallurgical processes is now being done by private agencies. No one practically familiar with the difficulties faced by the metallurgist in developing a new or unproved process can fail to know of many instances when fundamental scientific data are lacking. This, it should be the province of the Bureau to supply, and that, with proper organization and funds, it can do valuable work along these lines has been abundantly proved by its own work as well as that of other Government bureaus. One who sees in efforts in this direction only the making of "nice jobs for pleasant young men" fails to measure the possibilities of an extremely useful organization. However, if agreement as to principles be effected, concessions as to phrases may be made. The Foster bill, seems to us too broad, and while excellent in general plan and purpose, may well be amended in detail. On the other hand, the bill as phrased by the committee from the Mining and Metallurgical Society seems not to have taken into sufficient account the necessity of opening a road for carrying on such work as the testing of permissible explosives. This is one of the best things that the Bureau of Mines has done. With no police power whatever, it has by mere publicity practically forced the adoption of safe powders in the coal mines. There is no longer any reason why tests of powders should be made free for manufacturers. A moderate fee should be imposed. If this be

turned into the Treasury and not returned to the general funds of the Bureau, there will be ample check on any undue increase in activities along this line. This is but one instance of the sort of work that the Bureau may well do to advantage, and which is, from one point of view, private work. A practicable way, though a closely guarded way, should be left open for the doing of such things. Reason is good here as elsewhere. Neither free assays nor absolute prohibition of metallurgical investigations is desirable.

Baiting the Trusts

One of the greatest deterrents to real progress is often found in the unwise efforts of advocates whose zeal outruns their judgment. Out of this the term 'muck-raking' was born, and through it a movement that is essentially for the public welfare has been brought into a certain amount of disrepute. An instance of this sort is seen in the attacks emanating from various sources which have recently been made upon "the Guggenheims". We have not hesitated in the past to criticize those in control of the American Smelting & Refining Company and the American Smelters Securities Company, both individually and collectively, nor shall we hesitate to do so in the future when, in our judgment, they merit criticism; but we are resolutely opposed to unwarranted and unjustifiable attacks upon these as well as all other corporations. It has recently been charged that the 'Smelter Trust' (in popular terminology) has prevailed upon the United States Government to cease the minting of gold coins and turn over the refining business of the mints to it, and also that it is preparing to unload the Braden Copper Company upon a too confiding public. The first of these charges finds its origin in economies in the Mint service. For the past eight years directors of the Mint have been urging in their reports the uselessness of coining all the gold bullion and foreign coin received at the mints. The amount of gold coin already stored in the vaults of the Treasury is greater than will ever be required, as the only continued demand upon the Treasury is for bars for export. During the first six months of 1904 the total presentation of notes for redemption in gold coin amounted to a little over $6,500,000, while during the same period over $60,000,000 in certificates was presented for the purchase of gold in the form of bars. The demand for these is at times so great that it cannot be met, and it has occasionally been necessary to export gold coin. The Royal Mint of Great Britain reported the re-coinage of nearly $10,000,000 of American gold coins in 1910. The British standard of fineness differs slightly from the American, so that these coins were no better than bullion for minting purposes and had the disadvantage of suffering much greater abrasion in shipment. The lack of economy in coining gold for settlement of international balances is evident. We have already expressed our favorable opinion of the policy of discontinuing this unnecessary work and also of the closing of those branch offices of the Mint, which changes in the mineral industry have rendered no longer necessary. That, as an incidental readjustment of this change, much doré bullion which formerly was shipped to the mints for refining, will naturally gravitate to the refineries of the American Smelting & Refining Company and the American Smelters Securities Company is, in our opinion, neither a catastrophe for the individual producer, nor a justification for savage attacks upon those corporations. If the complete cessation of refining by the Mint were contemplated, and if there were no other refineries outside of those possessed by these companies, some alarm would naturally be felt by the individual producers of bullion, but neither is true. It has been urged that the Government is at a great advantage in the refining of doré bullion because it has not to consider the question of interest, a serious factor in a privately owned refinery. On the other hand, the private refinery is at a considerable advantage, because it operates in connection therewith a lead desilverizing plant and copper refinery (in most cases) and the facility thus afforded for the reworking of by-products, residues, and sweeps, is a notable factor in economy of operation. Gold refining is done at the mints by the Wohlwill process, an excellent method for the production of pure gold, but one not well adapted to the refining of ordinary cyanide bullion, which frequently contains large quantities of base metal, and must either first be inquarted and parted in the usual way or else alloyed with purer gold to bring it within workable limits. It will be seen, therefore, that in some respects the private refiner is at an advantage as compared with the Government. And so long as more than one private refining company is in the field, it does not appear probable that unjust treatment is likely to be meted out to the producer of precious metals as a result of the decrease of Government activities in refining. Specific criticism of improper charges would be more effective than general inveighing against the companies concerned.

The allegations made in regard to the Braden Copper Company, and printed in *Collier's Weekly*, are so vague as almost to defy analysis. The report of Mr. Pope Yeatman to the directors of that company was published in the *Mining and Scientific Press*, December 16, and is readily available to all who are possessed of a sufficient understanding of mining matters to read it intelligently. What degree of success the Braden Copper Company is likely to attain is a matter upon which we have not expressed an opinion. That its technical work is in unusually capable hands is well known, and the main facts as to the property itself are readily available. Each intending investor should study for himself the proposed financing of this as of other properties. Whoever purchases shares in any enterprise, whether it be a corner grocery or a corporation, of which he has no adequate understanding, is speculating, not investing, and should expect a corresponding amount of sympathy if the venture does not prove as profitable as was hoped. If people insist upon buying shares because some one else has done so, rather than because careful study shows them worth buying, they can hardly complain when they fall into the hands of financial sharpers. Development of Chilean industries will, we believe, be good for Chile as well as the rest of the world. At present the whole finances of the country are based practically on the nitre industry, and, profitable as that has proved, it is desirable that they rest on a broader basis. In any country where new industries are being established cheap labor is at first a factor. There is inevitable hardship in the situation, as wants are apt to increase faster than earning power develops, but in making comparisons the fair basis is with what the laborer earned before the new industry came, rather than with what laborers elsewhere in similar but long-established industries are earning. The mines and mills of the Braden Copper Company will give to many Chileans incomes they have never even hoped to have, and developing the copper deposits of our Southern neighbor will diversify the industries of the country in a most desirable manner. We see no evidence of natural depravity in the desire of the management of the company for a continued and ample supply of sober and efficient laborers at a low rate of wage. As labor becomes efficient it will obtain its larger reward in Chile as in North America. It is the way of the world. In the meantime misdirected criticism not only fails of its mark, but serves to discredit intelligent criticism, in this as in every other instance.

Applied Geology—A Review of Progress

By Alfred H. Brooks

*The science of geology, generally regarded as having originated in the vague speculations of the cosmogonists hardly two centuries ago, has today become of great practical utility. During the past decade all geologic investigations have shown a marked tendency toward material problems, which is in contrast with the previous decade, when the interests of pure science were much more strongly emphasized. No one will deny that economic, or, as I prefer to call it, applied geology is attracting more and more attention from professional geologists. It is appropriate that the members of this Society should take cognizance of this trend in geologic thought, analyze the conditions which have brought it about, and decide, it may be, whether it makes for the good or the evil of the science.

Before discussing this subject it will be well to attempt a definition of the term 'applied geology.' Some appear to believe that when the geologist emerges from the tunnel's mouth he is at once transplanted into the realm of pure science, and that the miner's candle illuminates only the so-called practical or even commercial problems. I submit that such opinions are not justified. The surveys made as a basis for geologic maps and structure sections, usually classed as belonging to the realm of pure science, often yield results which are the most concrete examples of applied geology. On the other hand, the exhaustive study of

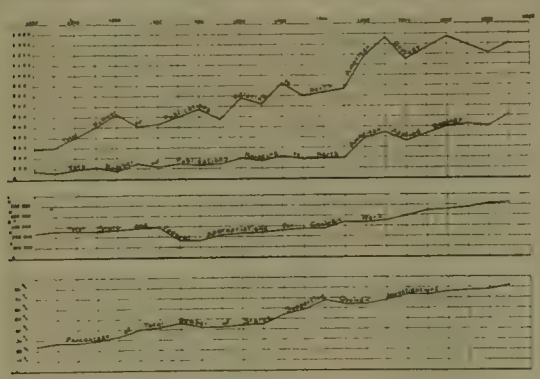


Fig. 1.

mineral deposits is essential to the solution of many fundamental geologic problems. A close analysis will make it evident that the line of demarcation between the fields of pure and applied geology is in a large measure arbitrary. The collection today of a new group of facts or the determination of new principles relating to pure science, may result tomorrow in their application to industrial problems. G. K. Gilbert has recognized two fields of geologic research, the one embracing the study of local problems of stratigraphy and structure, the other, the general problems of geologic philosophy, and has shown that both may yield results of the highest industrial importance. As David Paige has expressed it: "There indeed can be no antagonism between theoretical knowledge and its economic application. The practical expression of a truth can never be divorced from its theoretic conception." If, in spite of what has been said, the two fields of science are to be differentiated, applied geology may be defined as the science which utilizes the methods and principles of pure geology to supply the material needs of man.

While the present tendency of geologic science toward the investigation of problems of everyday life is patent to all, yet it is desirable to express this tendency quantitatively. For this purpose, I have determined the percentage of geologic publications issued annually during the last quarter of a century devoted in part or entirely to applied geology. The result of this analysis is graphically presented in the diagram (Fig. 1) in which the one curve represents the total number of publications; another, those classed as bearing upon applied geology. This diagram is based on an actual count, judging by the titles, of the publications included in the annual bibliography of North American geology. It is conceded, of course, that a mere enumeration of titles is, at best, but a crude method, which neither takes into account the extent of the individual publications nor attempts to appraise their value to science. However, I trust it will serve as a rough measure of the activities of North American geologists. On this basis, the diagram clearly records a very rapid increase during the past decade in the ratio of publications dealing with applied geology to the total of geologic literature. The figures show that applied geology was at its lowest ebb in 1890, when only 12%, and at its highest flood in 1909, when 47% of the total publications related to this subject. To consider the percentage of economic papers by decades: In the ten years ending in 1895 the average was 22%; for the following decade, 30%; and for the last five years, 44 per cent.

Another measure of this trend in geology has been obtained by a similar classification of the publications of the United States Geological Survey. The result of this enumeration is shown in a second diagram (Fig. 2). In

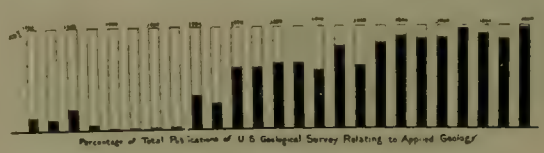


Fig. 2.

this, it will be seen that in 1890 less than 1% of the publications issued by the Federal Survey treated of applied geology, and in 1910 the percentage was 98. Considering it by decades: for the ten years ended in 1895 the average of economic papers was 11% of the total number of publications; in the following decade, 71%; and in the last five years, 92 per cent.

These figures are not to be interpreted as evidence that pure science has not been recognized in these publications of the Federal Survey. I have classed with the applied geology group all publications which treat in any measure of this subject, though many of them deal chiefly with problems of more purely scientific interest. For example, the geologic folios, which include some of the most notable contributions to pure science, are here included in the literature of applied geology. To me it is less surprising that nearly all the recent publications contain some practical deductions than that most of those of twenty years ago omitted all data of this kind.

The marked tendency toward practical problems, as indicated by these figures, is by no means confined to one organization, for it is exhibited in the same degree by state surveys, and is also reflected in the work of the universities. Nor is it limited to this continent, for countries as widely separated geographically and in scientific traditions as South America, Japan, and Germany show similar signs. Everywhere geologic research of practical problems is receiving more and more support, both publicly and privately.

It is pertinent to consider the attitude of the public at large toward this economic tendency. There are undoubtedly those who believe that the direction of scientific work should rest entirely with the investigator and not with the

*Abstract from a presidential address delivered before the Geological Society of Washington, December 13, 1911. Published by permission of the Director of the United States Geological Survey.

people. Let them bear in mind that geologic investigations, since they involve heavy expenditures and trespass on private property, can, for the most part be properly carried on only through government agencies, in this differing from such sciences as chemistry, physics, or biology, which can be furthered by private means. If geologic surveys are properly a function of the state, in the last analysis the people must be the final arbiters as to what phase of the science is to be emphasized. In our democracy the citizen has a right to inquire what he, as a member of the body politic, is gaining by expenditures from the public purse.

It is estimated, on the best data available, that during the past quarter century the total grants for geologic work made by state and Federal governments aggregate over $8,000,000. This may be regarded as evidence of public confidence. More significant to the present discussion is the annual grant of funds during this interval, and this is illustrated by a curve on the same diagram with those showing character of publications (Fig. 1). This curve is in part based on estimates, but these are without doubt sufficiently accurate to indicate that the total annual appropriations of state and Federal governments for geology have been augmented at a rate which proves that they are affected by some other factors than that of increase of population. The annual grant of funds is now more than double that of twenty-five years ago. It is probably safe to interpret this as indicating that the present economic tendency in geology is approved by the people of the United States. The close parallelism between the lines marking the publications relating to applied geology and the annual allotments of public funds for geologic surveys is probably not entirely fortuitous.

Perhaps the best measure of popular confidence in the results of geologic research is the number of different geologic organizations supported by public funds. We are apt to credit the obtaining of government support for this or that research entirely to some individual or organization, forgetting that, until the general public has in a measure been persuaded of its value, all efforts would be useless. Therefore, when we find geologic surveys throughout the country supported by commonwealths having widely different social and industrial conditions, it is fair to presume that the average citizen has acquired the belief that these are attaining results beneficial to the community. The numerical increase of state geologic surveys during the last twenty-five years is illustrated by the curve on the diagram which marks the percentage of total number of states supporting geologic work (Fig. 1). In 1886 24% of the states had geologic surveys; in 1895 the percentage was 42, and in 1910, 80.

This growing public interest is also manifested by the increase in geologic teaching at colleges and universities. I interpret the statistics published by T. C. Hopkins as indicating that in 1886 there were about 220 of the higher institutions of learning in which geology was taught, while in 1894, there were 378. Of these, 51 had geology organized as a separate department. I have been unable to find any more recent data on geologic education, but that it has made great strides in the last seventeen years will be conceded by all. It will also be generally admitted that the teaching of economic geology is receiving constantly greater attention in the colleges and technical schools. More significant evidence of the present status of geology among the people is the fact of the large number of geologists now in private employment. There are many professional geologists who are engaged in consulting practice. Nearly every large mining company and many railways include in their personnel one or more geologists. In a commercial directory of mining experts recently published fully 10% classed themselves as geologists, while an edition of the same directory issued ten years ago included only one who claimed to be a geologist. While at that time, as now, many mining engineers were in fact professional geologists, they did not care to advertise the fact.

All this indicates that applied geology has during the last two decades become a dominant element in our geologic work; also that this tendency toward industrial problems pervades all geologic investigations, whether under federal, state, or private auspices. Furthermore it has been made evident that this trend is not limited to the North American continent, but is world-wide. It is clear, also, that since emphasis has been laid upon the economic side there has been a marked increase in the support given to geologic work, from which fact may be drawn the logical conclusion that the public endorses this policy. It does not necessarily follow that this dominating practical note in geology has made for the advancement of the science. Before discussing this important question it will be well to trace briefly the origin of geology as an applied science.

It seems to be generally assumed that the application of geology to industry was not attempted until after its development into a more or less complete rational science. It cannot be denied that the application of the principles of a science must await the establishment of those principles through scientific inquiries. It is true, however, that long before geology had developed as a science men observed the geologic phenomena that bore on certain vocations and often correctly interpreted such observations.

The science of applied geology, therefore, had its origin among those who, like the miners, were by vocation brought into intimate contact with natural phenomena. Many of the elementary facts relating to mineral deposits were forced on the attention of the miner, and as the correct interpretation of these facts added to his material welfare, some deductive reasoning was undoubtedly applied. The rudimentary conceptions thus formed were more likely to be correct than those of the early closest academician, whose science for generations began and ended in pure speculation.

Therefore, to trace the origin of applied geology the oldest archives treating of mining, quarrying, agriculture, engineering, and mineralogy must be searched—a task which has been quite beyond me. And reaching far back of any written record was the traditional lore bearing on geologic phenomena of countless generations of miners and husbandmen. Even the man of the stone age must have subconsciously acquired knowledge of the distribution of the materials which he fashioned into implements of the chase and war. If we are to allow our imagination full scope, we can conceive of some primitive economic geologist who, by finding a deposit of copper and revealing the superiority of the new material for weapons, became the hero of his tribe.

A review of the conditions which brought about the rapid growth of geologic work in this country during the first decades of the nineteenth century cannot fail to consider the political and industrial situation. The war of 1812 had united as one nation the commonwealths which up to that time, in spite of the federation, had strong centrifugal tendencies. During the war with Great Britain, New England had been on the verge of rebellion, while the Trans-Appalachian region was not held to the East by any strong bonds. The country, rent by domestic quarrels and the turmoil of opposing political factions, paid small heed to the problems of industry and commerce.

After the war the people thought less about state rights and more about industrial prosperity. There was no longer a French party or an English party, but men of all political faiths had come to the conclusion that we must work out our own salvation. We had learned to supply our own material needs during the war when English frigates cut off European sources of supply. In short, the nation had found itself and was ready to begin to harvest the resources of the vast territory which the war had settled for all time was to be our own. Our people, while possessing the self-confidence of the pioneer, were facing new problems, and, guided by their scientific instincts, turned to the scientist for help.

In spite of the fact that the war had developed a relatively strongly-centralized federal government, our political theory was still one of state rights. Moreover, the Republicans were in power, with a hopelessly small Federalist minority. It was natural, therefore, that the people, loyal to their political faith, should turn to the commonwealths for aid in developing the new land. This aid for the most part took the form of large grants for public in-

provement of transportation facilities—at first for canals and wagon-roads, later for railways. During the period ended with 1838 the states borrowed sums aggregating $160,000,000 for purposes of public improvement. Compared with this sum, the expenditures for geologic surveys were small. It is a significant fact, however, that in 1838 a larger percentage of the states supported geologic surveys than in any subsequent year until 1898. This is graphically illustrated in Fig. 3. The upper curve shows the total number of states, and the lower the percentage of total number which supported geologic surveys between 1826 and 1910.

The very rapid increase in state surveys is all the more significant when compared with the status of governmental surveys in Europe. Though much geologic work was done in European countries during the early part of the century, it was not until about the middle, that the governments began organizing systematic surveys. England led by establishing her survey in 1832. Next came surveys of Austria-Hungary and Spain, organized in 1849, of Bavaria in 1851, and France in 1855. Most European countries did not undertake systematic geologic surveys until about 1860, or more than twenty years after our first maximum of state surveys had been reached.

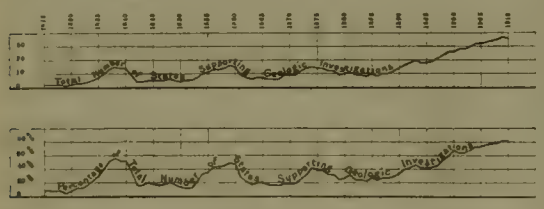


Fig. 3.

As already indicated, the principal influence that has led to this first era of state surveys, as G. P. Merrill has called it, was the widespread interest in scientific investigations, and the great industrial advancement which created a demand for the practical results of such investigations. A good example of the faith the people had in applied geology is seen in the first geological survey of Georgia, which was paid for by land owners of two counties—a condition that has never been repeated until recently in some of the rich mining districts of the West.

Another reason for the large number of state grants for geologic work lay in the general westward movement of population from the Atlantic states. This had a two-fold effect on geologic surveys. First it gave rise to a demand for information about the new lands, and second, it put the older states on their mettle to hold their population. So rapid was the westward movement that the Atlantic states became alarmed for their future. In 1815 and 1816 the legislatures of both North Carolina and Virginia appointed committees to devise means for checking the drain on their population. This was unquestionably the motive in establishing many of the Eastern state surveys, and in directing their activities toward agricultural problems.

Meanwhile the Federal Government had undertaken the investigation of the resources of the unorganized Western territories. The chief purpose seems to have been a classification of the public lands—a work which was to be interrupted for over half a century and then resumed as the proper function of Federal geologists.

According to Merrill[1] the first epoch of state surveys declined even more rapidly than it arose, due largely to the financial crisis of 1837. An era of promotion, inflation, and straining of state credits to their utmost, accompanied by a waste of the borrowed millions and the lack of any sound Federal financial policy, resulted in a money panic, the collapse of many ill-advised enterprises, the repudiation of their public debts by several of the states, and a wide-spread commercial depression. It is no wonder that, under these conditions, geologic surveys were regarded as luxuries that might well be spared; particularly since these first governmental surveys, it must be admitted, hardly justified themselves from the standpoint of practical results. This fact does not detract from the credit due the pioneer geologists who carried on these surveys under almost insuperable difficulties. They learned much about areal distribution of the larger geologic units, but most of the studies were not detailed enough to yield results of practical value. Moreover, even in that day many geologists were still living in 'flat land'—they considered formations in only the two horizontal dimensions; for while the vertical element was by no means ignored, it was not closely understood.

During the decade following the panic, few states had surveys, and no great progress was made in the science, beyond the publication of results attained in the previous era. Though the contributions to geologic literature by the class of professional geologists—whose appearance was perhaps the most important result of the activity of the previous decade—were not unimportant, yet as a whole both pure and applied science were at a rather low ebb.

The panic was but a temporary check to industries, however. The estimated production of pig iron was 347,000 tons in 1840, and 600,000 in 1850, while the coal production during the same period increased from 2,000,000 to 7,000,000 tons, and the railway mileage from 2812 to 9021. These industrial advancements were accompanied by the rapid settlement of the Middle West, by the beginnings of copper mining in Michigan in 1844, and of iron mining in Michigan and Missouri in 1853, and most important of all, the discovery of gold in California in 1848. All this activity gave a new impetus to geologic work, which is reflected in the revival of interest in state surveys. At this time, too, men began to dream of a transcontinental railway and therefore the Federal Government undertook a more systematic exploration of the western Cordilleran region than had previously been made. The curve of state surveys, as seen in the diagram, continued to rise until the outbreak of the Civil War. In this second epoch of geologic work the states of the Middle West—then the frontier—led. This was but natural, because history has proved geology always appealed more strongly to the pioneer than to any other class of people.

It is difficult to measure the accomplishment of this second period of geologic activity, under state and Federal auspices, owing to its abrupt termination by the Civil War, which interrupted many important investigations. One fact stands out clearly: that applied geology was the mainspring of most of the research, and the results indicate that pure science had not been the loser thereby.

The prosperous time following the Civil War in the North and West, with its almost unique industrial advancement, again centred public interest on mineral resources. This caused the Federal Government to resume explorations in the West, which took the form of areal geologic surveys and in some cases detailed study of mineral deposits. Many states undertook similar work, and the curve of geologic surveys arose until the interruption by the panic of 1873.

The results thus attained proved a final justification of geology, not only as an intellectual pursuit, but also as a practical aid to mankind. While the immediate benefits of these investigations were large, they were not so important as the institution of geologic mapping, based on accurate mensuration. Crude as those maps were, compared with the present standards of refinement, they represent the earliest attempt in this country to apply engineering methods to geologic problems. It was very unfortunate that this first epoch of engineering geology, as it might be called, was so soon interrupted and the work practically discontinued for over a decade. The people were, in fact, hardly educated up to an appreciation of its value; moreover, the natural resources that could be readily exploited without the aid of science were so extensive that the time was hardly ripe to make full use of this new geology.

We have seen that the period following the Civil War was especially favorable to the development of applied

[1] The extensive use I have made of 'Contributions to the History of American Geology,' by G. P. Merrill, will be evident to all who have read that work.

geology. The same is true of pure science. Thus, in fact, has been the history of geology in this country—advances in pure science were always in more or less direct proportion to advances made in the applied science.

It has been shown that, in the early history of the Nation, the genius of the American people was essentially scientific. A deep interest was felt both in the facts and deductions of science, and in the affairs of life deference was paid to the opinion of the investigator. Unfortunately, for reasons which are difficult to fathom, this scientific attitude gradually declined. At the beginning of our national existence we were in close contact with the intellectual life of Europe, which was then essentially scientific. This gave us our first intellectual stimulus and led us to do our full share of the work of advancing both pure and applied science. Then came an interim between the time when we forsook the intellectual standards of the Old World and before we fully established those of our own. Meanwhile, the opening of a continent, with its unbounded resources, was calculated to bring out the characteristic efficiency and self-reliance of the average American. Then gradually developed what may be called the era of the 'practical man'—an era characterized essentially by unscientific thought among the mass of the people. The practical man now became a national fetish, and the people, overlooking the fact that his success was due to energy and opportunity, attributed it rather to the absence of technical and scientific knowledge. Nowhere was this national trait better shown than in the mineral industry, where the era of the 'practical man' cost the Nation untold millions. His distrust of applied science was deep rooted. For a generation every mining community swarmed with these self-styled experts, whose technical and scientific limitations were only exceeded by their blatant self-assertion.

Unfortunately, at this time there also developed between the geologist and the mining engineer an antagonism, which was detrimental to the advance of the science. A school of geology arose which revived to a certain extent the ancient practice of speculation without observation, and regarded itself as moving in a higher intellectual sphere than that of the engineer, who dealt with practical problems. On the other hand, many engineers came to regard all work of the geologist as either visionary or purely speculative.

Since the rise of the modern school of applied geology, which may be said to have begun in the eighties, the antagonism between the engineer and the geologist has gradually disappeared. The geologist has made his results of more value by adopting some of the methods of the engineer, while the engineer no longer hesitates to use geology in his own field. Both professions have been improved by this mutual help, and the geologist has by no means gained the least. The modern mining engineer now recognizes that, even in his own special field, scientific investigations are essential. This is evidenced by the general hearty support given by engineers to the new Federal Bureau of Mines.

It is not necessary to describe in detail the recent progress in applied geology. While most of the countries of the world have taken part, it is a field that the American geologist has made peculiarly his own. Among our important contributions in this field is the geology of mineral oils, presented by M. R. Campbell to this Society last year. In this, as in the survey of coal deposits, stratigraphic and structural geology have almost come to be exact sciences. Equally important to the Nation are the results achieved in underground water investigations. The tectonics of mineral veins now also approaches an exact science; while many of the conclusions on the genesis of orebodies, notably that of secondary enrichment, are among the triumphs of applied geology.

Moreover, the field is being extended. In Germany the work of the geologist is regarded almost as essential to railway or canal location as that of the engineer—a lesson we have only recently learned at Panama. The investigations of soils is now a distinct science, based largely on applied geology. Questions of public health, such as purity of water and sanitation problems, also in part fall in the domain of the geologist.

A significant phase of the new epoch in applied geology is its contributions to political economy. A striking example of this is the geologic survey of Korea, executed by the Japanese during their war with Russia. It need hardly be said that this was not made for the purpose of advancing geologic knowledge, but solely to gain a scientific valuation of the land which was costing so much blood and treasure. Though the present status of the science does not permit of a quantitative determination of resources which is more than approximate, yet the fact that geologists are being called upon by political economists for assistance indicates how fundamentally the science affects the welfare of the Nation.

This historical survey of applied geology, in which special emphasis has been laid on its progress in this country, seems to point to several conclusions. First, that much of the modern science of geology originated in the field of applied science. It was the striving of mankind to solve problems of material welfare that gave the first impulse to geologic thought. Second, that, as a rule, the science has made most rapid strides at those times when its study was inspired by a desire to achieve some practical end. Whenever geology has become entirely divorced from industry, it has drifted toward pure speculation. The geologists of the past, like those of the present, received much of their inspiration from the fact that they were adding to the material welfare of mankind. Werner, Humboldt, von Buch, de la Beche, were not only trained as mining engineers, but continued for most of their careers to be intimately connected with the mining industry. William Smith was an engineer before he was a geologist, and even Hutton knew from personal experience the value of applying the sciences of agriculture and chemistry. On this continent McClure, Eaton, Rodgers, Owen, Leslie, Logan, Whitney, Orton, Cook, Dawson, and King, with a host of others were all identified with the industrial application of their science. The elder Silliman, in an account of his own training in geology, said: "I learned in the mining districts how and what to observe." The years that Dana spent on explorations may be counted in the field of applied geology. James Hall, for two generations the leader in American geology and the founder of that organization which for three-quarters of a century has preserved the highest scientific ideals, gained his early inspiration in studying practical problems. An enumeration of the leading geologists of the present generation will, I think, show that the larger part have given much attention to the material application of geology.

The recent economic trend of geology is only a counterpart of similar tendencies in most fields of scientific research. The introduction of science into practical affairs is a feature of the present age. It has come about not only because, as the sciences progressed, their results were more directly applicable to material problems, but more specially because of the gradually changing conditions throughout the world. With a sparse population and abundance of natural resources, the need of applied science is never so evident as when the lands become crowded and the more readily accessible resources depleted. The people of a virgin land need pay small heed to exhaustion of soil or destruction of forests, and can carry on shallow mining operations with little recourse to science or technology. It is only when increasing population results in a demand for a greater food supply and makes sanitation important; when the depletion of timber becomes a factor in cost of structures; and the superficial deposits can no longer yield sufficient minerals, that the need of scientific knowledge becomes strongly emphasized. This stage has been reached in most of the civilized countries of the world to a greater or less extent, and the evils of relative overpopulation and depletion of nature's wealth are resulting in an appeal to applied science.

In this respect the present generation has made greater strides than all that preceded. We are now applying science to the affairs of the Nation as never before. The old-fash-

ional publicist, with his classical education, or at least traditions, is being shouldered out of the way by the man who analyzes the problems of public welfare on scientific principles. The trained investigator is being more and more appealed to in the affairs of the Nation. In this we are following Germany, whose long leadership in pure science has now been overshadowed by her leadership in applied science. We have begun to realize that it is one thing to win prosperity and happiness out of the bounty of a new land, another to gain it by utilizing resources which can only be made available by scientific genius.

Gilbert has said that "pure science is fundamentally the creature and servant of the material needs of mankind." Yet it is not uncommon to find the devotee of pure science assuming that his field is on a higher plane than that of those studying problems which involve the material welfare of the human race. This seems specially true in the field of geology. If a bacteriologist finds a new toxin for a disease germ, a botanist a new food plant, a sanitary engineer a measure for preserving human life, all unite in commending his work. Yet there are not a few geologists, though I believe a constantly decreasing number, who seem to view with suspicion any attempt to make the science of geology more useful. Those who are devoting themselves to economic geology are charged with commercializing the science, as if the applying of its principles to better the conditions of the people were not the highest use to which scientific research could be put. One reason for this attitude is because much which has been masquerading as applied geology is not science at all. The commercial exploitation of natural resources under the cloak of geology is not to be confounded with geologic research, which has for its aims the application of scientific principles to the needs of man.

The geologist who is studying the resources of the public domain to the end that a sound policy may be adopted for their utilization, or he who is gauging the exhaustion of our mineral wealth by studying statistics of production, is doing his share of scientific work no less than he who is engaged in the more pleasing task of evolving new geologic principles. The masters of science have not hesitated to turn their attention to economic problems. Clarence King deserves no less credit for his aid in opening up the West by economic investigations than for his contributions to knowledge on the age of the earth. We think of Major Powell as one of the founders of physiographic geology, but his memory will live rather for employing science to make available the latent fertility of the arid regions of the West. Surely no one will charge King or Powell with commercializing their science.

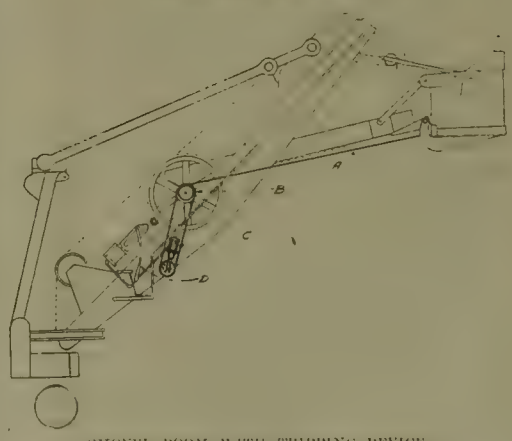
As I see it, there lies no danger in the present trend toward applied geology, provided our applied geology rests on a broad basis of scientific research. If the spring of pure science is cut off, the stream of applied geology must soon run dry. There is no field of pure geology which will not yield results applicable to questions of material welfare. On the other hand, any given investigation in applied geology may lead to problems of paleontology, petrography, geophysics, or other branches of pure science. In view of the pressing demand for results, we are justified in giving precedence to those fields of investigation which promise the earliest returns of material value. There is, however, grave danger that, carried away by the present furore for practical results, we may lose sight of our scientific ideals. Applied geology can only maintain its present high position of usefulness by continuing the researches which advance the knowledge of basic principles. Future progress in applied geology depends on progress in pure geology.

THE iron industry in South Russia shows stock on hand at different works at the end of the first six months of 1911 as follows: Pig iron, 71,244 tons; iron and steel (semi-finished), 34,794 tons; iron and steel (finished), 132,786 tons; in North Russia, pig iron, 65,862 tons; iron and steel (semi-finished), 27,180 tons; iron and steel (finished), 33,534 tons.

Trips for Steam-Shovel Dippers

Soon after the steam-shovels were first set at work in the Culebra cut, at Panama, improvements in the construction of dipper trips began to be made. Owing to the great weight of earth and rock in the 4 and 5-yd. dippers it is at times difficult for the craneman to unlatch the door by the usual hand-pull method, and in the course of a day considerable loss of time results. The first positive action trip, using steam power, was placed by a steam-shovel engineer, Thomas Custy, upon his own shovel, but was soon discarded. The device was improved and patented by A. H. Geddes. The latest device, by F. S. Wichman, after having under-

WICHMAN DIPPER TRIP.



SHOVEL BOOM WITH TRIPPING DEVICE.

gone a successful test upon two 95-ton steam-shovels, has been adopted by the Isthmian Canal Commission.

The mechanism of this dipper-door tripper is placed on the boom and has a ½-in. wire rope leading to the latch on the dipper door. In order to keep the cable always taut a drum is mounted on the face of the thrust gear, to which one end of the cable is fastened. The drum being the same diameter as the pitch diameter of the rack pinion, the cable is wound or unwound coincident with the travel of the dipper handle. To give the lengthwise pull of the cable, a 6-in. steam cylinder is mounted below the drum. This cylinder has a push piston, the outer end of which is bifurcated to receive a sheave, over which the cable passes on its way to the drum. Steam is admitted to the cylinder when it is desired to trip the dipper door through a 'three-way cock' operated by a lever at the craneman's seat.

Operating Costs at the Pittsburg-Silver Peak Mill

A complete description of the mill of the Pittsburg Silver Peak Gold Mining Co., at Blair, Nevada, was prepared by Henry Hanson, at that time mill superintendent, and published in the *Mining and Scientific Press* soon after the plant was completed.* Detailed statements of mining costs, which for desert conditions are notably low, were furnished within the past year† by Edmund Juessen till recently general manager for the company. Below are given corresponding details covering operating costs in the mill for the year 1911. These are printed through the courtesy of S. J. Kidder, general superintendent, who has immediate charge of the mill.

The general plan of ore treatment is essentially the same as when it was described by Mr. Hanson, though 20 stamps have been added, making the total now 120, and some changes have been made in the handling of solutions and other minor matters. The process involves crushing to 35 mesh with 1050-lb. stamps, 96 drops per minute, with a fall of 6½ to 7½ in. Outside amalgamation is used with a plate area of 12.8 sq. ft. per stamp, and a grade of 11¼ in. per foot. The plate tailing goes to a distributing sump and thence to sizing cones, 4 ft. 3 in. diam., fitted with Merrill hydraulic sizers. Before classification the pulp carries 5 or 6 parts of water to 1 of solid. After classification the sand contains 3 or 4 parts of water and the slime 14 to 16. The leaching-vats are five in number, 36 by 11½ ft. The whole cycle of treatment from charging to charging occupies a little over seven days. The combined overflow from the settling and sizing cones flows to five dewatering tanks. The thickened slime is drawn continuously from a bottom outlet and flows to a sludge storage tank where cyanide and lime are added to make an 0.025% cyanide solution. The pulp is agitated constantly by air and drawn continuously to Merrill filter-presses. Zinc-dust is used for precipitation. The refining process used at the plant is practically identical with that used at the Homestake mine in South Dakota.

All men employed in mill and cyanide plants work 8 hours. The regular mill crew consists of 3 men on a shift. In addition to this number are 2 plate men and 2 repairmen on the day shift, making in all 14 men for the 24 hr. day. In the cyanide department 4 men are employed on each shift, with no extras on the day shift, making the total cyanide crew 12 men for the three shifts. In the refinery 2 men are employed, on the day shift only. Their work consists of cleaning the precipitation-press and carrying on all work connected with the refining of mill and cyanide products. In the assay office, where the assaying for the mine and plant, as well as some custom work, is done, 3 men are employed. The average cost per ton for mining, milling, and all expenses in December 1910 was $2.60.

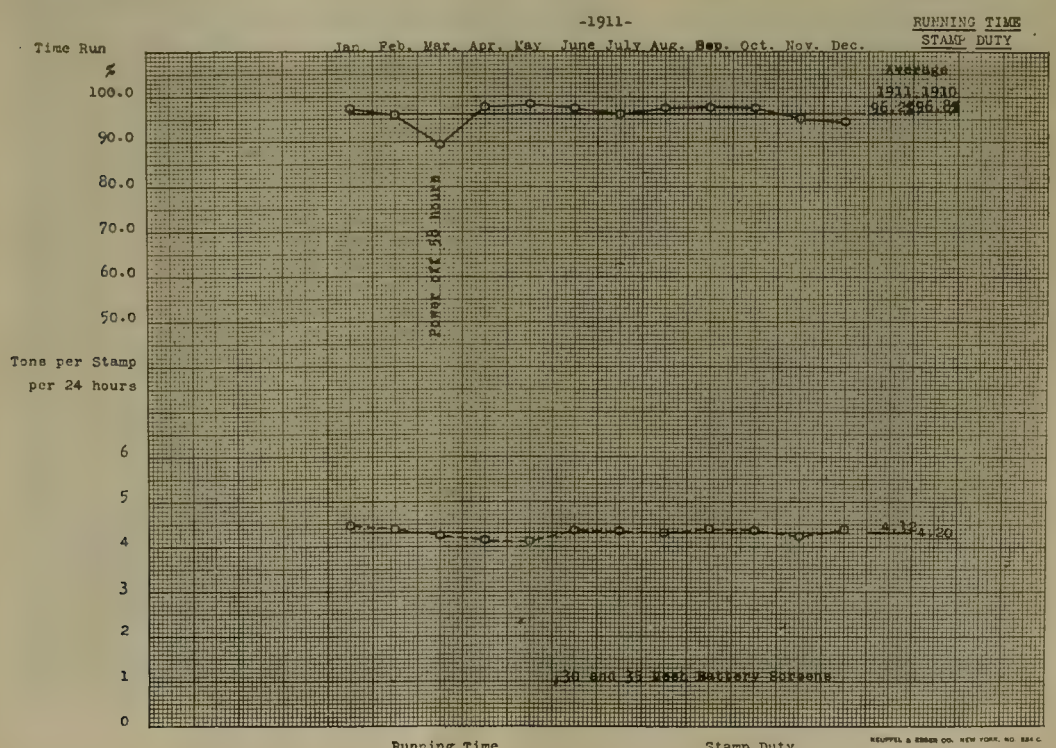
The average cost per ton for each step in the milling process in 1911 was as follows:

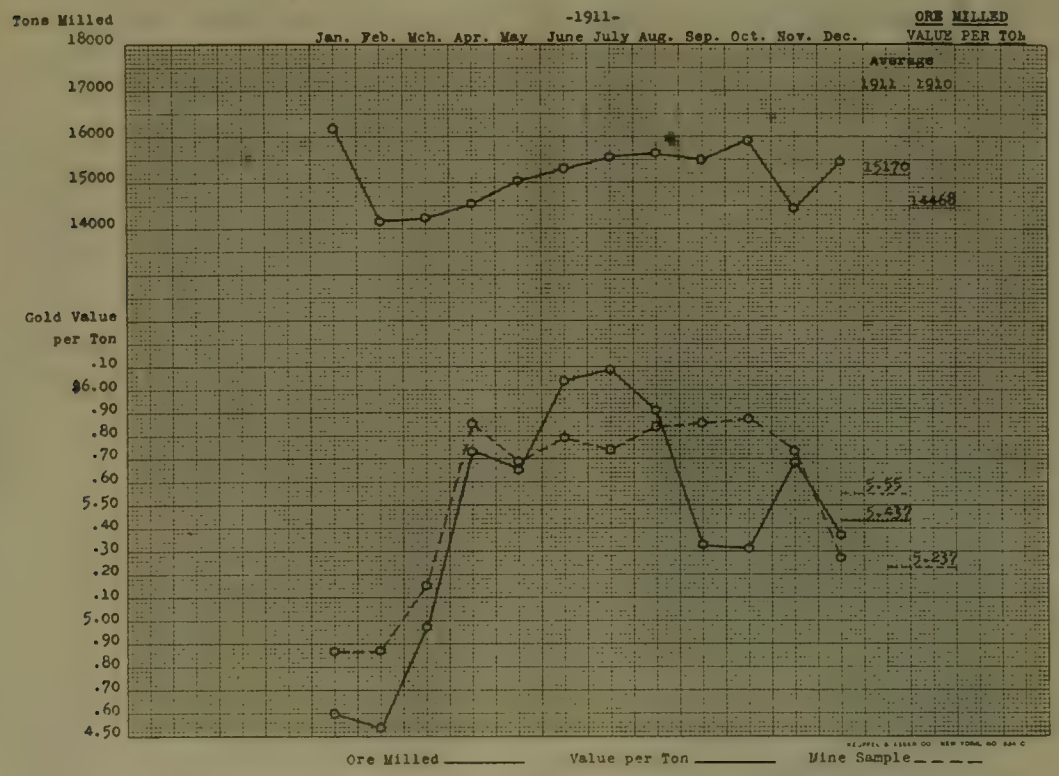
Stamping	$0.298
Amalgamating	0.047
Neutralizing and settling	0.074
Leaching and sluicing	0.145
Filter-pressing	0.104
Precipitating	0.036
Refining	0.048
Assaying	0.033
Water service	0.070
Heating	0.007
Superintendent and foremen	0.053
Total direct operating	$0.915
Pro-general	0.079
Suspense account	0.046
Total operating	$1.040

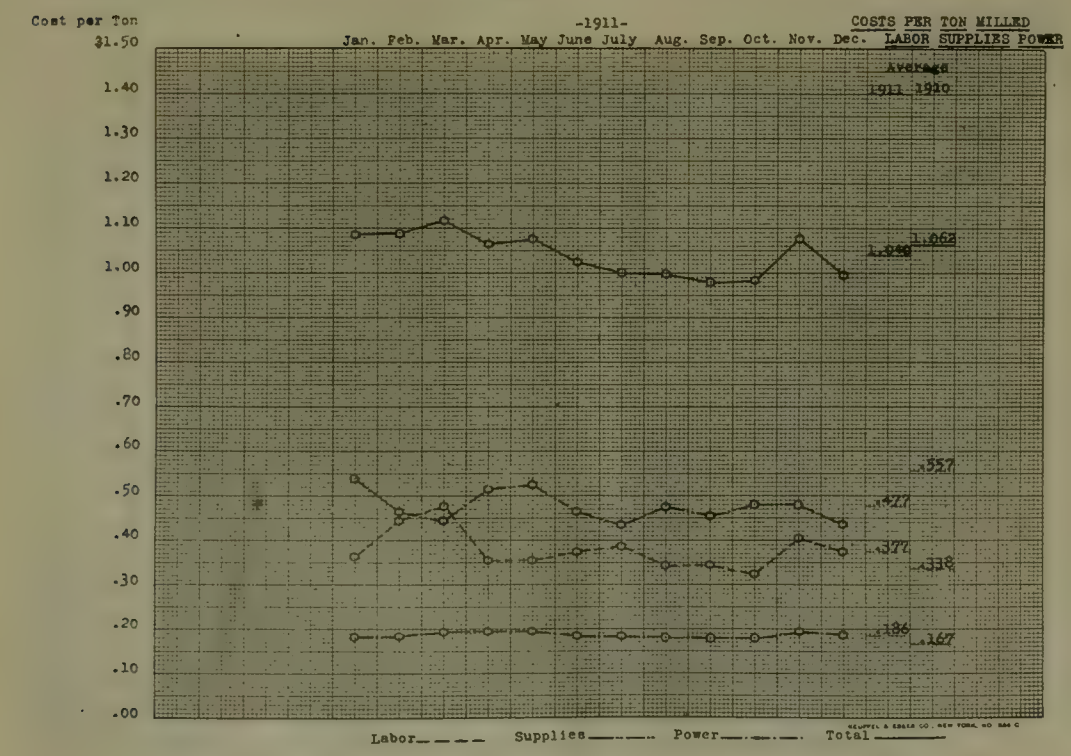
The use of a 'pro-general' and 'suspense' account, is explained in Mr. Juessen's article to which reference has already been made. Costs by the month are shown in great detail in the following diagrams, prepared by Mr. Kidder.

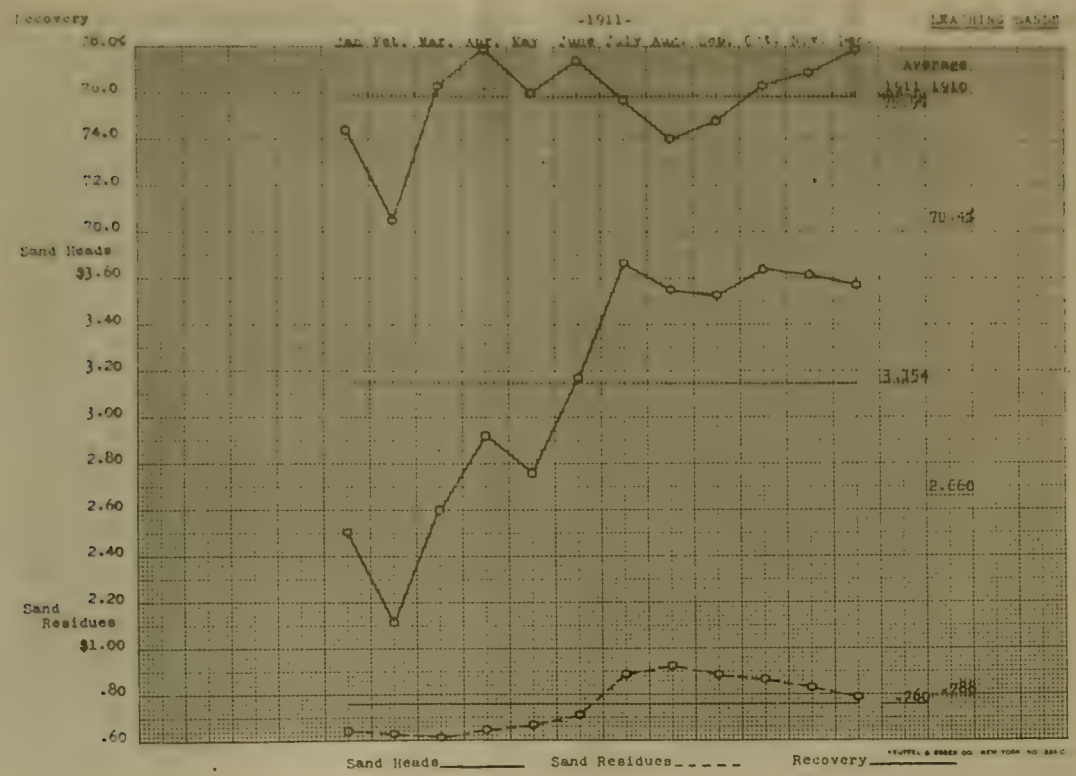
Mining and Scientific Press, May 8, 1909, republished in 'More Recent Cyanide Practice,' pp. 263-273, 1910.

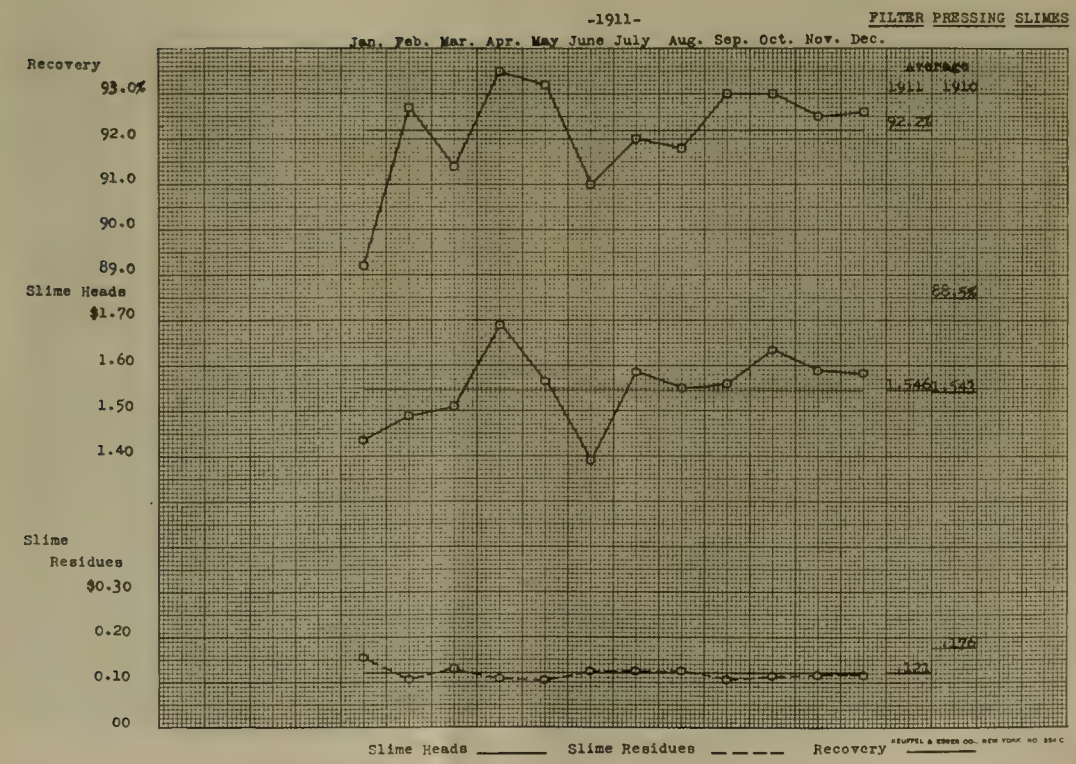
†*Mining and Scientific Press*, July 8, 1911.

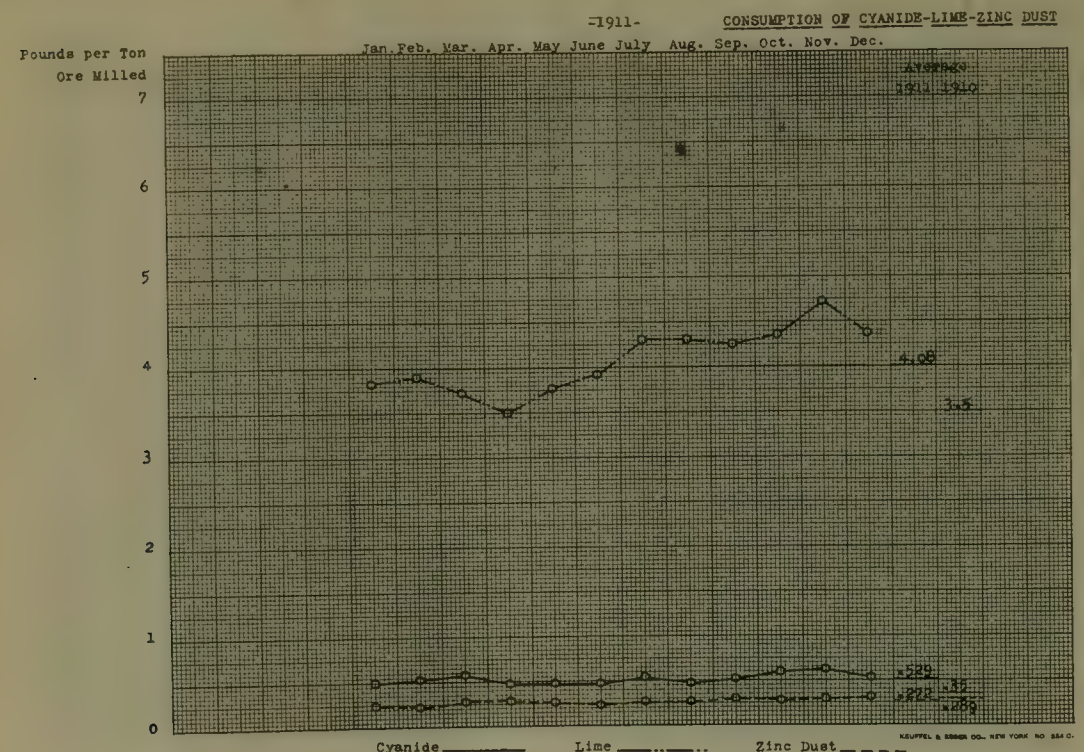


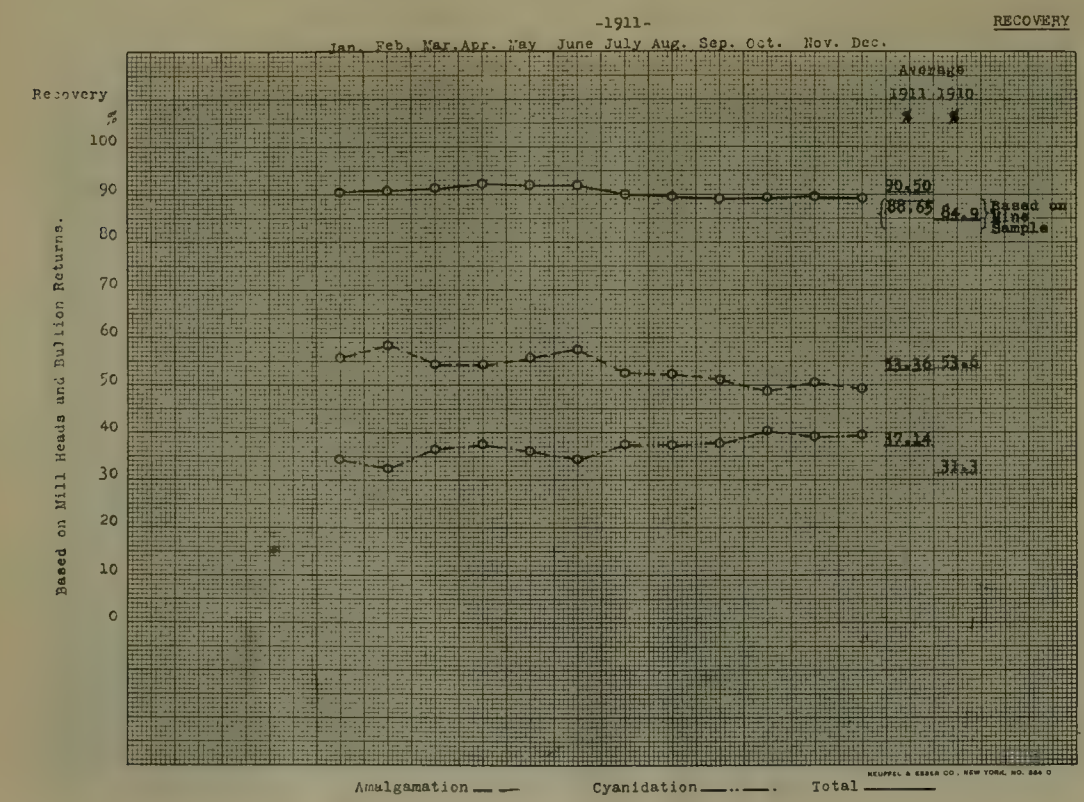

Tons Milled
-1911-
Jan. Feb. Mch. Apr. May June July Aug. Sep. Oct. Nov. Dec.
ORE MILLED
VALUE PER TON
Average
1911 1910
18000
17000
16000
15000
14000
15170
14468
Gold Value per Ton
.10
$6.00
.90
.80
.70
.60
5.50
.40
.30
.20
.10
5.00
.90
.80
.70
.60
4.50
5.55
5.437
5.237
Ore Milled
Value per Ton
Mine Sample


Cost per Ton
-1911-
Jan. Feb. Mar. Apr. May June July Aug. Sep. Oct. Nov. Dec.
COSTS PER TON MILLED
LABOR SUPPLIES POWER
Average
1911 1910
$1.50
1.40
1.30
1.20
1.10
1.00
.90
.80
.70
.60
.50
.40
.30
.20
.10
.00
1.062
1.048
.357
.377
.338
.186
.167
Labor
Supplies
Power
Total


Recovery
-1911-
Jan. Feb. Mar. Apr. May June July Aug. Sep. Oct. Nov. Dec.
AVERAGE
1911 1910
78.0%
76.0
74.0
72.0
70.0
70.43
Sand Heads
$3.60
3.40
3.20
3.154
3.00
2.80
2.60
2.660
2.40
2.20
Sand Residues
$1.00
.80
.788
.760
.60
Sand Heads _____ Sand Residues _ _ _ _ Recovery _____


-1911-
FILTER PRESSING SLIMES
Jan. Feb. Mar. Apr. May June July Aug. Sep. Oct. Nov. Dec.
Recovery
AVERAGE
1911 1910
93.0%
92.0
92.24
91.0
90.0
89.0
Slime Heads
$1.70
88.58
1.60
1.50
1.546
1.543
1.40
Slime Residues
$0.30
0.20
.176
0.10
.121
00
Slime Heads _____ Slime Residues _ _ _ _ Recovery _____


-1911-
CONSUMPTION OF CYANIDE-LIME-ZINC DUST
Pounds per Ton Ore Milled
Jan. Feb. Mar. Apr. May June July Aug. Sep. Oct. Nov. Dec.
Averages
1911 1910
7
6
5
4
3
2
1
0
4.08
3.5
.529
.32
.222
.289
Cyanide
Lime
Zinc Dust
KEUFFEL & ESSER CO., NEW YORK NO. 344 C.


-1911-
RECOVERY
Jan. Feb. Mar. Apr. May June July Aug. Sep. Oct. Nov. Dec.
Recovery %
Based on Mill Heads and Bullion Returns.
Averages
1911 1910
100
90
80
70
60
50
40
30
20
10
0
90.50
88.65
84.9
Based on Mine Sample
53.36
53.8
37.14
31.3
Amalgamation
Cyanidation
Total
KEUFFEL & ESSER CO., NEW YORK, NO. 344 D

Problems in Modern Copper Smelting

By S. F. Bretherton

As copper is the most interesting of the base metals, its importance in the commercial world being augmented by the wonderful science of electricity, I will discuss its metallurgy, only attempting to describe modern copper smelting, which is more important for advanced students. When I say 'modern', I mean within the last thirty years. Less than thirty years ago such mines as the United Verde of Arizona, the copper mines of northern California, and others, were considered of little value because the ore was sulphide and considered refractory. Such properties were examined by several noted engineers and rejected, even at a comparatively low valuation. Today such mines have become the basis for the cheapest and best metallurgical work in the world.

For several years the Dominion Copper Co. of Globe, Arizona, hauled a trainload per day of sulphide ore all the way from Bisbee to Globe, Arizona, several hundred miles, in order to get the sulphide to make copper matte for converting. Not only this: it enabled them to make a much cleaner slag than is possible when smelting directly to black copper. I can remember the time when at Clifton and Globe, Arizona, Santa Rita, New Mexico, and other places, rich oxidized copper ore was smelted to pig copper, reducing a comparatively small tonnage in the furnace, using 20 to 24% fuel, and throwing a slag over the dump containing 2 to 3% copper, worth $6 to $9 per ton. Today the average slag thrown over the dump will not exceed, I think, 60c. per ton in copper, and the fuel used in the blast-furnace from 1 to 10%, depending on the sulphur contained in the ore and the character of the slag to be made. Briefly, the advantages of smelting sulphide copper ores are as follows:

1. Greater capacity for the same sized blast-furnace.
2. Less danger of 'freeze-ups', a term generally used by the smelter-men when the furnace is lost by incrustations forming from any cause.
3. Smaller fuel consumption.
4. Cleaner slag.

I might add the saving of roasting the ore. When smelting direct to black copper, it was necessary to roast any rich sulphide ore. For some time after the system of smelting to copper matte was in general use, it was thought necessary to roast most of the sulphides, and more fuel was used than at present, but as the method was improved, first with the aid of hot blast, and then cold blast under higher pressure, the percentage of fuel was continually reduced until, in some cases, smelting in the blast-furnace to a low-grade matte was accomplished without any fuel.

I have just referred to 1 to 10% fuel in the charge in matte smelting, depending on the percentage of sulphur and character of the slag to be made. If the percentage of sulphur is low, it is necessary to use more fuel to furnish the required heat and save the sulphur for matte making. Again, if it is necessary to make a slag low in iron and high in magnesia, alumina, barium, or zinc oxide, a much greater heat is required to keep it fluid. A slag chiefly containing iron base requires less heat than when the iron is replaced with an alkaline base (manganese is generally classed as iron for fluxing purposes), but it is necessary to study the specific gravity of the slag, in order to get a good matte separation, and at times in running customs plants I have had so little iron, and so much zinc and barium or perhaps magnesia and alumina, that it required more than the usual amount of heat to keep the slag hot enough to run properly. Too much iron base means a fluid slag, but too heavy for a good matte separation; too little iron and too high a percentage of alkaline bases, especially magnesium and barium, requires more heat, and is also too viscous, holding matte or shots of metal suspended mechanically. Slag containing too much silica and alumina will do the same thing, but the most treacherous slag of all is one which contains too much zinc oxide or barium, especially if they are together.

Alumina, like magnesia, is not objectionable in limited quantities. In iron smelting, alumina is classed as a base, but in ordinary copper or lead smelting I consider it safer to class it as an acid. I find it acts so for me, no doubt, for the reason that in the shallow lead or copper furnace a much lower temperature and less percentage of fuel is used than in the deeper iron blast-furnaces. In lead smelting the metallurgist has very little margin to work on when figuring his slag; that is, he cannot depend on getting any iron from unroasted sulphides; if he did, the volatilization of lead would be too great, causing serious losses, and he must be careful to watch his silica so as not to form silicate of lead in the slag. The copper metallurgist does not fear the volatilization of copper or the formation of silicate of copper; in fact, a silicious slag for copper smelting does cleaner work and is more suitable for fire concentration. But if he depends on getting all his iron for slag-making purposes from raw sulphides, as I have frequently had to do, it is necessary, after figuring the charge, to see that his instructions are carried out on the feed floor, for too much fuel, too deep burden, or too small a volume of blast might mean a freeze-up, due to lack of iron in the slag. The shape of the furnace, the size and number of the tuyeres, the way the furnace is fed, all have some bearing on this question, as well as the amount of the blast used. The size and character of the ore has also to be considered.

Fine ore is very objectionable in blast-furnace work (here comes in the question of the proper method of crushing and sampling). Reverberatory smelting practice has the advantage over the blast-furnace in smelting fine ore, but the ore has to be all crushed fine and a preliminary roast given it. I have also found that very little zinc can be volatilized in the reverberatory furnace, whereas I have volatilized over 49% of it in the ordinary blast-furnace, which is a great advantage when the ore contains more zinc than the slag can carry. You have doubtless read articles describing the necessity of roasting matte before re-smelting in order to get a matte richer in copper for either the converter or for marketing direct. I remember an article written several years ago by one of our prominent metallurgists, claiming that the re-smelting of matte in the blast-furnace without roasting did not increase its copper content by concentration. My experience for several years has been, both in Arizona and California, to ship matte containing 30 to 40% from ore in Arizona, averaging about 1½% copper, and in California 3%. This means a concentration of 20 and 13 tons of ore to 1 ton of matte, respectively, requiring a re-smelting of this matte with silicious ore, a re-smelting which was made more difficult on account of having a poor quality of silicious ore on hand to work with.

This roughly outlines the principles of copper matte smelting down to where the converter is used. To make this clearer, it will be necessary to describe each particular feature I have taken up in detail. Some of you may be called upon at some time in the future to decide as to the advisability of erecting a small smelter for a partly developed mine, perhaps some distance from a railroad, the owners having read about 1½% copper in 'porphyries' paying dividends where the ore is first concentrated and then smelted in the reverberatory or blast-furnace, or about where 2½ to 3% copper sulphide is made to pay dividends by direct smelting to matte and then converted to blister copper containing the silver and gold which is

*An address delivered before the Mining Association of the University of California, January 24.

shipped to Eastern refiners for further separation.

It may be well here to put in a word of caution. Converting the matte to blister copper means a saving in freight on waste, such as iron and other sulphides contained in the matte, and also a better price for the copper of 1 to 1½c. per pound, but it is not practicable to operate a converting plant in connection with a small matting plant, so that unless the ore contains much precious metal to help the copper carry the expenses, and conditions are unusually favorable, it is often better to ship the crude ore and put in no reduction plant at all. It is true that some of our largest and best paying copper properties of today, such as the United Verde, and Copper Queen of Arizona, the copper smelters of Montana, and others, which could be mentioned, were started as copper matting plants.

To illustrate this point: Some time ago I was called upon to examine property 45 miles from the railroad. The owners felt sure they had a good property which could be made to pay handsome profits with less than 3% copper. The cost of marketing copper is greater than is generally realized, especially in the form of matte. Matte containing 40% copper is the most profitable to make, on account of slag losses, and is the most suitable for converting plants, where it is blown to blister copper. A 40% copper matte made from a 3% ore would equal a concentration of 14 tons of ore into 1 ton of matte, allowing for about 5% loss of copper in smelting. The expense on this ton of matte would be, estimating copper at 15c. per pound: Wagon haul as back freight, 42 miles, not less than $6; shipping to Salt Lake City (the nearest market), railroad freight, $5.25; copper refining deduction, 2¾c. per pound, $22; copper deduction, wet assay, 1.3%, $3.90. This amounts to $37.15 per ton of matte, which, divided by 14 tons, equals $2.65 per ton of ore. Estimating mining and all development expenses at least $2.50 per ton of ore; general and all offices expense at 35c. per ton; smelting so far from a railroad, $3 per ton, at the very least; made a total of $8.50 per ton, even on the basis of a comparatively large plant. Divide this by 60 lb. of copper, less 5% for loss, or 57 lb., the cost would be 14.93c. per pound, in round numbers 15c. Usually copper ore contains precious metals to assist the copper in carrying the expense, but in this particular case the gold and silver content was scarcely worth considering.

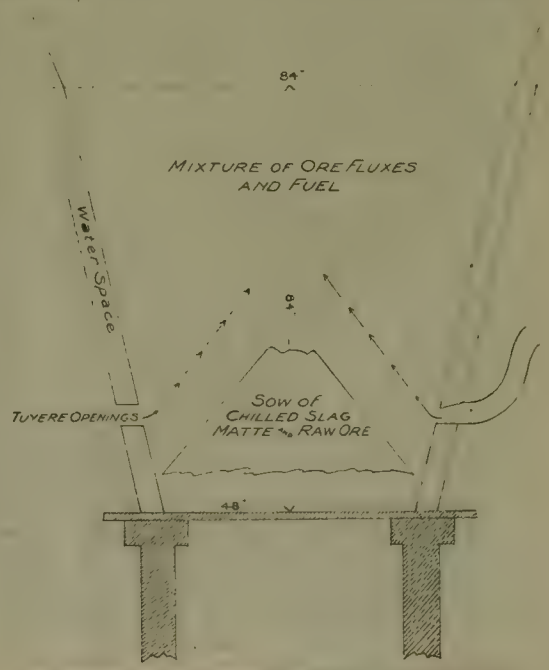
The method of concentrating matte to metallic copper in the converter was the greatest advance in copper metallurgy within the last thirty years. The refining of copper by electricity can perhaps be classed as the second most important advance. The practice of converting copper matte has been constantly improved since being first introduced at Butte, Montana. The use of silicious ore for lining, instead of barren quartz and clay; larger converters; machinery for tamping; and, last but not least, the long-wished for method of adding silicious ore to the converters, as required, is now being accomplished successfully, by using a basic lining and adding the silicious ore instead of depending entirely upon the lining to furnish the silica required for combining with the iron in the matte as the sulphur is oxidized and driven off.

The great success and continued improvement in converting practice have had considerable bearing on blast-furnace and reverberatory smelting practice. To some extent the same principles are applied in the much higher blast pressure and larger volume of blast now used. The higher pressure and deep shaft furnaces for copper matting can be used where ores are comparatively clean, but my experience has been in the smelting of ore containing high percentages of zinc that it was necessary for us to carry a very low burden above the tuyeres, with an extremely hot top, otherwise the incrustations would form so quickly on the walls of the furnace that the furnace would have to shut down in order to be barred off. The shape of the furnace has considerable bearing on this question also. For this reason I have planned a blast-furnace, especially designed for the smelting of refractory ore containing zinc, shown in the accompanying illustration.

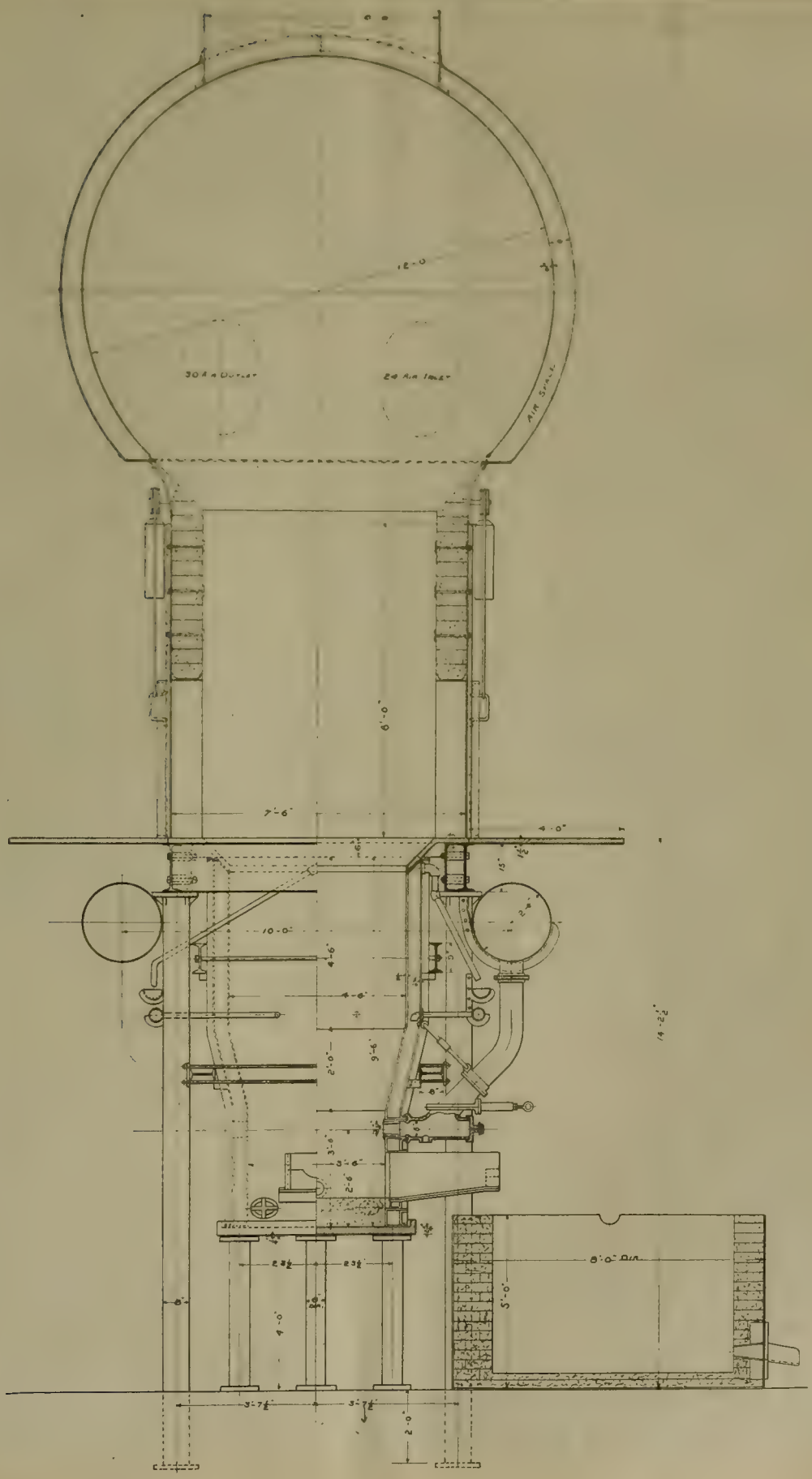
The extremely large top of this furnace is to allow the dust to fall back on the charge, which results from the fume passing through this increased area and decreasing its speed just before entering the smokestack. This was found to be a great advantage. The dust, which is mechanically thrown out by high blast-pressure and usually goes over into the dust chamber, was found to be very much lessened by the use of this enlarged top. There is a 6-in. space or shell surrounding this top, which is for blast-heating purposes. This feature was added only at the request of those for whom I was designing the furnace, as I do not consider the results obtained justify the expense. By this arrangement the space required for feed doors is cut out, the heating surface is not very great; then again, the interior of this shell, exposed to the hot fumes, quickly becomes coated with dust, which is a poor conductor of heat. The greatest advantage of this air chamber above the feed floor would be the benefit of the cooling effect to the men working on the feed floor. Of course, this can also be obtained by brickwork.

In the body of the furnace below the feed floor, it is only 7 ft. from the centre of the tuyeres to where it is possible to carry the top of the charge, which is much lower than the ordinary type of blast-furnace, but this furnace was especially designed for the smelting of ore containing zinc. The bosh, starting a few inches above the tuyeres, only extends up a distance of 2 ft.; from there to the top of the furnace the walls are perpendicular. I found this a great advantage, for the reason that the smelting zone belongs between the tuyeres and for a few feet above them. By allowing the weight of the charge to be carried by the boshes it keeps the pressure off the crucible and allows freer circulation of the blast between the tuyeres, at the same time holding the burden more compactly above. The following, showing the shape of one of the first blast-furnaces I was requested to use in copper smelting, illustrates my reasons for this, and while it was very provoking at the time, the experience taught me a valuable lesson.

The total height of the furnace from crucible to feed floor was about 9 ft. diam. at the top, 4 ft. at the tuyeres, with a continuous slope from the top to the bottom. The ore was the ordinary silicious copper ore with iron and zinc sulphides, containing some zinc and as much iron as we cared to use. After operating for a few hours, the smelting zone was all at the top of the furnace, slag and matte in the crucible, too cold to run, and a cone or sow formed, as shown in the sketch. This was due to the blast passing up the sides of the furnace instead of reaching the



CROSS-SECTION OF A POORLY DESIGNED BLAST-FURNACE.


12'-0"
30A Outlet
24 Air Inlet
Air Space
6'-0"
7'-6"
4'-0"
10'-0"
4'-6"
4'-6"
2'-0"
9'-6"
3'-0"
3'-6"
2'-6"
23½"
23½"
4'-0"
8'-0" Dia.
5'-0"
3'-7½"
3'-7½"
2'-0"
14'-2½"

centre of the charge. It followed the lines of least resistance, blowing the heat with it and leaving an unfused centre between the tuyeres above the crucible, which kept growing larger until the furnace was lost. What little smelting was done the last few hours the furnace was kept alive was between the centre and the walls, the slag dropping into the crucible near the outer rim, which we found to be the cause in cleaning out the furnace. This furnace was afterward abandoned and has never been used since, to my knowledge. The man who designed this furnace had had some practical experience, and I was very much surprised at his making such a blunder.

Some metallurgists advocate very wide blast-furnaces, even as much as 56 in., but this is only possible where the ore is coarse, having had the finer material removed by screening, and a considerable depth of burden is carried above the tuyeres. There is a limit to the coarseness of the ore as well; more especially in smelting ore containing zinc in shallow furnaces. As zinc sulphide is one of the most infusible ores, it is necessary to oxidize it so as to volatilize the sulphur and form zinc oxide. For this reason it is evident that in shallow furnaces the centre of any large lump of ore would pass into the crucible where oxidation ceases, and there accumulate until the furnace is lost, unless a good foreman stops the blast, takes out the breast, draws off all such accumulations, replaces the breast, and resumes operations. It will be evident to those of you who have had some practical experience that the blast entering at the side of the furnace will have a tendency to ascend while passing through the charge to the centre; so that if the furnace is too wide or the charge too fine, what is commonly known as a 'sow' will form in the centre of the furnace in the shape of a cone. This will mean the loss of the furnace in time, as it forces the blast with the heat away from the crucible and too much to the top of the furnace. Before this becomes serious there are generally one or more large blow-holes formed in the charge above the tuyeres, through which the blast escapes like wind forced up a chimney. It is the prevention of these blow-holes by proper feeding, which requires some of the feeder's skill.

Much zinc is always objectionable, but it can be handled to better advantage in copper smelting than in lead smelting; in fact, zincblende seems to give less trouble in a blast-furnace with hot-blast than when roasting in a reverberatory furnace, as it requires much more heat to liberate its sulphur than when roasting pyrite; and it must be that with hot-blast the oxygen, not having to unite with fuel, has a better chance to combine with the sulphur where such an intense heat exists as in the blast-furnace. Some metallurgists claim that no copper is necessary, and an iron matte will save the precious metals present. Mixtures containing much less iron and more silica can be smelted to better advantage than those I have named; but it would require too long to discuss the question of the different combining powers of each base with silica, to form singulo-silicates for lead smelting or bi-silicates for copper smelting.

The first heat required is for heating the air-blast up to the temperature where the oxygen will combine with either the carbon of the coke or the sulphur contained in pyrite; then the heat necessary for melting ores and fluxes so that they will combine to form the proper silicates for fluid and clean slag is produced by the oxidizing of the fuel in the charge by the oxygen in the blast. If cold-blast is used, the free oxygen going in with it is required to oxidize the extra fuel required to heat the blast, thus leaving little for the sulphur. If more cold-blast is used so as to get still more free oxygen, it drives the heat still farther away from the tuyere openings into the furnace, and reduces the smelting area of the furnace in that proportion, driving the heat higher up in the furnace and burning the fuel and smelting the ore so near the top of the furnaces that any metals volatilized have no chance to get caught. It keeps the fuel burning so high above the tuyeres that it leaves very little for the blast to encounter as it enters, unless a large quantity is used. When the cold-blast enters the furnace and encounters hot charge without fuel mixed with it to generate heat, a crusted furnace soon results, starting at the tuyere nozzle and reducing the capacity of the furnace until it is closed. This results when too much cold-blast is used, or too little fuel and sulphur are used with the cold-blast. By the use of the hot-blast this trouble is greatly decreased and the hotter the blast is the better it is, up to a point where all the heat necessary for smelting can be produced by the combination of the oxygen in the blast with easily oxidized elements in the ore, such as sulphur and arsenic. When these elements are not in sufficient quantity to produce by oxidation the heat required without making too high a concentration; that is, when there is not enough sulphur to make matte for the regular clean working of the furnace, then sufficient fuel should be used in order to save the necessary sulphur for making a proper grade of matte.

Petroleum Products in Siam

By Carl C. Hansen

The total imports of refined kerosene into Siam for the fiscal year ended March 31, 1911, amounted to 6,300,768 gal., worth $797,123, of which 1,843,856 gal., value $250,056, came from the United States, 4,452,072 gal., value $546,026, from Sumatra, and 4840 gal., value $1041, from Singapore. The Asiatic Petroleum Co. (Ltd.) has two brands of oil in the market, the 'Dragon' and 'Crown,' which retail at 54 and 56c. per tin of 5 gal., respectively; and the Standard Oil Co. exploits three brands of kerosene, the 'Eagle,' 'Cock,' and 'Devoe,' the retail prices being 54c., 59c., and $1.67 to $1.85 per tin of 5 gal., respectively.

The imports of benzine for the last fiscal year amounted to 209,660 gal., of which 89,320 gal., value $24,208, was imported from the United States, being retailed under the name 'Pratt's motor spirit' at $1.39 per tin of 5 gal.; and 120,340 gal, value $34,901, came from Sumatra, being known in the market as 'Shell motor spirit' and retailed at the same price as the Pratt. During the year under review 673,527 gal. of fuel oil, value $25,578, was also imported from Sumatra. The total value of the imports of lubricating oil for the fiscal year ended March 31, 1911, was $59,109, and of this amount the United States contributed $39,214 worth. Great Britain's share was $10,716. The yearly imports of petroleum oils, including kerosene, benzine, and fuel oils, for the five fiscal years from 1907 to March 31, 1911, inclusive, have amounted to 5,362,822, 6,123,041, 6,294,167, 6,610,601, and 7,183,955 gal., respectively. Of other petroleum products, candles to the value of $33,227, nearly all of which came from Burma, and wax valued at $66,714, were imported during the year ended March 31.—*Daily Consular Reports.*

Idle Mining Property

The remedy for the existing evil of idle mining property must be sought either in the adoption of leasehold, under which the Government can enforce operation, a system which fully attains the desired end of promoting mining development in Australia and New Zealand, according to the report in 1907 by A. C. Veatch, geologist of the Geological Survey, to the President, or in the thorough revision of the existing system. Radical amendment to the present law would be necessary in order to secure something more nearly approaching equality of opportunity. Some limitation should be put on the number of claims which an individual can locate in each mining district, and the prevention of monopolization would be furthered by the rigid enforcement of assessment development. The record of claims kept by a local official elected by the miners should be reported to the nearest land office in order to furnish the Federal Government with a notice of the intention of the claimant, and thus to initiate the operation of effective inspection, the purpose of which would be to enforce the use and development of mineral land as contemplated in the law. (From Report of Director, U. S. Geological Survey.)

Bureau of Mines Act

The chairman of the House Committee on Mines and Mining, M. D. Foster, has introduced a bill amending the Act governing the Bureau of Mines so that it will read:

"That there is hereby established in the Department of the Interior a bureau of mining, metallurgy, and mineral technology, to be designated the United States Bureau of Mines, and there shall be a director of said bureau, who shall be thoroughly equipped for the duties of said office by technical education and experience and who shall be appointed by the President, by and with the advice and consent of the Senate, and who shall receive a salary of $6000 per annum; and there shall also be in the said bureau such experts and other employees, to be appointed by the Secretary of the Interior, as may be required to carry out the purposes of this Act in accordance with the appropriations made from time to time by Congress for such purposes.

"Section 2. That it shall be the province and duty of the Bureau of Mines, subject to the direction of the Secretary of the Interior, to conduct inquiries and scientific technologic investigations concerning mining, and the *preparation, treatment and utilization* of mineral substances, with a view to *improving the health conditions of the operators and increasing* safety, efficiency, *economic development*, and the prevention of waste in the mining, quarrying, metallurgical and other mineral industries, and concerning explosives and fuels and untinished mineral products belonging to, or for the use of, the United States, with a view to their most efficient use; and to *disseminate information* concerning these subjects in such manner as will best carry out the purposes of this Act.

"Section 3. That the director of said bureau shall prepare, publish, and distribute, subject to the direction of the Secretary of the Interior, under the appropriations made from time to time by Congress, reports of inquiries and investigations, with appropriate recommendations of the bureau, concerning the nature, causes, and prevention of accidents, and the improvement of conditions, methods, and equipment with special reference to health, safety, and prevention of waste in the mining, quarrying, metallurgical, and other mineral industries; the use of explosives and electricity, safety methods and appliances, and rescue and *first-aid work in said industries;* the causes and *prevention of mine fires;* and other subjects included under the provisions of this Act.

"Section 4. That nothing in this Act shall be construed as authorizing the Bureau of Mines or any employee of said bureau to undertake any investigation or operation in behalf of any private party, except with the approval of the Secretary of the Interior, for the health and safety of persons employed in the mining, quarrying, metallurgical or other mineral industries; nor shall the director or any member of said bureau have any personal or private interest in any mine or the products of any mine under investigation: Provided, that nothing herein shall be construed as preventing the employment by the Bureau of Mines, in a consulting capacity or in the temporary investigation of special subjects, of any engineer or other expert whose principal professional practice is outside of such employment by said bureau.

"Section 5. That for tests or investigations authorized by the Secretary of the Interior under the provisions of this Act, other than those performed for the government of the United States or state governments within the United States, a reasonable fee covering the necessary expenses shall be charged, according to a schedule prepared by the Director of the Bureau of Mines and approved by the Secretary of the Interior, who shall prescribe rules and regulations under which such tests and investigations may be made. All moneys received from such sources shall be paid into the treasury to the credit of miscellaneous receipts.

Section 6 is the usual emergency clause.

Proposed Change in the Lead Tariff

By W. A. Scott

The Underwood bill passed the House of Representatives on January 29, and in amended form probably it will pass the Senate. By the provisions of this bill, as it passed the House, zinc and zinc in ore produced in foreign countries may be received in American markets free of duty; pig lead and lead in ore, instead of being charged a specific duty of 2½c. per pound as under the old schedule, is subject to a duty of 25% *ad valorem*. The lead and zinc producers of Idaho, Utah, Colorado, Missouri, and Kansas foresee lower prices of those metals as the result of a law that would give foreign producers such easy access to our markets as does the Underwood bill. The secretary of the American Mining Congress, who is at Washington, is being supplied with data by Western operators wherewith to try to defeat the measure in the Senate. The most united protest undoubtedly emanates from the Coeur d'Alene district, Idaho, where some of the largest lead-silver mines of the world are situated. That the ores of this region are not as high grade as were those formerly produced is shown by the fact that the portion that requires concentration before shipping constitutes an ever-increasing tonnage, while there is a corresponding decrease of the tonnage of shipping grade. The Idaho operators believe that the proposed reduction of duties will result in supplying the American market with lead from Mexico and Spain to such an extent as to depress the price below $4 per hundred. With lead at present prices there is special activity in the development of lead mines in northern and central Idaho, and in Park City and Tintic districts, Utah; but if there should come a pronounced drop in the price of lead, it is certain that this activity on new properties would be checked to a marked degree.

The manufacturers of lead pipe and similar commodities probably have made their influence felt in fixing the lead schedule in the Underwood bill, and it is probably true, as claimed, that American owners of lead mines and lead smelters in Mexico would welcome the changes provided for in the Underwood bill, as the new schedule would enable them to make a profit on their Mexican product even with lead at prices that would mean a loss to many of the Utah and Idaho operators. While the Guggenheims have nine lead-smelting plants in the Western states, their actual interests in mining properties are comparatively small. Their chief interest today in the Coeur d'Alene, in Utah, and in Colorado consist of smelting contracts; and since the International Smelting & Refining Co. joined the United States and Salida companies as competitors of the A. S. & R. Co. for the purchase and smelting of lead ores, the last-named concern is losing some of its big customers and is no longer in position to dictate smelting rates. It is, therefore, only business tactics on the part of the A. S. & R. Co. to so aid in framing duties as to let in cheaper ores for their American smelters, and afford an open market for the pig lead produced at their five smelting plants in Mexico. It should not be forgotten that, while the Guggenheims own and operate chiefly smelters in the United States, they own and operate not only smelters but mines in Mexico. In the practical workings of the Underwood law, our lead-mine operators might be cramped by low prices of lead, while the smelting company, which has no mines, could import ores from Spain at prices that would enable it to adjust itself to almost any market price of lead. It is not likely that a great tonnage of lead ore would be shipped from Mexican mines to smelters in the United States in the event of the Underwood bill becoming a law, because Mexico has not less than ten lead smelting plants, and with the abundance of coal and coke in that country, and the cheaper labor, its smelting as well as mining operations are on a more economical basis than are those of the United States. It is probable that the old lead duty will not be retained

Annual Meeting of the A. I. M. E.

A circular letter recently distributed calls attention to important issues bearing on the future development of the American Institute of Mining Engineers which will be decided at the annual meeting, which is to be held at the headquarters in New York City, 29 West 39th street, on February 19, 20, and 21. It is proposed hereafter to make the annual meeting the most important gathering, professionally and socially, of the year, and all are urged to make an effort to participate. Local committees have been organized, and a detailed program will be issued at an early date. The circular is signed John Birkinbine, D. W. Brunton, S. B. Christy, James Douglas, James Gayley, John Hays Hammond, H. M. Howe, Robert W. Hunt, C. Kirchhoff, W. A. Lathrop, B. B. Lawrence, A. R. Ledoux, E. E. Olcott, R. W. Raymond, J. W. Richards, E. G. Spilsbury, and Gardner F. Williams. The annual business meeting of the Institute will be held at the Institute headquarters on Tuesday, February 20, 1912, at 10 o'clock a.m. At this meeting members present, or by proxy, will elect a president, vice-president, secretary, and three members of the council, and three directors of the corporation; as required by the constitution. A form of proxy, in the name of Leonard Waldo and Bradley Stoughton, has been sent to qualified voting members, which may be signed, witnessed, and returned to the office of the Institute, with or without alteration. Members and associates in arrears for dues of 1911, or residing outside of the United States, Canada, and Mexico, are not entitled to vote. The following names, comprising all the nominations received for the offices of the council, have been recommended by the nomination committee, which consisted of E. Gybbon Spilsbury, James R. Finlay, Charles P. Perin, Arthur S. Dwight, and Louis D. Huntoon. Said nominations were approved by the council at the regular meeting, January 12, 1912.

For President of the Council—James F. Kemp, New York, N. Y. (term expires February 1913).

For Vice-Presidents of the Council—Benjamin B. Thayer, New York, N. Y.; Karl Eilers, New York, N. Y.; Waldemar Lindgren, Washington, D. C. (term expires February 1914).

For Secretary of the Council—Joseph Struthers, New York, N. Y. (term expires February 1913).

For Members of the Council—Joseph W. Richards, South Bethlehem, Pa.; John H. Janeway, Jr., New York, N. Y.; Sidney J. Jennings, Dobbs Ferry, N. Y. (term expires 1915).

The arrangement for the meeting, apart from the technical sessions, are in the hands of the New York local section, the executive committee, which consists of Benjamin B. Lawrence, James Douglas, Bradley Stoughton, C. P. Perin, and George F. Kunz. All inquiries concerning local matters, except those referring to papers and discussions for the technical sessions, should be addressed to Bradley Stoughton, 165 Broadway, New York. The control of the papers and discussions will be exercised by the president and the secretary of the council, as usual. Details of the technical sessions of the meeting will be given in the program of the local committee, which will be furnished to each member or guest on registration at headquarters. Members wishing to visit during the week of the meeting any industrial plant or work in New York City or vicinity will be assisted to do so by means of suitable introductions and guidance, upon timely notice given by them in advance to George Buckman, 29 West 39th street, New York City.

The following provisional program has been arranged, subject to possible but not probable change by the local committee:

Monday, February 19, 1912:

8:15 p.m.—Informal social meeting at Institute headquarters, beginning with an illustrated lecture on some topic of popular scientific interest.

Tuesday, February 20, 1912:

10:00 a.m.—Annual business meeting.

12:30 p.m.—Luncheon at the Engineering Societies building.

2:00 p.m.—Technical session.

7:00 p.m.—Banquet at Hotel Plaza, 59th street and Fifth avenue. committee: James Gayley, A. R. Ledoux, D. M. Riordan, Theodore Dwight, and Thomas Robins.

Wednesday, February 21, 1912:

10:00 a.m.—Technical session.

12:30 p.m.—Luncheon at Engineering Societies building.

2:00 p.m.—Technical session.

A Possible Oilfield

It will be remembered that, following suggestions of the State Geological Survey of Illinois as to geological structure, a new field was brought in last year near Carlyle. In the year since, southern Illinois has been re-studied by E. W. Shaw, recently of the geological corps of the Southern Pacific and now working jointly for the Illinois and the United States Geological Surveys. He has found a number of places where the structure is favorable to oil accumulation, and, in advance of a complete report, the following list of such localities has been announced as worthy of being tested for oil and gas: The vicinity of Darmstadt, northeast of Lenzburg; about Marissa and extending for several miles toward Oakdale; between Nashville and Addieville; the vicinity of Hoffman; between Mascouta and Okawville; between Trenton and Breese; in a belt extending a few miles north to a few miles south of O'Fallon; the central part of Irishtown township northeast of Carlyle; and one to three miles northeast of Bartelso.

The circular distributed says: "A more exact statement of positions and limits of the likely districts must await further study. It is not to be assumed that all of these districts mentioned contain pools of oil or gas, but only that conditions seem to be much more favorable than in surrounding territory. The oil and gas pools of Illinois have all been found in districts where the geology is similar to that in those enumerated above, but there are many such districts where no oil and gas exists. Judging from these facts, it would appear likely that if any oil is found outside the districts mentioned above it will be where there are similar conditions but where the geology is so obscure that they have not yet been discovered."

Government Assays Free

The proposal contained in a bill recently introduced in Congress, that the United States Government shall furnish assays at a nominal charge, has provoked prompt opposition. At a meeting of the principal assayers and metallurgists of San Francisco, held February 5, 1912, the following resolution was unanimously adopted: *Whereas*, a bill, H.R. 17,033, has been introduced by Mr. Raker of California into Congress and referred to the House Committee on Mines and Mining, providing for the establishment of a government experiment station at Auburn, Placer county, California, at which assays, tests, analyses, and miscellaneous investigations of minerals and metallurgical problems are to be made gratuitously or for a nominal charge, and, *whereas*, there already exist well established private plants where this work is adequately and economically done and which meet the existing conditions along these lines.

Now, therefore, be it resolved, that while cordially approving of well directed efforts on behalf of the Government in the advancement of science, we protest against any unnecessary interference with established industry and personal initiative and against this bill in particular, as an unwarranted and unwise incursion into the field of established business. *Be it also resolved*, that copies of this resolution be sent to Congress, to the press and to interested technical societies.

THE production of the ruby mines of Mogok in 1910 was 260,019 carats, valued at about $520,000. This was an increase in weight of 4715 carats over the previous year, but of only $1000 in value. The number of laborers in the ruby mines during the year on the per diem roll was 1463.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual comment. Insertion of any contribution is determined by its general interest to the readers of this journal.

American Institute of Mining Engineers

The Editor:

Sir—On January 27 a meeting was held in Washington of the members of the American Institute of Mining Engineers who are also members of the U. S. Geological Survey to consider the proposed amendments to the constitution of the Institute. At this meeting were present G. H. Ashley, G. F. Becker, A. H. Brooks, E. F. Burchard, R. H. Chapman, Frank L. Hess, W. Lindgren, H. D. McCaskey, E. W. Parker, F. L. Ransome, C. E. Siebenthal, George Otis Smith, A. C. Spencer, D. B. Sterrett. Arnold Hague was prevented from attending, but he, as well as George P. Merrill, of the National Museum, and J. A. Holmes, of the Bureau of Mines, desires to express his concurrence in the action taken.

The following resolutions were passed after full discussion, and without a single dissentient vote: (1) The members of the American Institute of Mining Engineers present do not approve of the proposed change of name of the Institute to 'American Institute of Mining and Metallurgy.' (2) The members of the American Institute of Mining Engineers present are not in favor of the change in classification of members on the basis proposed in the circular, which is not a reclassification based upon professional standing. (3) In the absence of a financial statement showing that an increased income is necessary, the members present are opposed to the proposed increase in dues. A committee was also appointed to communicate the resolutions to the mining press in the hope of eliciting expression of opinion from other members of the Institute.

WALDEMAR LINDGREN,
GEORGE F. BECKER,
A. H. BROOKS,
Committee.

Washington, D. C., January 30.

The above letter shows a healthy interest in the affairs of the Institute, as does also the following, which has been sent to members with request for proxies made out in the name of G. C. Stone and J. R. Finlay. It is evident that the meeting to be held in New York this month will be most important and we again urge every member who can do so to attend in person.—EDITOR.]

To the Members and Associates of the
American Institute of Mining Engineers:

Sirs—At the annual meeting of the A. I. M. E. in New York, on February 20, radical changes in its constitution are to be considered. Among these is a proposal to increase the dues of all corporate members. We, the undersigned, intend to vote against an increase of dues, and we ask the coöperation of members unable to attend the forthcoming meeting, who are of the same mind in this matter as we are. The reasons for an increase of dues offered officially by the secretary of the Institute are, in our opinion, vague and unsatisfactory. Without denying that an increase may be advisable, we propose to contest such a measure until full information respecting the situation has been communicated to all members of the Institute; and until after it has been determined by a careful investigation of the Institute's affairs that the same purpose cannot be accomplished by economies in administration. We intend to vote against the proposed increase in dues, and to offer a resolution to appoint an independent committee to study the affairs of the Institute before any further action be taken. If you desire us to vote for you upon these principles, please execute the proxy that we enclose herewith. If you have already given your proxy to some one else, you have the right to cancel it. If you have given us your proxy you will thereby cancel all those previously given.

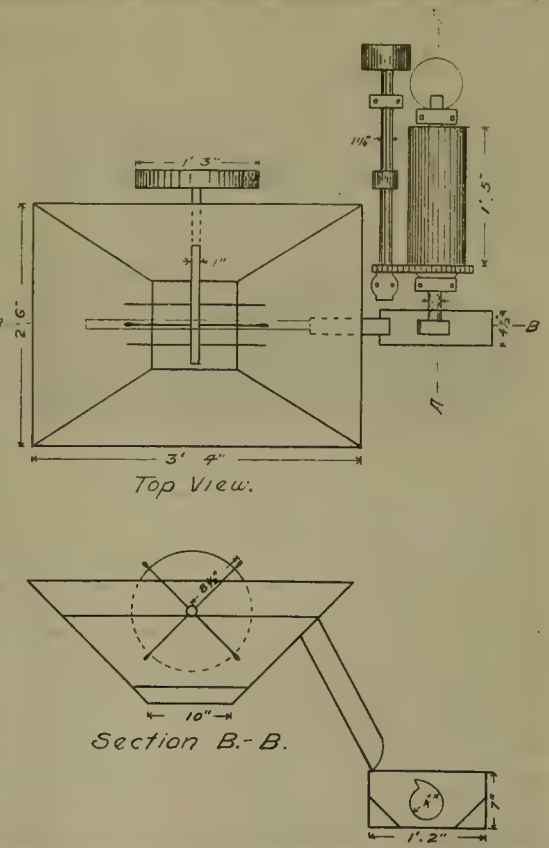
GEORGE C. STONE,	J. R. FINLAY,
CHRISTOPHER R. CORNING,	J. PARKE CHANNING,
W. R. INGALLS,	F. F. SHEALLESS,
J. LANGELOTH,	W. H. NICHOLS, JR.,
OTTO SUSSMAN,	J. A. VAN MATER,
ALLEN H. ROGERS,	ARTHUR THACHER,
LEWIS G. ROWAND,	ROBERT PEELE,
H. M. CHANCE,	W. C. RALSTON,
F. LYNWOOD GARRISON,	RICHARD H. VAIL,
JOHN H. ALLEN,	E. B. KIRBY.

New York, February 3.

Automatic Zinc-Dust Feeding

The Editor:

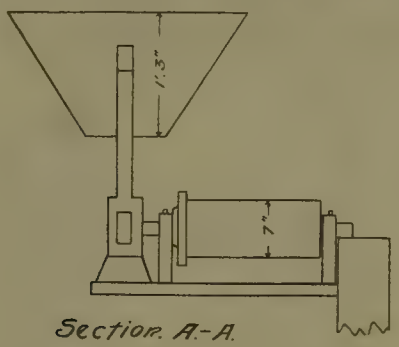
Sir—The drawing illustrates an automatic zinc-dust feeder that is being used with success at the Palmarito mine, Mocorito, Sinaloa, Mexico. It seems to possess several points of superiority over any feeder now in use. These points are: First, a positive continuous feed that is easily



and quickly regulated at the will of the operator; second, extreme mechanical simplicity; third, practically automatic action. Zinc-dust, owing to its hydroscopic properties, very readily absorbs moisture from the atmosphere, and the greater the percentage of moisture in the dust the greater its tendency to pack, and therefore the more difficulty in securing a positive feed. This was the problem to overcome here. At the low altitude of the mine, only about a hundred feet above sea-level, the air contains a great deal of moisture, and no matter how tightly closed the zinc container, it would absorb a high percentage of moisture. The feeder overcomes this difficulty and gives a positive continuous feed under varying degrees of moisture.

It may be briefly described as follows: A rectangular box, with sides sloping at an angle of 60°, made of 1-in. material lined with galvanized iron, having a central feed-compartment or slot, about 1 in. wide, that reaches to within 1½ in. of the bottom of the box. This space is

left so that the dust may enter the central feed-slot from each side, but not in such quantity as to offer any resistance to the revolution of the spokes that elevate the dust. An axle, 1½-in. diam., has attached to it four or more steel rods or spokes, ⅜-in. diam., with recessed openings at the ends shaped so as to form an elevator bucket to raise a definite quantity of zinc at each revolution. This shaft revolves at a speed of 15 or 20 r.p.m., not fast enough to cause the buckets to throw their contents by centrifugal force, but allows them to discharge by the force of gravity alone. The buckets are recessed in such a manner that they will not discharge their content until past the centre of gravity. The rods or spokes are flattened to knife-blade thinness, so that no zinc will adhere to them in their passage through the dust. These buckets discharge into a chute, also made of galvanized iron set at such an angle that the zinc does not stick, but runs into a continuous stream into the spiral feed of a miniature tube-mill. We have adopted Yaeger's idea of a small tube-



Section A-A.

mill to make the zinc emulsion, and find that it works well. A small stream of water washes the zinc into the feed of the tube-mill from the point where it strikes on leaving the chute.

The spokes radiating from the axle are threaded, and screw into the axle, so that in order to regulate the feed it is only necessary to take out a spoke and screw in another having a larger or smaller bucket, as may be needed to increase or diminish the feed.

To provide against the zinc in the container packing so that it will not run into the central feed-slot, a ⅜-in. steel rod slightly flattened at the ends is run through the axle on each side of the central feed-slot, and these rods serve as stirrers of the zinc and effectually overcome the difficulty of the zinc packing. A pulley on the shaft running the tube-mill connects with a pulley on the axle of the feeder and operates the feeder.

The container, as designed, easily holds 112 lb. of zinc-dust, the amount usually packed in the sealed boxes in which it is marketed, and a cover can be provided for the feeder, thus preventing oxidization while in operation. Thinking that this device may be of use to the many cyanide operators throughout the country, I cheerfully offer it for their benefit.

A. W. Morris.

Mocorito, Sinaloa, December 31, 1911.

Cyanidation at Silverton

The Editor:

Sir—There appears in your issue of January 20, 1912, under the heading of 'Special Correspondence' from Silverton, Colorado, the following: "There is a great deal of agitation at present for cyanide plants, and it is probable that several will be erected during the coming season. Much of the agitation has been carried on by men inexperienced and poorly informed in the art of cyanidation, and many failures and much discouragement will no doubt result." I cannot help resenting this doleful statement and offer the following for your consideration.

As early as 1889, J. M. Callow, whose ability no one will doubt, conducted elaborate cyanide tests upon the ores of Ice Lake basin and succeeded in demonstrating to his people beyond a doubt that the ores of the Grand View and Last Hopes properties were amenable to cyanide treatment. During the past season the Development Syndicate of which Root, Norton, and myself are members, conducted a series of tests on these ores, using compressed air for aeration and agitation and vacuum-filtration on 'Just' silicious filters. I do not claim to be an expert on cyanidation, although I have endeavored to keep in touch with its advancement, but I venture to say that Mr. Norton's experience and ability along this line is far better than average. Investigation of ores of this section, with regard to their amenability to cyanide treatment has been carried on by John T. Milliken, of the Golden Cycle G. M. Co., of Colorado Springs; Philip Argall, of the Independence mine of Victor; William H. Haldane, professor of metallurgy in the Colorado School of Mines; Louis Schaefer, a young engineer of exceptional ability, and others whose names are withheld for one reason or another, not to mention elaborate tests which have been made on the ores of a number of San Juan county properties and which have been unquestionably successful. It is among these people that much of the agitation for cyanide treatment of our ores has been carried on, and I challenge the allegation that such agitation is coupled with inexperience and poorly informed effort as the statement made in your esteemed journal would seem to indicate.

Warren C. Prosser.

Silverton, Colorado, January 28.

The Sherman Law

In an article on 'The Enforcement of the Anti-Trust Law' in the Februray *Century*, Mr. Wickersham, the Attorney General, states that discontent with the law and its enforcement by the present administration is not nearly so widespread as is popularly supposed. A few thoroughly discontented people are apt to make far more impression than do a host of people who are wholly satisfied with the same conditions which produce discontent on the part of others. It is a reasonable assumption that the majority of the people who are discontented with the Sherman law and with its enforcement are the stockholders and others interested in those corporations and combinations charged with its violation. The people who will most benefit from the enforcement of the law are the great army of consumers who have been purchasing the products of these corporations. It is certainly obvious that the number of consumers so benefited must far exceed the number of stockholders who may, in some degree, be injured. But even in the case of the stockholders, the injury to them is greatly exaggerated. The purpose of the law is not to destroy industries. Because the courts have not sought to destroy property, some extremists have uttered loud complaint, but that fortunately will not lead the courts to change their course.

Details have recently been made public of a new method of making chilled rolls for sheet and tin-plate mills, in which the chilling is done by air-blast instead of by water. The chilling section of the mold is surrounded by a drum having a spiral internal fin. Air under pressure is fed into this drum, and, after circulating in a spiral course around the mold, is exhausted to the atmosphere. The mold is ribbed, radiator fashion, to facilitate cooling. The operator can control the cooling effect at will by manipulating a gate valve where the blast enters the mold, and a thermometer fixed in the flow of the blast as it leaves the drum indicates exactly how the cooling is proceeding. It is claimed that the process not only produces a perfectly even chill, but a surface is given to a sheet or tin plate roll which is practically the same as that given by the water-chilling process and without the risk of internal stresses in the metal. The time of cooling is absolutely within the power of the operator, so that the metal can be set rapidly to get the necessary polish for the face and then the body be cooled gradually to eliminate the casting stresses.

Special Correspondence

LOS ANGELES

MINING ENGINEERS OF SOUTHERN CALIFORNIA ORGANIZED.—AFFILIATION WITH A. I. M. E. UNDER CONSIDERATION.—LIBRARY AND READING-ROOM PLANNED.

As a result of the visit of the members of the American Institute of Mining Engineers on their way to the San Francisco meeting last October, an organization of the mining engineers of southern California has been formed here, and steps have been taken toward the establishment of a library and reading-room. Affiliation with the American Institute of Mining Engineers is a subject under discussion. An organization to accomplish what is planned would require dues, it is felt, of not less than two dollars per month, independent of those paid to the Institute. Some uncertainty exists as to whether a chapter of the A. I. M. E. would have the power to carry out the plans of the new body, as the provision that the rules may at any time be changed by the Council of the Institute without consulting the chapter is regarded as unfavorable to the plans under way here. Among the matters for particular investigation are, whether a chapter may make rules which would limit the controlling vote in its own meetings to professional men, and whether the Institute would allow the recognition, under the name of Patron, or similar title, of persons who by a substantial contribution of cash or books were prominent in establishing the proposed library. These matters have been referred to the Council of the Institute for an opinion.

At the organization meeting, held December 28, of which F. J. H. Merrill was elected chairman, the following resolution was passed:

"Resolved, That it is the sense of this meeting that an organization of the mining engineers of Southern California should be formed at once for the purpose of professional intercourse and the maintenance of a suitable reading-room and professional library."

This resolution, which was presented by C. Colcock Jones, was supplemented by another, also presented by Mr. Jones, which was passed, providing for the appointment by the chair of a committee on organization. This committee appointed includes F. J. H. Merrill, C. C. Jones, T. B. Comstock, and W. F. Staunton.

Among the speakers at the organization meeting were Mr. Jones, who spoke of the pressing demand for a technical library for mining engineers and who mentioned the advantage of occupying rooms in the same building with the Sierra Madre club; and G. E. Bailey, who emphasized the fact that since the fire of 1906, which destroyed the libraries in San Francisco, there has been no adequate collection of technical books in the state. Russ Avery, president of the Chamber of Mines and Oil, offered the use of the rooms of that organization, together with the use of its reading-room, and expressed the hope that an affiliation with that body might be effected. A. Del Mar stated that he favored the organization of the professional mining engineers and geologists of Los Angeles and vicinity, and the establishment of a reading-room and library, and that he believed the organization should be independent of all clubs and existing societies and associations. In reply the chairman stated that there had been no intention, by those interested, of affiliation with any city organization, and that the idea of having the rooms near the Sierra Madre club was merely for convenience and economy. H. Y. Johnson spoke of his experience with Eastern technical organizations while associated with the United States Geological Survey at Washington. Julius Koebig favored the proposed organization for protection against unqualified men and promoters. L. D. Godshall favored the organization of a purely technical society, independent of existing bodies, but possibly affiliated with the A. I. M. E. Other speakers advocated the same ideas, excepting R. W. Hadden, who opposed affiliation with the Institute. W. R. Wharton said that E. A. Montgomery was unable to be present, but had telephoned the offer of the board of directors of the Sierra Madre club of the use of the clubrooms at any time, and any other feasible cooperation. E. Call Brown was secretary of the meeting, which was held in the Sierra Madre clubrooms. Those present were: J. H. Atkin, Russ Avery, G. E. Bailey, E. Call Brown, A. B. Carpenter, T. B. Comstock, A. Del Mar, J. H. Farrell, D. B. Gemill, L. D. Godshall, R. W. Hadden, A. B. Hall, Lewis Hind, Harry R. Johnson, C. Colcock Jones, Julius Koebig, Carl O. Lundberg, C. R. McCollom, F. J. H. Merrill, Dessix B. Myers, J. N. Nevius, R. H. Norton, T. H. Oxnam, H. W. Squires, W. F. Staunton, A. M. Strong, R. A. Sullinger, G. M. Swindell, W. R. Wharton, W. H. Wiley, Calvert Wilson, and Fred L. Wilson.

JOHANNESBURG, TRANSVAAL

NOVEMBER PRODUCTION BREAKS RECORD.—REPORT FOR LEADING MINES.—NEW EAST RAND PRODUCER.

Although November was a short month the output of gold constituted another record, being for the whole of the Transvaal 719,729 oz. of a total value of £3,057,213. The Rand output itself was 691,462 oz. of a total value of £2,937,141, an increase of 13,539 oz. and £57,507 on the preceding month. With a similar increase for the month of December (and there should be no difficulty experienced in

RANDFONTEIN CENTRAL MILL.

obtaining such an increase, seeing that it commands an additional day for milling), the December Rand gold output ought to exceed for the first time a total value of three millions sterling. It has taken only five years to add a million sterling to the value of the monthly gold output of the Transvaal, but, according to the present labor outlook, it will take a much longer period to add the next million. On mining grounds, too, the next additional million on the Rand monthly output will be difficult to obtain, for most of the available mining ground on the Rand, within comparatively easy reach of the outcrop, is already under tribute, while several properties are on the point of being exhausted. The progress for the next five years will probably therefore be much slower. It may take ten years to add another million to the value of the monthly output of the Rand after the three-million value has been reached, not because the Rand does not contain the latent resources to continue its progress at the present rate, but because of the looming labor and legislative troubles, not to mention those inherent to very deep mining.

A fair proportion of the increase credited to the month of November was due to the results obtained at the Modder 'B,' a new producer of some promise on the Far East Rand, where, until quite lately, there have been nothing but disappointments, where to record the closing down of Cloverfield, Van Dyk, and Grootvlei properties does not give a good aspect to the future of that field. With the success attending the starting of the mills at Modder 'B' and Brakpan, the Far East Rand is looking better, and it is hoped that this improving aspect will not be in any way marred by the results of the new Way-Arbuckle process now being introduced at the Benoni Consolidated Mines. The labor aspect is disquieting, but, nevertheless, the declared profits

for November were higher than for several months past.

The following are the twelve leading gold producers, with details of their stamps and tube-mills at work, along with the tonnage treated and value of gold obtained during November. It may be noticed that these produced more than half of the total gold output of the Rand.

	Stamps.	Tube-mills	Tons.	Value.
Randfontein	775	23	204,534	£248,505
Crown Mines	620	19	140,200	246,445
East Rand Proprietary	820	25	168,853	219,578
Robinson	250	6	52,300	115,759
Geldenhuis Deep	420	7	63,020	90,719
Rose Deep	300	7	63,800	88,994
Simmer & Jack	320	7	66,500	85,745
Robinson Deep	210	5	49,350	82,763
New Modderfontein	180	7	51,200	82,095
Nourse Mines	260	7	47,300	74,926
Village Main	220	5	38,687	74,454
Village Deep	180	6	48,700	69,387
Totals	4,555	124	994,444	£1,479,370

NEW YORK

COPPER SITUATION WEAKER. — RAY CONSOLIDATED AND CHINO TO MAKE APPEARANCE ON PARIS CURB.—SILVER MARKET.—GENERAL NOTES.

The close of the first month of the year appears to mark the wane of the much-talked-of revival in business and market activity, of which so much was made over the holiday season and during the first fortnight of January, while the two hundred and odd millions of dividend money just disbursed was seeking a permanent lodgment again. The boomlet, of which a good part was based on the improved conditions prevailing or supposed to prevail in the copper market, seems to be losing headway. There was a strong undertone of skepticism noticeable in the criticisms and comment on the situation at the time when the metal market was moved up so rapidly. It was said in more than one quarter that none of the unfavorable factors which created the business stagnation of the past year had been really and finally eliminated, and it was by no means plain to the average mind as to why general resumption of activity should be declared to be at hand. The present course of events seems rather to justify the position of the skeptical ones.

Wall Street has discussed the relations of 'big business' and politics, and operators have declared variously for a complete divorce on the one hand and for an indissoluble union on the other, with all shades of opinion occupying the middle ground. It seemed almost impossible to believe that any one topic could be so universally and perpetually discussed. In fact, it is quite plain that many of the disputants have so far become involved in discussion that all bearings are lost. To use a term of the Western cattle country, some one is needed to "turn the leaders and start the bunch to millin". The phraseology Wall Street probably would not understand, but it covers the situation.

In copper the strength has disappeared and prices are shrinking, even though it is anticipated that the Producers' report for January will show a further reduction in surplus stocks. Metal prices are lower, and copper can be purchased for a shade less than 14c., whereas it was predicted that a 15c. market would be established within a short time.

Foreign despatches quote the traders on the Paris Bourse as complaining somewhat bitterly that, believing fully in the predicted rise in copper metal and copper shares, they loaded up with Rio Tinto and are now facing substantial losses on the failure of hopes and predictions to materialize. Rio Tinto is one of the chief speculative issues on the Bourse, ranking in that regard as does Amalgamated in the New York markets. The French investor is the envy of all other nations and is regarded greedily by the large banking houses of other countries which have securities to distribute and know the importance of placing them as permanent investments. The French investor buys for income only, in small lots, and his investments are as permanent as he can make them. For some time there has been a strong effort to interest the French people in American securities, and through the Paris *Coulisse*, which is the Bourse's unlisted department or curb market, there have been distributed some very satisfactory amounts of Utah Copper. Ray Con. copper and Chino are to follow suit, and the shares will in a few days be traded in on the *Coulisse*. The two companies are not entirely new to the French public, as some good-sized blocks of bonds in each company were placed in France some months ago. Foreign bankers are undoubtedly taking greater notice of copper securities, especially of the new producers, than they have heretofore, partly on account of the new alignment of interests on this side and partly on account of the new war maps which are making in England and in Europe. It is now announced without attempt at concealment that the heavy exports of copper made during the past three months were for ammunition purposes, and in large part went to unusual points of destination.

The advance in silver, coupled with the possibilities of commercial awakening in China, is a cheering factor for many mining companies operating in Mexico, and would lead to some activity in properties and the formation of new companies to prospect and develop, if the new administration could but get its police department into effective action. The reports of brigandage and lawlessness are said to be exaggerated, but in any event are sufficient to prevent any new capital going into undeveloped or partly developed enterprises.

The bonds of the Inspiration Consolidated Copper Co. are being traded in on New York's curb market at a premium of 6 to 7%. The issue, which is for $6,000,000, was underwritten by J. P. Morgan & Co. and was offered to stockholders of February 1 on a *pro rata* basis. Practically all of the stock of the old Inspiration company and the Live Oak company was turned in for exchange, only one or two insignificant lots being turned in for cash.

The United Verde suspended dividends because revenue is needed to complete the new smelting plant, and shipments from smelter to refinery are to be made hereafter by way of Galveston by rail and thence to New York by water. Transportation costs are cut materially by this new routing, but refinery returns are also delayed some fifteen days in transit.

The United Verde Extension, which has the habit of periodical reorganization, has just secured the consent of the shareholders for another financial plan which practically means a cutting in two of the present holders' interests and the granting of a working option to some larger copper people, whose identity has not yet been revealed. San Toy shareholders are mildly interested in an insurgent movement inaugurated by a committee of local stockholders. San Toy's annual report was in the mails during the current week, and each shareholder, in the same day's mail, received a letter from Chihuahua asking that all proxies be withheld until the new committee had time to communicate further. A little curiosity was aroused, inasmuch as there has been no particular complaint against the management of the San Toy or any dissatisfaction among the shareholders of any consequence. The company paid $360,000 in dividends in 1911.

Cobalt Central was at one time one of the best engineered promotions among all of those supposed to be developing Canadian silver properties. This week the United States Marshal was sent out to make a levy on any property that could be found, and on his return he stated that he was "unable to find the company or any of its officers."

Stewart Mining, one of the Coeur d'Alene mines which is supposed to be controlled by the United Copper Co., has been active during the past week, and the shares have moved from 50c. to $1.25. It is stated that some 110,000 shares were purchased at private sale at figures above the quoted market value, and that the purchasers have an option on some 300,000 shares additional. In some quarters it is intimated that the money derived from the sale

of this stock is to be used in paying off the floating debt of the United Copper Co. It is hardly to be expected, however, that F. Augustus Heinze, with any material part of $10,000 in hand, would do anything so prosaic as to pay off the United Copper indebtedness, floating or sinking.

The Barnes-King Development Co.'s management is seeking for a new property in which to invest the treasury assets of the company and which can be equipped, if possible, in part at least, with the machinery on the old property. The company has something over a quarter of a million to purchase a new property if something suitable can be found.

SALT LAKE CITY, UTAH

Production of Phosphate Fertilizer May Utilize Sulphuric Acid By-product of Smelters. Bismuth Ore.

Several deals are pending in regard to the manufacture of fertilizer here, utilizing the phosphate ore from Utah, Idaho, and Wyoming, and the sulphuric acid which can be made as a by-product of the smelters. The importance of the phosphate as a fertilizer has not been recognized by many in this district, although there have been some who have been locating and buying phosphate deposits during recent years. Some of the larger Pacific Coast companies have been acquiring holdings in the Utah, Idaho, and Wyoming fields, but the mining has been done in a desultory way, and the rock has generally been shipped to California and Washington for treatment. Meanwhile the American, United States, and International smelters, operating in the Salt Lake and Tooele valleys, have been collecting the fume residues, but have not been utilizing the products for the manufacture of sulphuric acid. The position has been taken that the profit would be absorbed by the freight to markets. The smelters are now all making a study of phosphate conditions and markets, and it is expected that at least one contract will be closed soon whereby one of the smelters will begin the manufacture of sulphuric acid to supply a fertilizer plant which will be built in the neighborhood of Salt Lake City. The proposed fertilizer plant is backed by Salt Lake capitalists who are heavily interested in phosphates. They look first to the Coast for their market, but also expect to develop a demand for the production in the intermountain region and farther east. A deal of this kind will be important to the holders of phosphate deposits, to the farmers who want cheap fertilizers, and to the smelters who will find a new use for a by-product.

The less common minerals are attracting increased attention in Utah. Prospectors are now scouring the hills for phosphates, potash, and the rarer metals. The development of the alunite discovery near Marysvale has led to a study of potash and its possibilities, and now various reports are coming in from different parts of the state about discoveries of phosphates and potash. Marysvale is one of the latest to report a discovery of phosphate, in addition to the deposits of alunite there.

Frank L. and Clyde Wilson, who have long been operating in the Deep Creek district, in eastern Utah, claim they have made an important discovery of bismuth ore. They say that on the Wilson Consolidated property, near Ibapah, they have opened up a 3-ft. vein of ore which will average 5 to 10% bismuth, while samples run as high as 47% bismuth and $2.80 per ton in gold. A shipment of high grade is promised as soon as the roads open in the spring.

The Utah Consolidated is affected by the advance of copper more than many of the other properties, because a great deal of the ore which has been disclosed in recent developments is of so low a grade that it is close to the border line of profit. With copper higher in price, it is possible for the Utah Consolidated to ship an increased tonnage at a fair margin, and to make increased profits out of its higher grade. The shipments have been increased already from about 400 tons early in the year to close to 600 tons per day, and preparations are being made at the mine to increase shipments, without in any way slackening the prospecting.

CRIPPLE CREEK, COLORADO

Diminishing Production of Last Few Years. Effect of Drainage Adit. Development of Companies in District.

The fortunes of Cripple Creek are being substantially retrieved by two important late developments, the advance in metallurgy and the completion of the deep drainage adit. Of these, the latter will probably have the more immediate effect.

The gold production of Cripple Creek has steadily declined from more than $18,000,000 in 1900, to $11,000,000 in 1910, and to $10,500,000 in 1911. Contrary to general expectations, last year's output was half a million dollars below that of the preceding year. In the same period there was a steady increase in the tonnage of ore mined; but while the tonnage was growing the average value of the ore was diminishing. This is one cause of the decline in output, but in this situation there is a reason within a reason. This inner reason centres in the drainage of the district by cooperation, agitation for which began as far back as 1902. It was fully apparent to the operators at that time that adequate drainage was essential to continued productivity at a normal rate, and that the drainage could be effected only by united efforts. This agitation culminated in definite plans for another deep drainage adit late in 1906, and on May 11, 1907, work on the Roosevelt adit was started. Since

PORTLAND MINES.

that date few of the larger properties have made any attempt to continue production from their lower or submerged levels, on account of the heavy pumping expense necessary. It was deemed better policy to await the completion of the adit. Consequently for seven years the operators have with few exceptions confined their operations to ground largely worked over. The upper levels were still capable of yielding large tonnages of ore, though of a much lower average grade. It was clear that this must temporarily result in a diminished production, but now the operators see the wisdom of their policy of voluntary curtailment.

Cripple Creek has reached its turning point. Late in 1911 the benefits of the deep drainage adit began to show. The water courses cut on November 15, both in the main heading and the Fuller cross-cut to the C. K. & N. vein in El Paso ground, suddenly threw into the adit a volume of water which flowed for several days at the rate of 20,000 gal. per minute. This at once affected the entire district, with the exception of the Vindicator and Golden Cycle properties to the east, which lie in a separate drainage basin, cut off from the remainder of the camp by an impervious dike. The net results of the drainage enterprise to date are as follows: The El Paso mine is dry down to the drainage adit level, which is 1338 ft. below the collar of its shaft; the Gold Dollar and Mary McKinney are practically drained to their lowest workings; the Portland has recovered its 1500-ft. level and the Independence its 1000-ft. station; the Elkton, Strong, Granite, and Gold Coin will be drained to their lowest levels within a short time; the Cresson has recovered one level. The water level has receded an average of 80 ft. for the entire district; the

average rate of recession at present is 8½ ft. per month.

In point of dividends paid by Cripple Creek mines, the year 1911 was exceptional. The following dividends were paid during the year:

Golden Cycle	$1,410,000
Portland	240,000
Elkton	225,000
Vindicator	180,000
Stratton's Independence	120,000
Gold King	80,000
El Paso	61,250
Jerry Johnson	50,000
Auraria-Forest Queen	36,000
Maggie	26,000
Modoc	5,000
Acacia	7,200
Granite	16,500
Stratton's C. C. M. & D.	50,000
Cresson (estimated)	120,000
Lessees and private properties	250,000
Total for year	$3,006,950
Total for 1910	1,479,399

The total number of tons of ore mined in Cripple Creek during the year, including tailing re-treated (13,850 tons) and dump ore, was 903,596 tons, of which the gross bullion value was $15,622,436, as given in the reports of the mills and smelters. The smelters handled only 48,020 tons of the total output.

LONDON

LE ROI NO 2. TO INCREASE RESERVES AND DECREASE DIVIDENDS.—G. H. STANLEY'S PLAN FOR RE-TREATING RAND DUMPS.

The directors of the Le Roi No. 2 company have decided to restrict the already small dividends and to place as much as possible to reserve. The reason for this policy is not quite clear, but as it was promulgated at the instance of the largest shareholders, nobody can complain. For seven years the company has been existing in a hand-to-mouth sort of way, and, considering the original history of its formation, the results reflect great credit on the engineers. At the present juncture it is timely to give a résumé of past events and of the latest year's work. The company was floated in 1900 by the late Whitaker Wright for the purpose of working the Josie, Poorman, and adjoining copper-gold properties at Rossland, British Columbia. Subsequently the management was placed in the hands of Alexander Hill & Stewart, and their representative, Ernest Levy, has done excellent work under circumstances which were far from promising. During the year ended September 30 last, development and prospecting by means of the diamond-drill have continued to disclose new veins and shoots, but the ore reserve is less than formerly as regards quantity, though not in quality. The total footage of development work was 5577, and 14,932 ft. of diamond-drilling was done. The most important recent discoveries have been a new vein called the Holywell, and a new shoot in the North Annie vein. During the year, 67,033 tons of ore was raised. Of this, 22,414 tons was discarded as waste, 27,098 tons was shipped to the smelter, and 17,521 tons concentrated. The shipping ore was estimated to contain 1.6% copper, 16.7 dwt. gold., and 0.7 oz. silver per ton, having a gross value of $21 per ton, and net value, after deducting smelting charges, of $15.20 per ton. The concentrating ore averaged 0.5% copper, 2.8 dwt. gold, and 0.2 oz. silver per ton, and 1589 tons of concentrate was produced, which averaged 1.29% copper, 1.425 oz. gold, and 0.75 oz. silver per ton, with a gross value of $32 per ton, and a net value, after payment of smelter charges, of $25.50. The receipts for ore and concentrate were £84,806, and other receipts brought the income for the year to £91,474. The divisible profit was £30,176, which, added to the balance brought forward, made a disposable amount of £74,181. Out of this, £1700 went as directors' share of profits and £36,000 as dividend, being the same as during the year before. Owing to the inflated capital, £600,000, a legacy from the previous controllers, the rate of dividend seems unduly small. Many attempts have been made to reduce this nominal capital, but the directors have not seen fit to do so. The par value of the shares is £5, and it would be only reasonable to reduce it to £1, and so make the capitalization somewhere near the value of the assets. In future the yearly dividend is to be restricted to 2s. per £5 share instead of 6s. as paid during the last two years. Presumably other properties are in view.

It is rarely that the question of re-treatment of old Rand dumps comes up for discussion. Yet there are millions of dollars worth of gold locked up in them. The content may be only from $1 to $2 per ton, but the total tonnage must be nearly 100 million of material thrown aside before the modern practice of tube-milling and agitation of slime was adopted. The problem of re-treatment of the accumulated tailing has often been considered, but no serious effort has ever been made to carry the plan into effect, it being generally supposed that the question could be postponed until a later date when the mines themselves began to give a decreased output. The new policy of using the tailing as filling for the exhausted stopes has caused those interested in the metallurgical problem to press matters forward, for it is obvious that if the tailing is sent underground again, its gold will be lost forever. It is clearly recognized that the content of the tailing dumps varies widely, as also does the fineness or coarseness of the constituent particles and the relative amount of pyritic material present. Many people who have considered re-treating the dumps have been deterred by this irregularity and the consequent difficulty of separating the material that requires regrinding. A new classifier invented by G. H. Stanley, professor of metallurgy in the South African School of Mines, removes this difficulty. It has been tried experimentally at the Robinson mine, under the supervision of W. Laurie Hamilton, and the results have been tested by A. F. Crosse. Mr. Hamilton estimates that there is 70 million tons of sandy tailing, left in the days before the advent of the tube-mill, and that the gold in it amounts to from 1 to 1½ dwt. per ton. The Stanley machine is a combination of a hydraulic classifier and a screen, and is designed to keep the largest sizes together, irrespective of their specific gravity. Much of the coarse material is pyritic and settles easily, but the lighter parts are apt to pass over with the fine. In order to prevent this, a screen is interposed which collects the coarse light particles, and at intervals returns them to the heavy coarse material. By this arrangement the sand of the dumps is separated into three classes: (1) concentrate consisting of +60 material together with the pyrite; (2) fine, consisting of −60 material, and (3) slime. Of these three divisions, the concentrate contains from 40 to 65% of the total gold, and the fine 40 to 45%, while the slime is of less importance, being only 3 to 5% of the total weight of dump material. In the trials of the Robinson dump the following figures were obtained: Content of dump, 1.13 dwt.; content of concentrate, 1.55 dwt.; content of fine, 0.68 dwt.; content of slime, 1.85 dwt. The concentrate was reground, and by cyanidation and agitation gave an extraction of 80%. The fine did not require regrinding, and gave 67% extraction. The slime gave 90% extraction. It is calculated that the average extraction will be 75%, with a minimum of time occupied in the process. The cost of treatment per ton is estimated at 6d. for classification and transport, and 7½d. for regrinding, and 1s. 3d. for cyaniding, being a total over the whole amount treated of 2s. per ton. If the dump material is treated immediately before its delivery for stope-filling purposes, the cost of handling will be reduced. The probability is that a profit of 1s. 6d. per ton can be made on this particular dump, without including the outlay on plant or cost of administration.

According to statements made at the recent company meeting of the Atbasar Copper Fields, Ltd., the report of R. Gilman Brown shows a reserve of 389,000 tons of ore containing copper to the estimated value of £3,000,000.

General Mining News

ALASKA

PRINCE WILLIAM SOUND

What is regarded by some as an indication that the moraine on which Valdez is built would be profitable for dredging, was the pumping of gold-bearing sand at the Exchange building in that city. The water on being pumped is strained through a sieve. An accumulation of sand in the sieve equivalent to a quarter pan yielded about 7c. in gold.

A townsite has been staked by miners at the mouth of the Anuk river, a tributary to the Kuskokwim, and the Northern Commercial Co. has ordered logs for the construction of permanent buildings. A population of 500 is expected before the end of winter, as the gravel is unusually rich.

ARIZONA

COCHISE COUNTY

Reports from Bisbee state that Henry Buemler, of that city, recently arranged for teams to haul ore from the Beckler property to the railroad station of Rodeo, where it will be shipped to the Copper Queen smelter. The ore is said to assay about $100 per ton. Concentrating ore from the property will be delivered to the new concentrator of the Paradise M. & M. Company.

GILA COUNTY

(Special Correspondence.)—The Hardinge mills for the sixth unit of the Miami concentrator have not yet arrived. No announcement has yet been made as to when the construction of the 7500-ton mill by the Inspiration Con. Copper Co. will be started. Work is progressing on the water-supply dam, and J. M. Callow is experimenting. Underground work has not yet been started. At the Live Oak, development of the mine in a small way continues. A 15 by 20 double-drum hoist has been purchased from the Old Dominion company and will be erected at No. 2 shaft, which will be enlarged to three compartments. According to present intentions of the management, future increase of ore reserves will be accomplished by underground work rather than by churn-drilling. Churn-drill hole No. 2 of the Southwestern Miami Development Co. is now over 500 ft. deep. Ore is expected at about 900 ft. Drilling continues steadily on the Barney group, which is under option to the Lewisohns. A hole was recently started at the bottom of the 400-ft. shaft about 3000 ft. west of the Live Oak west-end line. The hole is in schist.

Six men are employed in the development of the New State group of 33 claims on lower Pinto creek, 15 miles west of Globe. On the Republic claim, a trench was started on the Duquesne vein, and is reported to have disclosed, near the surface, one to three feet of shipping ore containing gold, silver, and copper. The ore occurs in limestone. There are 20 tons of ore on the dump, and preparations are being made to ship. Smelter returns on a carload of ore recently shipped to the El Paso smelter from the Duquesne mine, 15 miles west of Globe, gave credit for 39 tons of ore assaying 0.76 oz. gold, 13.6% lead, 17.8% iron, and 33% insoluble. The net returns above freight and smelter charges amounted to about $18 per ton. A carload of lead-silver ore has just been shipped to the El Paso smelter from the Copper & Silver Zone group, two miles east of Globe, which is owned by H. W. Clark and associates and is being worked by several lessees. Shipments from these claims have been running 80 to 100 oz. in silver. The cross-cut north, from the McGraw shaft, on the 12th level at the Superior & Boston, has cut a vein reported to be 4 ft. wide and to carry copper ore of a good smelting grade. The Cracker Jim shaft has been unwatered and a 25-hp. gasoline hoist has been erected. The shaft is 125 ft. deep, and sinking will be resumed this week. It is proposed to cross-cut at 200 ft. to the Maverick vein, from which some high-grade copper ore has been mined.

Globe, February 2.

MARICOPA COUNTY

A compressor and air drills have been delivered at the Carney property, near Mesa. It is believed that the adit will intersect the orebody within the next 30 days. Thomas Frazier is superintendent of the property.

YAVAPAI COUNTY

Pitchblende has been discovered in a mine owned by W. H. Slaughter, near Columbia. It is rumored that operation on a large scale will be started at the property of the Ohio Mines Co., sometimes known as the Little Jessie, near Chaparal. Unusually rich gold ore recently was discovered in an old mine on Lynx creek, near Walker, according to A. J. Doran and J. L. Batcheldor, of Prescott.

YUMA COUNTY

George V. Bell is reported to have discovered rich deposits in the desert, near Quartzite. The old Fortuna property, which has been idle for ten years, has been dismantled. James Maxey secured what was left of the machinery for use in the Colorado river control work near Pascualitos, a station on the Southern Pacific railroad.

CALIFORNIA

AMADOR COUNTY

(Telegraphic Correspondence.)—The collapse of shaft timbers in the Bunker Hill mine, two miles north of Sutter Creek, caused a cave-in Wednesday afternoon which imprisoned 63 miners. The telephone wires and air-pipes were not injured, and the men were rescued Thursday before noon. The United States Bureau of Mines offered assistance, and F. L. Lowell is on the way from San Francisco to represent the Bureau.

EUREKA MINES, AMADOR COUNTY.

Amador City, February 8.

(Special Correspondence.)—Among the companies whose reorganization marks the revival of Mother Lode development, the Con. Amador M. Co., a reorganization of the Amador company, owning the Eureka mine, has aroused unusual interest among old-time mining men. The new company will operate the property on a large scale. E. H. R. Green, son of E. H. Green, one of the early capitalists, is president of the new company; J. B. Mackie, associated with pioneer-day development, is vice-president; A. L. Black, cashier of the Bank of California, will represent the old English stockholders, while other members of the board of directors will be James R. Cashman, an associate of Andrew B. McCreery, together with Frank Seed, and R. B. Symington, who was earlier associated with D. O. Mills, Elviza Hayward, and P. B. Cornwall, as consulting engineer. The report of J. Ross Browne, in 1868, referred to the property as one of the most valuable gold mines in California. Development was started in 1852, and in that year a 10-stamp mill was erected. The property of the present company includes two old claims, the Eureka and the Badger, which Mr. Hayward consolidated in 1859.

Within the first 500 ft. of the surface the yield did not exceed $11 per ton of ore, and it is said in the report that for the first 200 ft. so much difficulty was experienced in keeping the mill going that the laborers worked 'on trust' until the property paid expenses. R. W. Raymond, then special commissioner of mining statistics, in 1869 reported on the property, which was variously known as the Amador, Eureka, and Hayward, but which then was owned by the Amador company. The total yield for October 1867 to October 1868, inclusive, was $566,946, according to the report, in which Dr. Raymond called attention to the fact that while the property yielded a revenue of $300,000 per year, the company paid for it only $750,000 cash, and cited that as a good example of the actual cash value of a mine in regard to the profits. The property was examined for the company by Messrs. Ashburner and Janin. The mine has been idle for 25 years. The Amador M. Co. was organized February 5, 1872, exactly 40 years before the present reorganization. Among the men first associated with the company were David D. Colton, Milton S. Lathan, E. H. Green, and Mark L. MacDonald.

Sutter Creek, February 8.

The Keystone Mines Co. is repairing the shaft of the Keystone mine, near Amador City, which it was organized to take over from the Consolidated Mines Co. It is reported that the shaft will be sunk to greater depth and that cross-cutting will be started in the near future. C. R. Downs is superintendent of the property.

Inyo County

The Skidoo Mines Co. in December made a total production of $14,336, of which $13,240 was bullion and the rest concentrate. Operation and development expenses amounted to $8263, leaving a net profit for the month of $6074. The cyanide plant has been closed for the winter.

Jim Butler has accepted the presidency of the Prospectors' Alliance of America, which was organized at Bishop a short time ago. Other officers are: vice-president, L. C. Hall; secretary, C. E. Kunze; treasurer, W. M. Snider; directors, T. L. Oddie, Governor of Nevada, A. H. Swallow, G. W. Leidy, Eugene Grutt of Rawhide, and C. E. Kunze. Honorary memberships were conferred on William E. Borah, U. S. Senator from Idaho; J. E. Raker, U. S. Representative from First district, California; and Charles E. Fuller, of Illinois. By-laws and articles of incorporation were adopted. The membership fee is one dollar and the annual dues two dollars. The meetings will be held annually, and special sessions may be called, a quorum to consist of 25, including proxies. At the meeting it was reported that about 200 had signed the membership list, while 560 had signified their intention of joining. They all were elected members at the meeting.

Los Angeles County

The election of the Chamber of Mines and Oil, held here recently, resulted as follows: President, Russ Avery; first vice-president, S. E. Varmilyea; second vice-president, W. C. Kennedy; treasurer, D. F. McGarry; chairman of committee on building and expositions, Henry Blumenberg, Jr.; on commercial and mercantile affairs, M. W. Everhardy; on engineering and economic geology, Harry R. Johnson; on hotels and entertainment, E. A. Montgomery; on finance and auditing, Calvert Wilson; on grievances, Joseph A. Lewis; on laws and statistics, Theodore Martin; on library and publications, F. J. H. Merrill; on manufacturing, S. G. Bailie; on membership, Harry S. Jones; on mineral and geological exhibit, J. Nelson Nevius; on mines and mining, W. H. Aldridge; on petroleum, W. W. Orcutt; on publicity, Desaix B. Myers; on reports and certificates, R. King; on transportation, H. D. MacKinnon.

Nevada County

The mill and all other buildings, excepting the superintendent's cottage, on the W. Y. O. D. property were destroyed by fire on January 31. The men underground were safely removed through the Pennsylvania workings. The mill machinery was being removed to the Pennsylvania property, to enlarge the mill there, and the loss was less than otherwise would have been the case. The Empire M. Co. recently acquired both the W. Y. O. D. and Pennsylvania properties from the Pennsylvania M. Co., and planned it is reported, to use the W. Y. O. D. shaft for pumping only. The W. Y. O. D. property originally was owned by Joseph Weisbein and associates.

San Bernardino County

It is rumored that operation is to be resumed at the Big Chief M. Co.'s property at Hart. F. E. Browne is in charge of the mine.

San Diego County

A prospector named Lee Morris is reported to have discovered a vein assaying $60 to $100 per ton in the hills east of Campo, 55 miles from San Diego.

Sierra County

Mrs. Julia K. Davis, of Downieville, is reported to have picked up a nugget valued at $280 near the north fork of the Yuba river, about four miles north of Downieville.

The North Star Mines Co. has reopened the drift on the 1000-ft. level, which had caved in. The drift is now in 1500 ft. from the shaft, and will be continued into new ground. Pumping was resumed a short while ago and will be maintained until the mine is drained, says a recent report.

Tuolumne County

(Special Correspondence.)—The United States S. & R. Co. has secured a good bond on the Santa Ysabel mine, which adjoins the App on the south, and is negotiating, it is said, for the purchase of the Dutch and other properties in that vicinity. The transfer of the App and Rawhide mines by W. A. Nevills to the above-named company has not yet been made, the delay being occasioned by the making out of abstracts of title, but the deeds of conveyance will in all probability be signed and delivered within a few days. A new shaft is being sunk in a rich shoot of ore at the property owned by H. V. Pullen and Ed Burley, in the Basin district. The best ore, which assays about $80 per ton, will be sent to the Selby works in the spring.

The company operating the Carlotta mine, near Tuolumne, has found a 2-ft. vein of rich ore in the south drift from the Carlotta shaft. The mill was started this week. The new 10-stamp mill at the Gem mine, operated by J. M. Wulzen, is making its initial run on good-grade ore. The Bonanza mine at Sonora, under bond to Los Angeles men, has been unwatered to the depth of 200 ft., and prospecting begun at 180 ft. Construction of a cyanide plant at Soulsbyville to treat the tailing of the Soulsby mine purchased from the Bagdad-Chase company by C. J. Sullivan and Frank Thomasson has been completed. The Sugarman pocket mine, on Bald mountain, northeast of Sonora, from which many thousands of dollars in gold has been taken, is being worked by Charles Smith and Robert Watson. The addition of 20 stamps to the Dutch mill will be completed about April 1. The Yankee Hill M. Co., which recently secured a large tract of land in the vicinity of Columbia, will begin prospecting with a drill for gold-bearing gravel within a few days. The Golden Dawn, near Soulsbyville, which is being worked by Nicholls brothers and Thomas Webster, is showing encouraging prospects, some of the ore being good enough for sacking and shipping. The Stanislaus M. Co., organized under the laws of California, filed articles of incorporation in this county on January 31. The capital stock is $400,000, with shares at $1 each, and the directors are V. D. Knupp, N. M. Ball, W. B. Phillips, E. E. Graham, and E. R. Abadie, all of Porterville. The company is actively operating the If I Can mine, near Mt. Pass. A mill and other surface improvements have recently been completed on the property.

Tuolumne, February 3.

COLORADO

Clear Creek County

(Special Correspondence.)—A 7-ft. orebody has been found on the foot-wall of the Gem vein at the 2000-ft. level that mills $32.19 in gold and silver. Von Tilborg & Co. are operating under lease. James Cousins, manager

of the New Era mine at Freeland, has started shipments of smelting ore. The 60-ton mill is running on ore 12 hr. shift. The McKelvey mill, in the west part of town, has again been brought into commission. The Hudson mill is now treating a large amount of custom ore, and \$3 ore is being handled at a profit. A. H. Roller is manager of the mill.

Idaho Springs, February 2.

SAN JUAN COUNTY

Otto Means has secured a lease and bond on the Gold Prince mine and mill at Animas Forks.

TELLER COUNTY (CRIPPLE CREEK)

The El Paso Con. Gold M. Co. in 1911 shipped about 36,000 tons of ore, of which 18,700 tons was mined by lessees from the upper levels.

Fred Johnson and associates of Cripple Creek, lessees on the Pride of Cripple Creek property, have discovered ore said to assay as high as 40 oz. gold per ton on the 600 ft. level, north of the shaft. Due to the large amount of dead-work, the January output of the Forest Queen mine, Ironclad hill, will not exceed 450 tons of ore. Hemby & Anderson, operating the Wild Horse, Silver Tip, and Ramona claims, Bull hill, are shipping about three cars per month of ore reported to assay \$75 to \$100 per ton.

The Vindicator Con. Gold M. Co. in 1911 made a net profit of \$238,804, and with the dividend paid January 28, amounting to \$45,000, has disbursed in dividends a total of \$2,452,000. The company during the year shipped 19,232 tons of ore valued at \$647,710, leaving a profit of \$529,349 after freight and treatment charges were paid. Lessees shipped 11,001 tons of ore valued at \$182,612, on which the net profit was \$121,693. F. L. Sigel is president and general manager for the company.

At a depth of 100 ft. on the Emma Abbott claim, owned by the Lady Campbell Gold M. Co., on the east slope of Tenderfoot hill, a 6-in. vein of ore assaying \$520 per ton was found recently, state advices from Cripple Creek. The claim is leased to F. J. Fitzmorris, of Kansas, and Peter Timmons, August Bay, and H. Dailey, of Cripple Creek.

A \$2500 gold brick was taken January 30 from the Kavanagh mill, the brick representing the clean-up for the month. During the month 1200 tons of ore was treated, the ore averaging \$2.60 per ton.

MONTANA

FLATHEAD COUNTY

(Special Correspondence.)—The engineers who have been at work at Kootenai falls for the past month have completed their examinations of the power-site there and have returned to New York to prepare their report on the plan to use these falls for obtaining power for the Coeur d'Alene mines and various cities, including Spokane. The Kootenai Power Construction Co. is the corporation organized by Joseph A. Coram of Boston to develop the power.

Libby, February 5.

LINCOLN COUNTY

(Special Correspondence.)—H. L. Wilson, foreman of the Snowshoe mine, recently stated that shaft-sinking has been discontinued at the mine and a station is now being cut at the bottom. The shaft is down 600 ft. A drift will be run in on the ore vein, which it is thought is not over 15 ft. from the bottom of the shaft.

Libby, February 5.

NEVADA

CHURCHILL COUNTY

H. J. Hoover, lessee on the Queen property near Wonder, has started development, which for the present will be confined to the 100-ft. level. The whim used in sinking to the 100-ft. level will be used, but later, when shaft-sinking is resumed, a hoist will be secured.

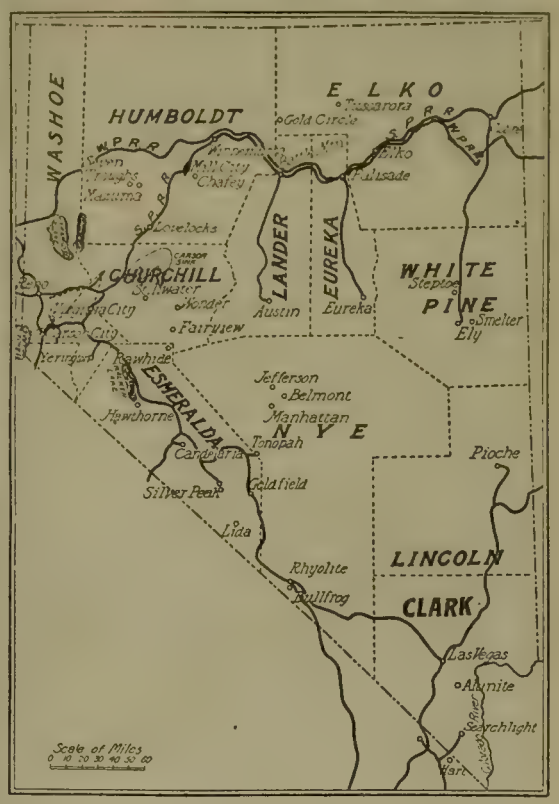
ESMERALDA COUNTY

W. J. and R. F. Tobin have regained control of the Pioneer Con. Mines Co. They recently stated that shipments will be started in the near future. J. R. Bryan is manager for the company. The official report for 1911 states that the company has no debts, and has a balance of \$29,472 in the bank. During the year the company acquired the properties of the Bullfrog Pioneer Gold Mines Co., the Bullfrog Valley View M. Co., and the Gold Hill M. & M. Co. Operation on the company account started last June.

The Nevada Eagles M. Co. has about 10 tons of second-grade ore ready for shipment. It is reported that next month the force will be increased, and that plans for a mill are being made.

LANDER COUNTY

(Special Correspondence.)—Salt Lake capitalists, represented by W. J. Bowring and George Arbogast, have taken a lease and bond on the Austin Central group. Developments will commence about February 15, with work conducted from two points. The Maricopa Mines Co. reports a large tonnage of available milling ore. The Whitlach



NEVADA.

Consolidated is sinking a shaft to prospect a fissure. It is possible the work may determine the extensions of the Silver Chamber, Snow Flake, and other veins. The Gold Basin G. M. Co. has been formed to operate in the Gold Basin district, 45 miles southwest of Austin. The company is organized under the laws of Utah, with a capitalization of \$1,000,000. The company owns 13 claims in the district with a prospect shaft 100 ft. deep. Frank B. Cook is president, Reuben May vice president, and Shand Smith secretary-treasurer of the company.

Austin, February 2.

NYE COUNTY

(Special Correspondence.)—A conservative estimate places the 1911 output of Manhattan at \$1,000,000. Of this amount, \$700,000 came from the quartz mines and \$300,000 from placers. Of the total quartz yield the Big Four produced about \$400,000. Rumors concerning the Big Four are rife, the latest being that the company plans building a new mill. An abundance of water is available, Manhattan being signally favored in this respect. The heavy flow of water on the 400-ft. level of the Big Four has forced the lessees to concentrate their work on the 300-

ft. level. The company reports a large quantity of milling ore developed, which can be profitably treated with milling facilities convenient. The orebody near the 200-ft. level in the White Caps is understood to range from 6 to 15 ft. wide, with a large portion running $40 to $103 per ton. On the Manhattan Consolidated the Steffner lease has opened a large vein of $20 ore at a depth of 200 ft. The Mineral Hills Consolidated has proved its vein to a depth of 250 ft. The adit is going ahead steadily to intersect the vein at greater depth. On the Dexter, Union No. 2, and other claims the lessees report improving conditions. About 50 leases are active, with about 25 producing. All indications favor a marked increase in the gold yield for the present year. The Tobin brothers, of Denver, have resumed charge of the Pioneer Consolidated group, in the Bullfrog district, and preliminary work has started. Shipments will commence within a few weeks, according to statements of the owners. The property has lain idle for three years, owing to dissensions among the stockholders. It is rumored that attempts are being made to resume activities at the Mayflower Consolidated and Homestake King, two former Bullfrog producers. The Round Mountain M. Co. is treating 200 tons of ore per day. The ore is said to assay on the average $6, with total mining and milling costs of $4.10 per ton.

Manhattan, February 1.

It is reported that Weir Bros. & Co. of New York have underwritten 100,000 shares of the Halifax Tonopah M. Co., which has four patented claims, amounting to 81 acres, adjoining on the east the Tonopah Belmont property. The company is said to be expending about $10,000 per month in development.

The Tonopah Midway M. Co. in 1911 shipped 2035 tons of ore, valued at $65,699, and having a net value of $22 per ton. Disbursements for the year amounted to $64,000, of which $34,606 was for labor. Receipts were $88,048, of which $47,527 was from ore sales, $5000 from the sale of a fraction of the property, while there was a cash balance in the bank of $35,520.

David D. Sullivan, says a Tonopah report, one of the syndicate which has an option on the Millett-Albion group of claims at Millett, is making plans for building a mill on the property. A test shipment of ore will be made soon to the Selby smelter to determine what process will be used. It is reported that a company, to be known as the Smoky Valley Gold Mining Co., will be organized, as a close corporation, to operate the property.

WHITE PINE COUNTY

The unwatering of the Giroux shaft is said to be going forward with greater rapidity than has been accomplished heretofore. The big pumps on the 1200-ft. level were put in commission last week, and the damage done to the shaft by the fire of August 23 has been repaired from the 1200-ft. level to the surface and the shaft is in good working condition. The foundation for a twin set of boilers for the Morris shaft has been completed.

WASHINGTON

PACIFIC COUNTY

Press despatches state that there was a rush toward the vicinity of South Bend on account of recent gold discoveries. One party of about 50 goldseekers came into conflict with the civil authorities through their occupation of part of the Ellsworth ranch.

SPOKANE COUNTY

Officials of the American Mining Congress will be formally advised in a few days that a fund of $5000 has been subscribed and guaranteed by operators and business men of Spokane for the 1912 convention, which will meet the last week in November or early in December.

The Spokane Mining Men's club adopted the following resolution at the last meeting: "That while we favor equitable, reciprocal trade relations, we are unalterably opposed to the reduction of the tariff on lead and zinc as proposed by the Underwood bill now pending in Congress." W. W. Gifford, secretary of the club, says that though the club adopted a resolution on December 7 in regard to reciprocal relations between the United States and Canada upon lead and zinc, it did not desire removal of the tariff on these metals.

CANADA

BRITISH COLUMBIA

The Windemere district, at the head of the Columbia river, will be benefited by the Kootenai Central railway, financed by London capital, which is to be completed from Fort Steel to Cranbrook early next September. The running time between Windemere and Spokane will be cut to 10 hours. At present it is three days by stage, thence six hours by rail. The mines have been idle for the last eight years, awaiting transportation.

A. Erskine Smith, president of the Red Cliff M. Co., Portland Canal district, it is rumored, will arrange for the construction of a mill for the company.

An analysis by the Canadian Department of Mines, of which Eugene Haanel is director, of a 4-oz. sample of black sand concentrate sent by Gilbert Blair, secretary for the British Columbia Platinum Co., Ltd., showed the following content: platinum, 521.57 oz.; osmiridium, 58.82 oz.; gold, 75.82 oz., and a small undetermined quantity of silver per ton. The concentrate was obtained, it is reported, from 1½ to 2 cu. yd. of river sand and gravel from the company's property on Tulameen river, Similkameen district.

ONTARIO

The Wettlaufer Lorraine company in 1911 shipped 925,017 oz. silver. The positive ore reserve is estimated to contain 1,003,000 oz. silver. About 2180 ft. of development work was done, according to the report of H. Lindsley, general manager for the company. Total receipts from the sale of ore amounted to $481,368. Production, development, administrative and general expenses, and depreciation amounted to $167,977. A total of $212,488 has been paid in dividends. The surplus at the end of the year was $100,902, against $121,908 the previous year. The net profit for the year was $13,390.

MEXICO

CHIHUAHUA

(Special Correspondence.)—Serious disturbances have occurred in this state. All stores in Juarez have been looted, and one of the largest warehouses in the city, belonging to Messrs. Ketelsen & Degetau, was completely destroyed, with a loss of some $250,000.

Juarez, February 5.

Operation of both mine and mill at the Calera M. Co.'s property, five miles from the San Isidro station, has been resumed. Frank Kyle is general manager for the company.

In the Parral district, work will be resumed soon in the Guadalupe mine, owned by Vincente Visconti. In the same district the Tepozan Gold Mines, Ltd., has been organized to operate the Tepozan mine, and later on the company is to erect a cyanide mill, according to a recent report. John F. Johnston is general manager for the company.

Paul Ginther, of Santa Rosalia, recently stated that he had 3000 claims in this state under option, most of which will be purchased. He will resume operation in the near future at the El Cerro de las Campanas and the El Siglo Veinte properties, in the Naica district, which were closed last year on account of the political disturbances.

SONORA

(Special Correspondence.)—Things seem to be unsettled again in Mexico and peace far away. There is practically no organized government in this state, there being four leaders, all of whom are striving to obtain supreme power. If the United States Government does not intervene, it is anticipated that these conditions will not improve in Mexico for some time, and if it does intervene, many are afraid of serious trouble, at least for several weeks.

Sonora, February 5.

PHILIPPINE ISLANDS

(Special Correspondence.)—The Paracale dredging field, after various delays, is to be financed in Melbourne. The

area taken over by the syndicate comprises about 800 acres of the choicest ground, including the 300 acres of the old Paracale Gold Dredging Company.

The ground averages about 30c. throughout the field, and the gold bearing sand is about 36 ft. deep. The new company is capitalized at £300,000, in £1 shares. The stock has been subscribed by a small group of Australian capitalists. The contract calls for dredges to handle at least 80,000 cu. yd. of sand per month.

Manila, January 20.

Among the Copper Mines

CONSOLIDATION of the Ray Central Copper M. Co. and the Ray Con. Co. was announced by telegraphic advices from New York Thursday. This merger has long been in contemplation and is clearly in the interest of economy in operation, as the properties are adjacent and but parts of one orebody. According to a report made by Weed & Probert last year, the Ray Central had 5,020,000 tons of actual and 1,420,000 of probable ore, with an average assay value of 2.15% copper. Estimating on the basis of a production of 1000 tons per day, the probable cost was placed at $2.97 per ton, equivalent to 10.38c. per pound of copper. The larger daily production possible as a result of the consolidation should reduce this figure.

THE OLD DOMINION properties at Globe, Arizona, were discussed interestingly recently by Dr. James Douglas, who is quoted as follows: "The company's output in 1911 was about 25,000,000 lb. of copper, practically all of which came from the Old Dominion and United Globe mines, as very little custom ore was treated during the year. The remarkable feature of the development during the past two years is the depth to which the secondary enrichment extended, and the size of the orebodies at a depth of even 1600 ft. from the surface. At the Old Dominion, as elsewhere, the increased quantity of concentrating and the decreased quantity of lump ore, points to modifications in the company's smelting methods for the future."

THE CANANEA DULUTH COMPANY, says the *Boston News Bureau* of January 24, has been dissolved and its assets, consisting chiefly of the capital stock in the Cananea Development Co., an operating company, have been turned over to the Cananea Central Copper Co. It is understood that the Cananea Central Cppper Co. will itself be dissolved in the near future so that operations may be still further concentrated. This would leave the Greene Con. Copper Co. the only large subsidiary of the Greene-Cananea Copper Co. The Greene Consolidated dividend of 60c. per share was paid January 23 to the Greene-Cananea Copper Co., the owner of all but a small minority. Checks for $30.000 were mailed to the minority stockholders.

The UTAH COPPER CO., in the quarter ended December 31, made a net profit from its milling operations of $1,475,680. This combined with other revenue, from rents, Nevada Consolidated dividends, Bingham & Garfield railroad dividends, and miscellaneous sources, brought the total net profit of Utah Copper to $2,157,765 for the period named. The income from Bingham & Garfield dividends does not represent the earnings of the railroad company merely during the quarter, but includes trackage rentals for the year. The dividends paid during the quarter amounted to $1,177,012, leaving a net surplus of $980,753. The earnings given are computed on a basis of 13.642c. per lb. for copper. At the end of the quarter no copper due for delivery from the refinery remained unsold. The entire Magna plant was operated throughout the quarter, but weather conditions reduced its capacity during November and December much below the normal of 12,000 tons per day. Six units of the Arthur plant have been in operation since the latter part of October, when the sixth remodeled plant was placed in commission. The seventh unit was put in operation about the middle of January, and from present indications the capacity of the Arthur plant when all 13 units have been remodeled will be at least 8000 tons per day. There was 1,520,058 cu. yd. of capping removed from the Utah and Boston groups during the quarter, against 1,595,095 cu. yd. in the previous quarter, the reduction being caused by weather conditions. The Bingham & Garfield railroad during the quarter hauled an average of 7275 tons of ore per day from the mines to the mills. To provide for an increase in business this year, additional equipment has been ordered. The total amount of copper contained in concentrate for this quarter and the preceding three quarters of 1911, together with a comparison of the production for the year 1911 with the year 1910, is given below:

	Pounds.		Pounds.
January	6,707,116	April	8,169,248
February	7,329,326	May	8,391,879
March	7,260,267	June	7,908,685
Total	21,296,709	Total	24,469,812
Av. mo. prod.	7,098,903	Av. mo. prod.	8,156,604
	Pounds.		Pounds.
July	7,555,406	October	8,660,729
August	9,010,669	November	9,117,961
September	9,285,381	December	9,039,557
Total	25,851,456	Total	26,818,247
Av. mo. prod.	8,617,152	Av. mo. prod.	8,939,416

	Pounds.
Total production for the year 1910	89,019,511
Total production for the year 1911	98,436,224
Average monthly production for the year 1910	7,418,293
Average monthly production for the year 1911	8,203,019

THE NEVADA CON. COPPER CO.'S income for the quarter ended December 31 was $1,088,644. The payment of the ninth quarterly dividend, requiring $749,389, left a net surplus of $339,255. Depreciation on the Steptoe plant was placed at $136,991, leaving a net credit to undivided profits of $202,264. The December production was 4,679,674 lb. of copper, a smaller amount than for any other of the 15 months to be included in the coming annual report, owing to the unusually severe winter weather. While the settlement of the Veteran miners' strike permitted the resumption of operation on that property, production there was low, as there was much repair work to be done. The company during the quarter produced 15,434,788 lb. of copper. The production for the 15 months to be included in the annual report, which averaged 5,236,084 lb. per month, was as follows:

	Pounds.		Pounds.
October	4,980,306	January	5,268,954
November	5,207,353	February	4,992,533
December	5,510,936	March	5,632,256
Total	15,698,595	Total	15,893,743
	Pounds.		Pounds.
April	5,298,632	July	5,258,582
May	5,277,355	August	5,249,514
June	5,101,078	September	5,328,983
Total	15,677,065	Total	15,837,079

	Pounds.
October	5,547,131
November	5,207,983
December	4,679,674
Total	15,434,788

Copper Producers' Association Figures

Production of copper for January was 119,337,753 lb., a decrease of 3,558,944 lb.; domestic deliveries, 62,343,901 lb., a decrease of 3,645,573 lb.; foreign deliveries 90,167,904 lb., an increase of 929,188 lb.; total deliveries, 142,511,005 lb., a decrease of 2,715,385 pounds.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

C. F. Moore was in San Francisco.

F. McRae, of Reno, is in San Francisco.

Charles Butters is in Central America.

Gelásio Caetani is at Telluride, Colorado.

Charles W. Goodale has gone to Winnipeg.

George W. Starr was in San Francisco this week.

Whitman Symmes was in San Francisco Monday.

C. R. Downs, of Sutter Creek, was in San Francisco.

W. H. Storms has returned from a trip to Ione and Placerville.

C. E. Julihn has been appointed superintendent for the Union Con. and Sierra Nevada companies on the Comstock.

J. F. Newsom, F. L. Sizer, and G. H. Clevenger came up from Palo Alto to attend the Mining and Metallurgical Society meeting last Monday.

Charles J. Coll has resigned the position of general manager for the Acadia Coal Co., Ltd., Stellarton, Nova Scotia. Many regrets are being expressed at his departure from the province, since Mr. Coll was not only active in improving the technical and administrative management of the company, but also in public affairs, he having served as president of the Mining Society of Nova Scotia and as a member of the Council of the Canadian Mining Institute.

Obituary

John Herron, a well known mining engineer, died Saturday, February 3, as the result of an accident in the Pandora mine, at Telluride, Colorado, of which property he was in charge at the time of his death. Mr. Herron was 54 years old, having been born in India, December 31, 1857. He was educated at the University of Chicago, graduating with the class of 1880. He immediately took up railroad engineering, being first employed by J. F. Wallace on construction work in Illinois, and later, while still only 25 years old, he became chief engineer of a new road in Ohio. For many years he followed railroad engineering and bridge construction in the Middle West, but reached Montana in the early days of the construction of the Great Northern, where he was known as one of the most competent locating engineers. In 1893, owing to the total suspension of railroad construction in the Northwest, he accepted a position with the Montana Mining Co. at Maryville, Montana, as a draftsman, and remained with that company for five years, working up to the position of superintendent, in direct charge of all its mine operations. In 1898 Mr. Herron went to the Tomboy mine as general manager, and the English company operating that property, even after he was forced, as a result of a nervous break-down, to give up active charge of the mine in 1904, consulted him frequently. From 1906 until last July he has been engaged in consulting work and made numerous trips to Mexico for the purpose of examinations. John Herron's sterling qualities as well as his marked ability as an operating man, were known to those who were closely associated with him, but he was of a most retiring disposition, and could hardly be induced to speak of his own work. His absolute honesty would not permit him to claim quite all the credit even which really belonged to him. The news of his death will come as a shock to his many friends, and it is greatly to be regretted that the profession has lost one whose standards were so high and his personal character so admirable. He was a member of the American Socity of Civil Engineers, the Montana Society of Engineers, and the Institution of Mining and Metallurgy. Mr. Herron's home has been at Palo Alto, California, for the past eight years, and he leaves a widow and a son and two daughters.

F. L. S.

Market Reports

LOCAL METAL PRICES

San Francisco February 8.

Antimony	11—11½c	Quicksilver (flask)	46.00
Electrolytic Copper	15—16½c	Tin	47—48½c
Pig Lead	4.35—5.30c	Spelter	7½—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

Average daily prices in cents per pound, based on wholesale transactions, standard brands.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Feb. 1	13.85	4.25	6.40	58½
" 2	13.85	4.25	6.40	58½
" 3	13.85	4.10	6.40	58½
" 4	Sunday.	No market.		
" 5	13.80	4.00	6.40	58½
" 6	13.80	4.00	6.40	58½
" 7	13.80	4.00	6.40	58½

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, Feb. 8.		Closing Prices Feb. 8.
Adventure	5¼	Mohawk	$ 52½
Allouez	39¼	North Butte	26¾
Calumet & Arizona	59¾	Old Dominion	44¼
Calumet & Hecla	410	Osceola	107½
Centennial	18	Parrot	—
Copper Range	51	Shannon	9¼
Daly West	—	Superior & Boston	3⅜
Franklin	12¼	Tamarack	28
Granby	35	Trinity	5¾
Greene Cananea, ctf.	8¼	Utah Con	16
Isle-Royale	23¾	Victoria	4¼
La Salle	4¾	Winona	6¼
Mass Copper	7¼	Wolverine	97

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, February 8.

Atlanta	$ .16	Mayflower	$ .02
Belcher	.42	Mexican	3.72
Belmont	8.75	Midway	.28
B. & B.	.12	Montana-Tonopah	1.00
Booth	.06	Nevada Hills	2.38
Chollar	.15	Ophir	1.47
Combination Fraction	.17	Pittsburg Silver Peak	1.22
Con. Virgina	.86	Round Mountain	.49
Florence	.58	Savage	.24
Goldfield Con.	4.45	Tonopah Extension	1.45
Gould & Curry	.08	Tonopah of Nevada	7.00
Jim Butler	.35	Union	1.02
Jumbo Extension	.22	Vernal	.16
MacNamara	.26	West End	.79

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, February 8.

Associated Oil	$43.75	Peerless	$ 4.50
Brookshire	.54	Pinal	3.50
Caribou (New Stock)	1.25	Premier	.40
Claremont	.75	P. S. Petroleum	.17
Coalinga National	.13	Republic	.35
Con. Midway	.02	Silver Tip	.70
Empire	1.05	Sterling	1.47
Enos	.03	S. W. & B.	.20
Maricopa 36	.85	Turner	1.00
Midway Premier	.27	Union	99.00
Monte Cristo	1.32	United Oil	.47
Palmer	.74	W. K. Oil	2.40

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. Feb. 8.		Closing Prices. Feb. 8.
Amalgamated Copper	$ 61⅛	La Rose	$ 3¼
A. S. & R. Co.	70¼	Mason Valley	11
Braden Copper	5	Miami Copper	23⅜
B. C. Copper Co.	4	Mines Co. of America	3⅜
Butte Coalition	22½	Nevada Con	18¾
Chino	25⅜	Nevada Utah	1/16
Davis Daly	⅜	Nipissing	7½
Doble	¼	Ohio Copper	1
Dolores	⅛	Ray Central	2
First National	2¼	Ray Con	16⅞
Foley O'Brien	⅛	South Utah	⅛
Giroux	4⅜	Superior & Pittsburg	17½
Goldfield Con.	4⅜	Tenn. Copper	35
Greene-Cananea	8¼	Trinity	6
Guanajuato Con.	⅛	Tuolumne Copper	3⅜
Hollinger	12	United Copper	1½
Inspiration	18	Utah Copper	54⅜
Kerr Lake	2¼	Yukon Gold	3⅜

The Lewis Report on Copper

Prices. Commencing with standard copper at £56 1s. 3d. per ton for cash, the closing quotation of the year was £63. The lowest points reached were £53 15s. 0d. on January 30 and £53 7s. 6d. on May 16, the highest being £64 2s. 6d. on December 21, when £65 was paid for three months prompt. During the first ten months the changes in prices were moderate between £53 7s. 6d. and £57 10s. 0d. per ton but, with the realization of the increasing strength of the statistical position, the market developed great activity during November and December, resulting in an advance from £55 cash to £65 for three months prompt, from which there was a reaction to £63 for cash, the sales of standard during these two months amounting to about 95,000 tons.

Standard copper fell £3 1s. 3d. per ton during the month of January from £56 10s. 3d. to £53 15s. 0d. for cash, influenced by unfavorable American producers' returns and unsatisfactory advices with regard to American consumption, electrolytic copper being pressed for sale down to 12¼c. per pound. Advantage was taken of the fall by dealers and speculators to buy freely, a good business being also done in manufactured copper with large purchases of Chile bars for conversion into sulphate of copper. In February the extreme prices were £55 11s. 3d. and £54 2s. 6d., the lower price being due to an increase of 9111 tons in the United States stocks during the previous month. Electrolytic sold at 12⅜ to 12⅛c. per lb. for home consumption, and £57 5s. 0d. to £57 10s. 0d. per ton c.i.f. for export, chiefly to Germany. The demand was very dull and listless during March, cash standard fluctuating between £54 3s. 9d. and £55 2s. 6d., American stocks showing an increase of 6338 tons and European a decrease of 3445 tons. Standard fell to £53 11s. 3d. on April 19, but recovered again to £54 13s. 9d. Very large sales of American electrolytic and Lake copper were reported, both for home consumption and export, at 11⅞ to 12c. per lb., and £56 10s. 0d. per ton c.i.f. for the former and at 12⅛c. for the latter, the electrical and engineering industries both in England and on the Continent being very busy and a considerable quantity of manufactured copper being taken for India.

Pending the decision of the United States Supreme Court in the Standard Oil case, the demand in May was very inactive; but this, proving more satisfactory than was generally expected, exercised a favorable influence on the New York Stock Exchange and on American business generally, including the copper market, and resulted in an advance in standard from £53 7s. 6d. on May 16 to £55 7s. 6d. on May 24, with sales of about 24,000 tons—and in electrolytic from £55 15s. 0d. to £56 15s. 0d., the low level of prices and steady reduction of the European stocks, together with the prospect of increased American consumption, inducing large purchases by speculators as well as by consumers. The same influences further developed during June, and standard rose to £57 10s. 0d., the sales amounting to 24,000 tons, and electrolytic to £58 10s. 0d. per ton c.i.f., and 12¾c. per lb., large quantities of the latter being bought for export to Europe. In July, influenced by the political situation, the demand fell off and the fluctuations in standard were limited to a range of £1 5s. 0d. per ton—from £56 0s. 0d. to £57 5s. 0d., and in August to 16s. 3d. per ton—from £56 to £56 16s. 3d.—the serious labor troubles and excessive heat in Europe interfering with consumption, the effect of the favorable American statistics for the previous month being counteracted by the severe fall in American securities. The great depreciation in the value of securities on the New York, London, Paris, and Berlin stock exchanges; the advance in the rates of the Banks of England, France, Germany, and other European countries; the long drawn-out negotiations with regard to Morocco; the declaration of war between Italy and Turkey and the occupation of Tripoli by the former power; exercised an adverse influence and caused much anxiety during September, resulting, however, in but a slight depreciation in the value of copper, standard falling from £56 4s. 9d to £54 5s. 0d., but recovering to £55, while American electrolytic sold down to £57 5s. 9d. per ton c.i.f., and 12c. per lb. In October an exceptionally large business was recorded in English manufactured copper, induced by the reduced price at which American electrolytic was obtainable down to £56 10s. 0d. per ton c.i.f. and a fall in standard to £54 6s. 3d., of which large purchases were made for delivery in three months against sales of manufactured and sulphate of copper, the demand being stimulated by a large reduction in the English and French stocks, partly due to considerable exports of standard to Italy. Prices consequently recovered to £56 2s. 6d. for standard and £58 for electrolytic, the former subsequently falling to £55 5s. 0d.

In November a complete change came over the market, the attention of speculators, as well as consumers, being drawn to the increasing strength of the statistical position and the improved prospects of the metal, due to a reduction of 5154 tons in the European and of 2634 tons in the American stocks at the end of October, with a total increase of 34,932 tons in the European consumption and export, and of 3017 tons in the American consumption, as compared with the previous month, and the prospect of further increase. Large sales of electrolytic were made at 13c., and standard rose from £55 to £59 5s. 0d., with sales of about 45,000 tons. This advance made further progress during December, there being a further decrease of 6279 tons in European and of 10,362 tons in American stocks for November, and in the former of 3924 tons for December; standard improving to £64 2s. 6d. for cash and £65 for three months prompt on December 21, the total sales being about 50,000 tons, and electrolytic to £66 per ton c.i.f. and 14¼c. per lb., large purchases being made by American manufacturers for delivery over three months as well as for export to Europe. The closing value of cash standard was £63.

Production in the United States has increased 15,020 tons or nearly 3⅛%, Lake Superior having decreased 1843 tons and Montana 5716 tons, while Arizona shows an increase of 7734 tons, and other states (chiefly Utah, Nevada, and New Mexico) 14,845 tons, the output of the 'porphyry' mines not having proved as large as was expected. Imports from 'other countries' into the United States have increased 7768 tons and into Germany 1720 tons, but into England and France they have decreased 1203 tons, German production increasing 640 tons. The total supplies have been 875,144 tons, against 851,199 tons in 1910—an increase of 23,945 tons, or 2 13/16%. Increased production has not been very noticeable in any 'other country' except Queensland, which has sent 6500 tons to England, and Mexico—whence the increased supply to England and France has been 2650 tons. The shipments from Chile have fallen off about 6000 tons. At the Kansanshi mine in Rhodesia 1800 tons of fine copper has been produced and shipped to Europe, but smelting operations there have since been suspended pending arrangements for more economical transport from the mine to the railway. The prospect of large supplies from the Star of the Congo mine appears at present somewhat remote. Production of the world for 1911 may be estimated at 875,000 tons, as against 851,000 tons in 1910, 847,000 tons in 1909, 755,000 tons in 1908, and 720,000 tons in 1907, showing an irregular but persistent increase.

Consumption.—The forecast given in the annual report for 1910—that consumption promised to fall off to a considerable extent in the United States, but that in England and Germany there was every likelihood of it being maintained, if not increased—has proved correct. Whereas the consumption of the United States has been 13,941 tons less than during 1910, that of England has increased 856 tons, of Germany 18,318 tons, and of France 15,351 tons, while the exports of manufactured copper and sulphate of copper from England have increased 10,608 tons and of man-

*From the annual report of James Lewis & Son, Liverpool.

ufactured from Germany 8001 tons. Consumption, in long tons of fine copper, may be summarized as below:

	1910.	1911.
Consumption of the United States....	339,372	325,431
Consumption of England	96,336	97,192
Manufactured copper exported....	40,932	42,260
Sulphate of copper exported.....	10,678	19,958
Consumption of France.....	65,486	80,837
Consumption of Germany.....	117,169	135,487
Manufactured copper exported....	90,400	98,500
Consumption of American copper in Italy, Austria, and Russia.....	32,432	35,565
	792,904	835,230

Stocks in the United States and Europe have been reduced to the extent of 43,082 tons—100,693 tons against 143,775 tons a year ago. This follows a reduction of 23,685 tons during the year 1910, making a total in the two years of 66,767 tons. This shows the extent to which consumption has exceeded production.

Production and Consumption During 1912.—There is every likelihood of a considerable expansion of production in the United States in the course of the present year, the higher prices now ruling acting as a stimulus to it, but no large increase is apparent from other countries with the exception of Russia, where the price rules much higher than in the rest of Europe, being protected by a high import duty. In the United States consumption promises to be much larger than last year, with the increased activity developed in the iron and steel trades and the cheapness of money, and in Europe there is every prospect of a continued large consumption, the electrical and engineering trades being supplied with orders for many months ahead. At present the tonnage of steamers under construction in the United Kingdom is 1,519,653 tons, against 1,131,503 tons at the end of 1910. Shipbuilders are expected to be very busy throughout the year not only with mercantile but also with war ships.

EXPORTS FROM THE UNITED STATES

(Custom House returns)

	1910.	1911.
United Kingdom	41,865	48,646
France	48,046	61,024
Germany, Holland, and Belgium....	178,809	190,084
Austria, Italy, and Russia.....	32,432	35,565
China and Japan	.....	139
Sundries	783	1,048
Total	301,935	336,506

STATISTICS OF COPPER FOR THE YEAR 1911

DATE.	STOCKS.									AVERAGE PRICE of Standard for Month.	AVERAGE PRICE of Best Selected Ingots for Month.	VALUE per unit of Ore of 20%.
	LIVERPOOL AND SWANSEA.				LONDON.	FRANCE.	TOTAL.	Germany and Holland.	United States.	TOTAL			
	Chile.	America.	Sundries.	English Standard.	Sundries.	Sundries.						
1911	Tons Fine.	Tons Fine.	Tons Fine.	Tons Fine.	Tons Fine.	Tons Fine.	Tons Fine.	Tons Fine.	Tons Fine.	Tons Fine.	£ s. d.	£ s. d.	s. d.
Jan. 1	10,123	25,415	1,150	18,715	11,514	6,080	72,997	16,300	54,478	143,775	—	—	9 6
" 15	10,081	25,452	841	18,446	11,495	6,070	72,388	—	—	—	—	—	9 6
" 31	9,656	25,438	901	18,576	11,301	6,896	72,768	17,850	63,589	154,207	55 14 2½	59 3 4	9 6
Feb. 15	9,231	25,770	917	19,023	10,977	6,816	72,734	—	—	—	—	—	9 6
" 28	8,797	25,421	1,083	20,116	10,823	6,647	72,887	18,600	69,927	161,414	55 1 7½	58 17 6	9 6
Mar 15	8,134	24,835	2,133	20,893	10,308	6,454	72,757	—	—	—	—	—	9 6
" 31	7,578	24,190	1,477	21,099	9,907	6,491	70,742	17,300	72,325	160,367	54 16 4½	58 7 9½	9 3
April 15	7,327	23,427	1,636	20,994	9,627	6,242	69,253	—	—	—	—	—	9 0
" 30	6,766	22,693	1,547	21,261	9,296	6,080	67,643	16,700	73,909	158,252	54 3 1½	57 13 1½	9 3
May 15	6,273	21,822	1,231	21,447	9,138	6,449	66,360	—	—	—	—	—	9 3
" 31	5,530	21,034	1,013	21,459	8,521	6,081	63,638	17,750	74,105	155,493	54 8 7	58 2 2½	9 6
June 15	5,165	20,311	916	21,383	8,342	5,924	62,041	—	—	—	—	—	9 3
" 30	5,061	19,851	859	21,545	8,263	5,843	61,422	17,300	70,283	149,005	56 9 9½	59 18 9	9 9
July 15	4,853	19,339	852	21,326	8,068	5,641	60,099	—	—	—	—	—	9 9
" 31	4,731	18,766	932	21,238	8,140	5,893	59,700	17,950	61,491	139,141	56 15 6½	60 4 4½	9 6
Aug. 15	4,302	18,411	1,060	21,093	7,715	5,653	58,215	—	—	—	—	—	9 6
" 31	4,374	18,215	1,007	21,350	7,715	5,728	58,389	18,450	59,572	136,411	56 7 6	60 3 10½	9 6
Sept. 15	4,216	17,755	1,342	21,346	7,926	5,792	58,377	—	—	—	—	—	9 6
" 30	4,062	17,293	1,355	21,383	7,998	5,654	57,765	18,350	62,900	139,015	55 7 1	58 17 2½	9 3
Oct. 15	3,905	16,432	1,097	20,685	7,766	5,853	55,738	—	—	—	—	—	9 6
" 31	3,833	15,531	815	20,133	7,845	5,704	53,961	17,100	60,266	131,227	55 5 2½	58 17 3	9 6
Nov. 15	3,815	14,695	797	19,507	7,581	5,623	52,018	—	—	—	—	—	9 9
" 30	3,832	14,001	711	18,723	7,330	5,485	50,082	14,600	49,904	114,586	57 8 3½	60 18 9	10 3
Dec. 15	3,982	13,367	777	18,211	7,098	5,384	48,819	—	—	—	—	—	10 9
" 31	4,225	12,939	786	17,346	6,808	5,254	47,358	13,400	39,935	100,693	61 3 10½	65 5 6½	11 0
Avg. 1911	5,994	20,097	1,090	20,292	8,860	5,990	62,323	17,050	62,514	141,815	56 1 9½	59 14 1½	9 7½
" 1910	12,446	32,802	1,878	19,734	19,060	6,393	92,313	9,250	63,010	164,573	57 3 2½	61 2 11	9 9
" 1909	7,985	22,582	2,075	11,701	15,470	5,795	65,611	2,600	69,404	137,615	58 17 3	62 4 2½	9 8
" 1908	3,025	9,991	1,534	1,639	7,113	4,735	28,087	—	—	—	60 0 4½	63 11 8½	9 11½
" 1907	814	740	861	2,425	1,153	1,763	7,757	—	—	—	87 1 8	93 14 5½	15 9
" 1906	695	86	515	2,695	800	1,826	6,580	—	—	—	87 8 5½	92 5 0½	16 5½
" 1905	3,612	271	366	3,080	1,178	1,945	10,452	—	—	—	69 12 0½	74 5 10	13 0½
" 1904	1,441	344	950	1,818	782	2,166	6,951	—	—	—	59 0 6½	62 12 1½	10 9
" 1903	1,503	94	1,059	3,821	783	1,145	8,405	—	—	—	58 3 2	62 14 7½	10 3½
" 1902	3,641	4,881	1,610	2,965	1,454	1,293	15,843	—	—	—	52 11 5½	56 12 7	8 10½
" 1901	4,742	173	1,847	10,236	1,233	1,957	20,187	—	—	—	66 19 8½	73 8 8	12 5

STATISTICS OF COPPER FOR THE PAST ELEVEN YEARS (in tons fine)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1911	167,930	95,551	100	97,292	76,136	4,675	76,162	80,837	178,129	269,005
1910	162,139	94,559	100	96,436	62,014	3,953	61,533	65,486	161,922	252,528
1909	201,567	78,105	150	68,900	56,199	3,873	54,216	58,089	126,989	201,221
1908	197,737	88,216	150	79,757	65,233	3,768	60,980	64,748	144,505	228,953
1907	164,374	83,119	130	78,032	57,776	3,482	56,743	60,225	138,257	217,894
1906	158,104	74,387	200	80,451	52,646	4,337	51,471	55,808	136,259	206,309
1905	142,658	85,414	200	60,491	44,203	3,372	45,247	48,619	109,110	191,152
1904	159,676	73,447	225	83,396	58,645	1,777	57,295	59,072	142,468	214,138
1903	139,332	76,305	350	69,393	42,474	3,387	41,760	45,147	114,540	187,458
1902	160,201	79,978	400	84,777	45,000	4,082	45,172	49,254	134,031	209,927
1901	149,578	79,400	403	77,349	33,833	4,464	35,419	39,883	117,232	192,168

1. Imports into England.
2. Exports from England.
3. British production.
4. English home consumption.
5. Imports of all kinds into France direct.
6. Exports of English copper to France.
7. French consumption of copper imported direct.
8. French consumption of English copper and of copper imported direct.
9. English consumption and French consumption of copper imported direct and from England.
10. English consumption, English exports, and French consumption of copper imported direct.

Exports from Chile to all countries in 1910 amounted to 35,700 long tons of fine copper, and in 1911 to 29,700.

PRODUCTION EXPORTS AND IMPORTS

Production, imports, and exports of the United States, in long tons of fine copper, may be summarized as below:

	1910.	1911.
Lake Superior	98,839	96,996
Arizona	133,754	141,488
Montana	127,787	122,071
Other states and territories	124,553	139,398
Total	484,933	499,953
Imported	153,766	161,534
Total	638,699	661,487
Exported	310,316	346,041
Available supply	328,383	315,446
Stock, December 31	*52,299	*42,314
Consumption	339,372	325,431

*Omitting copper in transit and in process of refining.

STATISTICS OF EUROPEAN IMPORTS AND CONSUMPTION

Statistics of the import of copper produce into Liverpool, Swansea, London, and outports, in tons of fine copper, are given below:

	1910.	1911.
Imports into Great Britain—		
Chile	24,695	20,688
United States	39,493	47,631
*Spain and Portugal	11,429	12,331
Ditto (precipitate)	9,186	7,447
Ditto (pyrite)	15,016	14,138
Australia	24,251	26,363
Cape and Namaqua	8,108	7,960
Japan	7,217	4,931
Norway and Sweden	1,267	1,140
Canada	1,482	2,304
Newfoundland	1,240	1,038
Mexico	10,614	12,073
Peru	3,649	4,051
River Plate	1	.....
Africa	2,883	3,251
Venezuela	635	1,191
Other countries	1,015	1,341
Total	162,181	167,878
Imports into France—		
Chile	2,483	2,735
United States	48,046	61,024
Mexico	6,125	7,316
Japan	1,775	2,926
Other countries	3,585	2,135
Total	62,014	76,136
Total imports into England and France	224,195	244,014
Imports into Germany—		
United States	159,346	169,829
England	5,150	2,275
Australia	8,380	4,432
Spain and Portugal	19,943	21,695
Other countries	18,703	22,619
Total	211,522	220,850
Production	28,860	29,500
Total	240,382	250,350
Exports—Unmanufactured copper	18,614	19,263
Manufactured copper	90,499	98,500
Total	109,113	117,763
Stocks in Hamburg and Rotterdam, December 31	16,300	13,400
Consumption of Germany	117,169	135,487

Tin Production of Cornwall

The year 1911 was a satisfactory one for Cornwall, as far as the price of tin is concerned. The amount of tin concentrate sold at Redruth fortnightly ticketings has not been as great as in 1908 and 1909, but the total receipts have been substantially greater, as will be seen by reference to the following table.

	Tons of concentrate.	Total receipts. £	Average price. £ s. d.
1907	5,752½	597,599	104 13 0
1908	6,568½	508,756	77 9 0
1909	6,970½	539,245	77 7 2
1910	6,102½	549,096	89 19 7
1911	6,151¼	702,599	114 4 5

Once more Dolcoath has been the largest producer, having sold 1699 tons for £197,896. The next in the list is Carn Brea & Tincroft, which produced 776 tons, selling for £82,787. As will be seen from the next table, no other mine came within 50% of these figures. As compared with the previous year, South Crofty showed an increase due to good management, and Levant and West Kitty showed a recovery.

	Total for 1911. Tons.	Value.	Total for 1910. Tons.	Value.
Dolcoath	1,699	£197,896	1,718	£160,328
Carn Brea & Tincroft	776½	82,787	930	73,756
South Crofty	678	76,275	632	56,652
Grenville	594½	70,308	614½	56,776
Basset	553	68,075	653	61,821
East Pool & Agar	476½	53,587	507½	45,581
Levant	364½	41,982	189½	17,269
Wheal Kitty	173	20,101	230	22,307
West Kitty	134½	15,848	68	5,901
Geevor	115	12,504	97	8,357
St. Ives Consolidated	93	9,570	....	.....
Wheal Hampton	78	8,057	....	.....
Botallack	72¾	8,050	10	866
Tehidy Tin Streams	34½	2,847	36	2,227
Phoenix	12	1,299	22½	1,902
Condurrow	4½	455	....	.....
Falmouth Con	...	....	81	7,204
Providence	...	....	24½	2,203
Farbola	...	....	7½	634
Wheal Vor	...	....	8½	678
Various small mines	292	32,958	273	24,624
	6,151¼	£702,599	6,102½	£549,096

It will be seen that Falmouth Consolidated, one of the Schiff-Dietzsch group, is not selling any concentrate at the ticketings nowadays. Presumably the output, if any, is sold by private contract in Cornwall or to Germany, probably to the latter, as better prices can be obtained there, and the directors have no connection with the Cornish community.

Hollinger Gold Mines

The Hollinger Gold Mines Co. will be merged with the Miller, Middleton, and Dixon Gillies groups in Porcupine, giving the new company 15 claims. Terms are now being worked out. The annual report of the Hollinger announces 462,000 tons of ore in sight, having gross value of $10,230,000. Orebodies discovered every 100 ft. in depth should, it is estimated, yield approximately 225,000 tons with gross value of $4,000,000 and net profits of $2,500,000. Net profits for the next four to five years are placed at $7,500,000. A mill which will cost $275,000 will be ready for crushing 300 tons of ore per day in April. The cyanide plant will have a daily capacity of 500 tons. The company has accounts payable of $150,404. The No. 1 vein has shown the greatest tonnage, 210,000, with a gross value of $7,560,000. Below the 300-ft. level this vein every 100 ft. is expected to yield net profits of $2,100,000. Development to date has amounted to 3717 feet.

Book Reviews

Any of the books noticed in these columns are for sale by or can be procured from, the MINING AND SCIENTIFIC PRESS.

ELECTRO ANALYSIS. By Edgar F. Smith. Fifth edition, revised and enlarged. Pp. 332. Ill. P. Blakiston & Sons, Philadelphia, 1911. For sale by the *Mining and Scientific Press*. Price $2.50.

This well known manual of electrolytic methods of analysis appears in revised form to include the methods in which improvement has been made in the past four years.

USEFUL RUSSIAN WEIGHTS AND MEASURES, WITH THEIR ENGLISH EQUIVALENTS. By W. A. Mercer. Pp. 4. London, 1911. Price 50c. For sale by the *Mining and Scientific Press*.

This is a convenient little table of Russian weights and measures, with their English equivalents. The addition of American equivalents would have added greatly to its serviceableness; grains per cubic yard and pennyweights per ton convey but little clearer ideas than dolis per 100 poods in the United States.

COMMERCIAL HANDBOOK OF CANADA (HEATON'S ANNUAL). By Ernest Heaton and J. B. Robinson. Pp. 397. Heaton's Agency, Toronto, 1912. Price $1.25. For sale by the *Mining and Scientific Press*.

This is the standard authority upon the customs tariff, law and regulations of Canada, and also contains general information regarding Canada, and descriptions of towns, agricultural, and fruit districts, mining, railways, water power, etc. It will be of much service to anyone contemplating travel or residence in Canada, and to professional men the chapter giving the requirements for the practice of a profession in each of the provinces will be useful.

A MANUAL OF FIRE ASSAYING. By Charles H. Fulton. Second edition, rewritten and enlarged. Pp. 205; ill. McGraw Hill Book Co., New York, 1911. Price $2. For sale by the *Mining and Scientific Press*.

The author has taken advantage of the issuing of a second edition to rewrite the text. No marked changes have been made, though several of the chapters have been added to. Mr. Fulton is well known for his writings on assaying and metallurgy, and it goes almost without saying that his presentation of the subject is at once lucid, accurate, and scholarly. Its excellence as a text book is well known.

T. T. R.

METALLURGY OF IRON AND STEEL. By Bradley Stoughton. Second edition, revised. Pp. 537; ill. McGraw Hill Book Co., New York, 1911. Price $3. For sale by the *Mining and Scientific Press*.

The first edition of this admirable text was issued early in 1908, but the steady progress in the industry has made a thorough revision advisable. Thus the sections relating to the use of dry blast, electric smelting and refining, special open hearth processes, case-hardening, and others, have been entirely rewritten, while minor changes have been made throughout, many of which add greatly to the convenience of use. New illustrations have been introduced, and an entirely new chapter, on metallurgical fuels, has been added. Both for classroom use and for the general reader, this is unquestionably the best brief treatment of the metallurgy of iron and steel now available. T. T. R.

THE statistical bureau of the convention of the owners of oilfields in Baku (Caucasus) reckons that the total shortage of oil in Russia from all the oilfields for 1911 amounts to 630,000 tons. The output on Tcheleken island and at Grozni equals that of 1910, while an increase of 90,000 tons is reported for Maikop, which has little effect on the enormous Baku deficit. The opinion is expressed that a serious lack of oil may soon be expected. Dealers in oil who have bound themselves by contracts will be obliged to pay high prices.

Commercial Paragraphs

JAMES IRVING & Co., of Los Angeles, Cal., refiners and assayers, have moved to 107 North Spring street.

C. A. DELANEY has been appointed Western representative of the AMERICAN LOCOMOTIVE Co., with offices in the McCormick building, Chicago.

THE WAGNER ELECTRIC MFG. Co. of St. Louis announces the removal of its San Francisco office to the Rialto building. A. J. Myers continues in charge.

The rapidly increasing demand in Pittsburg and vicinity for the asbestos, magnesia, and other products of the H. W. JOHNS-MANVILLE Co., has necessitated a move from its present location in Liberty avenue, above Ninth street, to larger quarters. After January 24, 1912, the Pittsburg branch of the H. W. JOHNS-MANVILLE Co. will therefore occupy the entire eight-story stone, reinforced concrete, and steel building at the northeast corner of Wood street and First avenue.

Catalogues Received

THE HAYWARD Co., 50 Church St., New York. Pamphlet No. 579. Illustrating various excavating machinery manufactured by this company. $7\frac{1}{4}$ by 9 inches.

SMITH-BOOTH-USHER Co., Los Angeles, Cal. Catalogue 'A,' covering its line of machinery, supplies, pipe, and fittings for mines, mills, irrigation and power plants, etc. 8 by 7 in. 576 pages. Illustrated.

UNION IRON WORKS Co., San Francisco. Catalogue No. 5, 'Evans Hydraulic Elevators and Hydraulic Mining Machinery.' 24 pages. Illustrated. $6\frac{3}{4}$ by $10\frac{1}{4}$ inches. Contains also valuable table for hydraulic and mining engineers.

INGERSOLL-RAND Co., 11 Broadway, New York. Bulletin No. 4016, 'MC 22,' 'Telescope Feed Hammer Drill.' 12 pages. Illustrated. 6 by 9 inches. Also Bulletin No. 4204, 'Arc Valve Tappet Rock Drills.' 16 pages. Illustrated. 6 by 9 inches.

DURING 1910 there was a falling off in the production of Indian diamonds, which are found mainly in central India. The total quantity obtained in 1910 was only 77.74 carats, valued at $2950, as against 147,355, valued at $5445 in 1909. It is apparent that diamond mining in India at the present time amounts to very little, and it is predicted that as a business it will cease altogether within a short time unless some large company undertakes the development of the mines in central India. This will require a tremendous outlay for building roads to make the mines accessible. There is no doubt that very rich diamond fields exist in India, but in such out of the way places and so difficult and dangerous of access that they are not workable by individuals of small means.

THE minerals that were mined in Great Britain during 1910 amounted to $594,226,815, an increase over 1909 of $13,278,941. This increase was due principally to the advance in the value of coal. The output of iron ore was 15,226,015 tons, valued at $19,574,372. This ore yielded 4,975,735 tons of iron, which amounted to nearly one-half of the whole quantity of pig iron made in the United Kingdom.

THE production of petroleum in the south of Asia is confined principally to Burma and amounted to 214,829,647 gal. in 1910, compared with 233,678,087 in 1909. The imports of kerosene into India declined from 70,514,379 gal. in 1909 to 57,359,905 gal. in 1910.

THE Bunker Hill & Sullivan Mining & Concentrating Co., on February 5, paid dividend No. 173, of $65,400. This makes the total amount of dividends paid $13,290,450.

THE gold production of India during 1910 amounted to 573,119 oz., as compared with 574,816 oz. in 1909, the value each year being about $11,000,000.

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EDITORIAL

BRAZIL is buying American steel rails, the United States Steel Products Company having taken an order for 25,000 tons for shipment to that country.

SILVER continues to advance, having been quoted at 60⅝ cents at New York and 27⅞ pence in London on Tuesday, the highest price in some years. The rise is generally ascribed to the expected demands of the new Chinese republic, as well as heavy purchases in London for India.

NOME is reported to be facing a fuel famine. According to figures that we published January 6, the winter population this year is 2118, and the stock of coal at the close of navigation was 7660 tons. This has been supplemented by fuel oil and coal furnished by dredging companies, but it is still probable that an ice-breaking steamer will have to be sent in before spring.

STAMP-MILLING problems have always been the source of study by South African engineers, and we reproduce this week an article by Mr. H. Stadler which will be at once a source of interest and of useful information. If present-day problems were similarly made objects of concerted study by technical societies in America, their transactions would profit greatly in usefulness and interest.

NICARAGUA has long been a source of much attraction to engineers, and with the approaching completion of the Panama canal, seems likely to enjoy greater prosperity, together with her sister Central American republics. Elsewhere in this issue Mr. Oscar H. Hershey writes of the geology of the Pis Pis district, near the northeast coast, and later we hope to present a detailed description of the mines near the western coast, which are less well known.

BUTTE is making notable progress, and the mining companies there are increasing their output. The February production of the Anaconda is expected to reach 26,000,000 pounds. The more extensive use of electricity and compressed air and other mechanical improvements is contributing to reduce the cost of production, while the grade of the ore in depth is remarkably good. The problem of saving finely crushed sulphides is being attacked by centrifugal concentration, and the district's future bids fair to vie with its notable past.

TECHNICAL education rightly should rest upon the surest foundations, and the trustees of Columbia University are to be congratulated on the recognition of the increasing need in America of engineers whose professional knowledge rests upon the broadest possible general foundations, shown in the adoption of a plan providing for a three years' course in the various branches of engineering which must be preceded by three years study in a college or scientific school of high rank. It is interesting also to note that the alumni committee on technical education, having considered the matter from a business standpoint, reported that as the cost of education at Columbia is neces-

sarily very high, the return to the student should be of correspondingly high quality.

ANNOUNCEMENT of the annual meeting of the American Institute of Mining Engineers was given in our columns last week. Every member who can should attend the meeting, or, failing that, should forward his proxy before it is too late. In our 'Discussion' columns we last week printed a letter sent out by a notable group of members who announce as their aim the decentralization and broadening of the scope of the Institute in order to make it more useful to the widely scattered membership. It may be worth while to remind members that it is not necessary to give proxies only to some one of those who have already requested them; any friend who attends the meeting and is in sympathy with your views can vote for you if you provide him with a proxy in due form. We hope that the great general interest taken in this business meeting may be a precursor of a livelier interest and participation of the membership in the technical activities of the Institute.

IN the death of George Jarvis Brush, former director of the Sheffield Scientific School of Yale, a notable figure passes from the field of action. A graduate of Yale in the class of 1852, of which he was the last surviving member, he studied abroad, at Munich, the Royal Saxony School of Mines, and the Royal School of Mines in London. Returning to America he joined the faculty of his alma mater, with which he was connected until his retirement from active service in 1899. He was a member of many learned societies, to which he lent distinction as well as service, and Harvard conferred the degree of LL.D. upon him in 1886. For many years professor of metallurgy as well as of mineralogy, he held at Yale much the same position and influence as Thomas Egleston at Columbia, and both men left an indelible impress upon the development of metallurgy as well as mineralogy. Members of the profession everywhere will join with Yale men in mourning his going before.

DISCUSSION of anti-trust legislation from many points of view is needed. We print this week the argument made before the Senate Committee at Washington in behalf of the coal operators, by Mr. G. W. Traer. It is an especially significant document, not only because it has the approval of several of the great associations of coal operators, but because it was prepared by an able and conscientious leader among business men. Mr. Traer was originally trained for the bar, but turned instead to business, first in railway development, and then in coal mining. As representative of the J. C. Osgood interests, and later of others, he has had an active business career which, however, has not prevented his maintaining the mental attitude of a student. He is widely known as former chairman of interstate joint conventions of the operators and miners. What he says is based upon detailed knowledge of actual conditions in one of the great mining industries of the country.

ESTABLISHMENT of a republic in China by imperial decree was the news feature of the past week, and, to those familiar with the social conditions in that country, it is not surprising that the change has been unmarked by popular demonstration. In no other country in the world does the average citizen come into so little touch with the central governing authority, and the change of government will have little immediate effect upon the masses. The crucial problem of the new republic will be finance, one that has already too long been met with makeshifts. Fortunately a strong man is now at the head of affairs in Peking and we hope that the outcome will be a united, progressive, and prosperous China, ready to do business with the rest of the world in a businesslike way. The exports from the United States to China have grown from a value of eleven million dollars in 1900 to twenty-three million dollars in 1911, while our imports last year amounted to thirty-two million dollars worth of goods. Continued growth of trade and increasing trade relations will benefit both republics.

RAND shareholders will in future be allowed to see yearly reports before sending in their proxies, so that opportunity may be afforded for learning what action is proposed and what necessary. The right of the shareholders to information as to proposed courses of action of the directorate is too frequently ignored, but those who oppose such a course of action are often but little more lucid in their statements. An instance of this is seen in the recent purchase of shares in the North Dome by the management of the Temiskaming Mining Company, where an association which has been formed to oust the management is sending out requests to shareholders for proxies for that purpose. Some shareholders have, properly enough, replied that while they were not informed of the previous actions of the management, neither are they properly enlightened as to what is now proposed to be done, and are not disposed to sign away their rights without a definite understanding of the exact use to which the proxy will be put. The exigencies of the moment at times preclude consulting the wishes of shareholders, and the necessities of business diplomacy sometimes prevent open discussion, but the shareholder is, nevertheless, a partner in the enterprise and should receive the fullest information possible to convey. Frankness will pay in the end.

NATIONS of the Old World are buying copper, and the low-hanging war cloud, which seems to be endeavoring to envelop all of Europe in its folds, is now openly discussed as the reason for the phenomenal export demand which in turn is responsible for the figures of the Producers' Association for January. European nerves are evidently all a-jangle, and each incident in public affairs receives a sinister interpretation. Behind all the discussion of peace committees and arbitration courts lies a market conviction that war will prove inevitable, and there can be no questioning, in seriousness, the source of the demand which has cut the accumulated stocks in this country to a low mark of 66,280,643 pounds. The decrease in surplus for the month was 23,174,052 pounds. Of the month's production of 119,337,753 pounds, foreign demand accounted for 80,167,904 pounds, totaling a larger foreign shipment than for any one month of 1911, and exceeded only by January and December in 1910. Were conditions settled in other lines, the business atmosphere a normal one, it would be safe to predict a sharp rise in copper and an immediate access of activity in copper shares. As matters stand, the armies of Europe are apparently under orders to sleep upon their arms; on our own side of the water, there is much discussion of the possibility of reluctant intervention in Mexico. It follows, therefore, that a copper boom, if launched now, must be founded upon the world's unrest, rather than upon the normal growth of commercial enterprise, and the very factors which create the demand will so far unsettle business conditions as to largely diminish the profits derived.

The Improbability of Impartiality

In the mechanical world, whenever a new piece of apparatus has been successfully constructed, one of the first duties of the manufacturer is to standardize its parts in order to conduce to convenience in its use and repair. In

the realm of ideas a thoughtful observer can scarcely fail to detect a similar tendency toward standardization of ideas and methods of thought, presumably to make thinking less difficult. Essays and articles may be found in which standardized ideas, like building stones, are put together with but the scantiest bond of the cement of originality to form a more or less useful and harmonious whole. This is not only convenient but is oftentimes necessary, for in the complexity of modern life every energetic man finds more demands upon his activities than he can well meet, and is commonly forced to do things in the easiest and most effective way rather than in the ideal way. But such standardized ideas must be cleanly cut, like ashlar masonry, and this introduces the difficulty that they can thus only with difficulty be adjusted to the border line of fact, which is seldom definite and clear.

An example of this is seen in the common assumption that certain persons are, by virtue of their training and surroundings, impartial while others are similarly partial, an assumption voiced by a friend who remarked that complete reliance could not be placed upon articles appearing in technical journals, because they were in many cases prepared by men who were interested in the object of discussion and therefore could not treat it impartially. The superficiality of this reasoning must be evident, for it involves the fallacious belief that one who has no interest in an object will therefore be impartial in his discussion of it, while one interested will necessarily be partial. It is rare indeed that anyone is perfectly and consistently impartial, for even the mathematicians, who might, of all classes of men, be expected to attain freedom from mental bias, seem but little freer from disputes than other classes of men. In the solution of scientific problems investigators cling to the methods which appeal to them, and in their comparisons of various types of machinery or methods of work college professors inevitably emphasize those which they have had most opportunity to study in detail, awarding a less proportion of attention than is their due to those with which they are less familiar On the other hand, the description of his own device by an inventor is sometimes modest in the extreme and entirely free from the tendency toward exaggeration observable in the writings of one who is endeavoring to prove a point or establish a principle.

The real criterion is found in the analytical perusal of what the author has to offer his readers. There is no *a priori* reason why a description by John Smith of the Smith process or machine should be untrustworthy; and whether it is or not will depend upon the ability and intellectual honesty of Mr. Smith. If his intelligence is limited he may attempt to claim impossible virtues and efficacies, much as vendors of patent medicines once did. The inadvisability of such a course of action is generally recognized, as is evidenced by the infrequency of its use, and the description of an object by one interested in it is commonly reasonably fair and impartial, at times even more impartial than a similar description by a more enthusiastic observer who has no direct interest in the matter The difficulty lies, perhaps, in confusing material interest and impersonal interest, for it not infrequently happens that enthusiastic observers will make larger claims for a machine or a process than will its inventor. Authors of technical articles cannot therefore be arbitrarily divided into those who are partial and those who are not, for no such clear line of distinction exists and the reader must intelligently consider what he reads.

Mental bias in an author may be perfectly unconscious, and is often a matter of temperament; one man naturally inclines toward commending the good features, his neighbor as naturally looks for flaws and difficulties; one man gives a process or machine the benefit of the doubt, another concedes no more than is demonstrated. An accurate picture can not be obtained from the account of a single observer, as in the well worn story of the blind men and the elephant. By recognizing that no man is truly impartial, even though he consciously strive to attain it, and that a description by an interested person is not necessarily more partial than one by an outsider, a clearer perception of the value of technical descriptions may be gained.

Government Bureaus

Last week we published the text of a proposed bill amending the act creating the Bureau of Mines, and in our Washington letter this week some further details are given. A curious feature of much of the comment made upon the changes in the act is an apparent fear that the Bureau will do too much, and that it is therefore necessary to carefully restrict its activities. This can scarcely be based upon a desire to prevent the expenditure of public funds upon unnecessary work, for proposals to establish metallurgical experiment stations at various points throughout the West have been able to elicit no little public support. One of the stock arguments against the increase of Government activities beyond the necessary fields of legal administration is that the Government is unable to conduct any enterprise as cheaply as private corporations. The fact is ignored that where this is true it commonly arises from restrictions which hamper the methods of Government work, making them unduly expensive, and at times serving to prevent prompt and necessary action. A good example of this last is just at present seen in California, where the safety of some of the oilfields is being threatened by water. Concerted action by the operators to meet the situation is difficult to secure, and the State Mineralogist, who might properly take the lead in such a matter, is unprovided with funds for any such work, nor will the law permit him to make use of funds which the operators are willing to furnish. Thus a bureau created to advance the interests of the mineral industry is unable to act effectively because those who considered it necessary to properly circumscribe its scope were unable to foresee any such contingency. Flexibility and effectiveness is what is really desired, and in business circles this is secured by outlining the general scope of the work, securing a capable and trustworthy head, and leaving special problems to him to be settled as they arise. There is no good reason why a Government bureau should be organized on any other than a business basis.

Some criticism of proposed changes is apparently based on ignorance of what is already being done. For some time the Bureau has been making tests upon explosives, and early last year fees were imposed for doing this work, in order that manufacturers might not avail themselves of the privilege except when necessary. It is quite on the cards that it may be found desirable in the future for the Bureau to make other tests, such as are now being made in other lines of work by the Bureau of Standards, and provision should be made for this. Work of this sort is a proper phase of government activity, both because of the desirability of having it performed under auspices which prevent the possibility of bias, and because the total quantity of this work is small and the necessary equipment expensive, so that it could scarcely be made an object of commercial enterprise. Metallurgical testing stations are quite another affair, and our opinions upon them have already been adequately expressed. If any criticism may be lodged against the amended act by the metal miner it is that it errs on the side of conservatism rather than of too much freedom for the Bureau.

Plea for Revision of the Sherman Act

By G. W. Traer

*On behalf of the Illinois Coal Operators' Association, I desire to offer the following suggestions for amendment of the so-called anti-trust laws, together with comments intended to disclose the reasoning upon which our suggestions are based. We believe that all improper trust methods or practices may be divided into three classes, that is to say:

1. Attempted monopoly; or attempts to effectuate by agreements or combinations of individuals, partnerships, or corporations, those results of monopoly for which it is condemned; namely, the fixing of arbitrary control of prices or the limiting of output below actual public needs.

2. Methods and practices by either individuals, partnerships, or corporations toward competitors, of such character as to require, in the public interest, prohibition and punishment under the law of criminal conspiracy.

3. Excessive issuance of securities by corporations, resulting in abnormal and improper absorption of capital for speculative purposes alone and not for the purpose of increasing efficiency.

Remedies Are Proposed

We therefore suggest changes in the law as follows:

(1.) That the Sherman act be amended so as to eliminate prohibition of 'restraint of trade' and substitute therefor prohibition of agreements or combinations by either buyers or sellers, the purpose or necessary effect of which shall be to fix or arbitrarily control prices or limit output. The prohibition of monopoly or attempted monopoly to remain as at present.

(2.) That a trade commission, composed of a suitable number of members, be appointed by the President, under the terms of a statute separate and distinct from the Sherman act, providing for such commission and prescribing its powers.

(3.) That all persons, firms, and corporations be subject to the jurisdiction of the Federal trade commission, with respect to all agreements or combinations which regulate or tend to regulate interstate trade or commerce.

(4.) That the trade commission have power to investigate all contracts and combinations which tend to or do create a monopoly or regulate or restrain interstate trade or commerce; and to make findings determining whether the same are in violation of the Sherman act as amended.

(5.) Appeals to be provided from the decision of the commission to the present Commerce Court or another special court created for the express purpose.

(6.) A requirement that makers of such contracts or combinations shall submit the same to the commission for determination as to whether they create a monopoly or unlawful restraint of trade; and if they shall obey an order of dissolution by the commission or by final order of court upon appeal, they shall be subject to no penalty by reason of the contract or combination.

(7.) Provision that the commission may hear and investigate without complaint from third parties, and shall do so upon such complaint; but there shall be no penalty in such cases unless it shall be found that the defendants intended the purpose and necessary effect to be to fix or arbitrarily control prices or limit output or create a monopoly.

(8.) A national incorporation act does not appear to be essential to the effective regulation of attempted monopoly or contracts or combinations in restraint of trade. Monopoly might be effected by a single individual. Unreasonable and vicious restraint of trade might be effected by agreement or concerted action between two individuals.

It seems clear, however, that if the capitalization of and issuance of securities by corporations engaged in interstate trade, is to be effectively regulated, it will have to be done by the Federal government. We believe it will prove advisable to permit the issuance of new securities as a basis which will permit of reasonable speculation on the future, as a reasonable stimulus to enterprise. Extreme conservation in this respect would give too great advantage to those already in business at any given time, and would work serious public harm by restricting development. A well organized bureau of corporations would seem to be a better place for the handling of these matters than a trade commission also charged with the regulation of the acts of individuals and partnerships as well as corporations.

Agreements and combinations and concerted action designed to 'stifle', 'strangle', or 'throttle' competition by unlawful acts are now punishable under the law of criminal conspiracy and should remain so. But such conduct is not attributable to corporations alone. A bureau of corporations or any other agency for controlling corporations as such, would not seem as suitable a place for investigating and prosecuting such conduct as a trade commission. In the investigation of alleged attempts to monopolize or unreasonably restrain trade, a trade commission would almost certainly unearth criminal conspiracy if such existed; and in case of such discovery it should be the duty of the commission to present the evidence to the proper officers of the law. Summarized in reverse order, our suggestions are:

That the prevention of improper issuance of securities by corporations engaged in interstate trade may be effected best by a bureau of corporations, through the medium of a national incorporation act requiring a Federal charter for such corporations.

That a trade commission shall be created, one duty of which shall be to investigate agreements, combinations, or concerted action among two or more individuals, partnerships, or corporations, the purpose or necessary effect of which shall be to 'stifle', strangle' or 'throttle' competition and to cause the prosecution of the same under the law of criminal conspiracy. By this means unlawful acts of competitors toward each other may be prevented.

That in place of the indefinite expression "restraint of trade" in the anti-trust law, there be substituted the explicit expressions "fixing or arbitrarily controlling prices or limiting output by combinations either of sellers or buyers"; and that all agreements or combinations regulating or tending to regulate trade or production be subject to the jurisdiction of the trade commission as suggested above. By this means concerted acts of either sellers or buyers toward the other, which are publicly harmful, may be prevented.

Condition of Coal Industry

If the committee please, I should like also to describe as briefly as possible, the conditions existing in the bituminous coal-mining industry of Illinois which relate to the subject-matter of the suggestions we have presented.

There are about 300 independent coal-producing companies in the state, operating more than 400 rail-shipping mines. The annual consumption of Illinois coal is about 50,000,000 tons. The annual capacity of the mines, if worked throughout the year to the full extent of actual transportation facilities, would be about 75,000,000 tons. Public necessity seems to require that there shall be in existence at all times sufficient mining capacity to supply the greater requirements of the winter months. This inevitably means a large surplus capacity during the spring and summer months. The natural fluctuation in the demand for Illinois coal between summer and winter is such that the industry never can expect to work full time.

*Address delivered Thursday, February 1, before the Committee on Interstate Trade and Commerce of the United States, at Washington, and published in *The Black Diamond*.

While Illinois coal can be stocked a considerable length of time, it cannot be mined many months in advance and held for use in the winter, like anthracite and more expensive Eastern bituminous coals, because it contains a higher percentage of moisture and will crumble and slack sooner than the higher priced coals. Consumers of Illinois coals aggravate, rather than help to overcome this condition by refusing to order coal as much as might be, in advance of the actual need for it. It must be produced substantially as ordered from time to time, and this makes the production or demand (and demand and production mean the same thing in this connection), much less during the months of April to September, inclusive, than during the other months of the year. This condition is so uniform that the relative percentages of production during the busy season and the duller season have not varied materially in ten years, except when temporarily affected by anticipation of a strike or other abnormal business conditions.

After making all allowances for Sundays, holidays, and other usual stoppages, it is fair to say that the excessive producing capacity results in an average loss of 60 days per annum for all mines, compared with what might be properly expected with a reasonable adjustment of the number of mines attempting to run, to the number actually required to fully and promptly supply all demands.

There are more than 70,000 miners and mine laborers at the mines in Illinois, working on the average 60 days per year less than they could work if there were a reasonable adjustment of producing capacity. This is equivalent to the absolute idleness for the entire year of 12,000 to 15,000 men. The very low average number of days' operation causes coal to cost much more than it would if fewer mines were operated a greater number of days.

The intense economy forced upon the mine-owners by these conditions is seriously affecting the proper conservation of the coal deposits. The general population of the communities in which coal mines are situated as a rule are suffering greatly in their business affairs.

Advantage of Buyers

Under the conditions I have described the seller of coal practically is under duress as compared with the buyer. A seller in deciding whether to deal with any given buyer should have at least some reasonable equality of alternative advantage or disadvantage, but the producer of coal under these conditions has no equality of choice. If a coal mine stands idle, physical deterioration proceeds with great rapidity. In many cases large quantities of water must be pumped out constantly or the mine will be flooded and destroyed, while in others underground fires from spontaneous combustion must be guarded against constantly. A heavy additional penalty is thus imposed upon the mine-owner who might otherwise choose to let his mine remain idle instead of producing and selling coal at a direct loss. A merchant or manufacturer is not put to the choice of selling at a loss or being put to ruinous expense to avoid having his store or factory flooded or burned, nor is the deterioration of an idle building or machinery comparable in any degree with that of an idle mine.

The buyer is in an entirely different position than the seller. Presumably, any two buyers, or any number in fact, may legally combine to place their purchases with this or that seller at their pleasure. No doubt it is true that such a combination of buyers, by misrepresentation of facts or other acts of a fraudulent nature, might be held punishable for conspiracy to defraud. But in such case the legal offense would consist solely of the misrepresentation or the fraudulent acts. The mere combination to purchase jointly is not condemned either by common law or statute.

There are numerous things which could be done by combination or coöperation, in the way of regulating production and distribution, with a view to reducing the cost of producing and distributing the coal and maintaining the properties; and which, at the same time, would result in direct benefit to the miners and mine laborers and to mining communities generally. The general public would be benefited also in so far as improved methods should result in better condition of the coal in the ground and lessened waste of capital and labor from overdevelopment, overproduction, and overcompetition. But it is practically impossible to effect by combination or cooperation any improvement in methods of production and distribution without at the same time lessening to some extent unreasonable or destructive competition, although such movements need not necessarily nor should they be permitted to go to the extent of fixing or arbitrarily controlling prices, limiting output, or eliminating fair and reasonable competition.

We do not believe the general good requires that combination or coöperation shall be illegal merely because it lessens the number of competitors in an industry, or because it reasonably regulates production and distribution, or because it may have some effect on prices.

Lessening the number of competitors may occur whenever two or more individuals engage in a partnership or form a corporation, or when several small corporations are merged in a large one. But this is not generally regarded as dangerous unless carried to the extent of practically arbitrary control of the situation.

Regulation of production and distribution or coöperation, even if it should have a material incidental effect on strained or destructive competition and thereby on prices which have been forced below the fair cost of production and distribution, has not yet been publicly condemned and should not necessarily be, unless it goes to the extent of giving practically arbitrary control to seller against buyer.

We believe that these principles should be recognized in framing and administering the laws, namely, that just as unreasonable combination leads to no competition, so no combination leads to unreasonable competition; and that competition without counter-check or reasonable regulation destroys itself and leads to consolidated ownership in units whose most conspicuous attribute frequently is tremendous and ominous financial power, rather than increased efficiency. The history of the coal-producing industry has exemplified these principles in the past and is continuing to do so today.

The Van Roi Mines

Four years ago the Le Roi No. 2 company issued a subsidiary called the Van Roi, for the purpose of acquiring the Vancouver group of silver-lead-zinc properties in the Slocan district of British Columbia. The capital is £34,500, divided into 30,000 preferred shares of £1 each and 90,000 common shares of 1s. each. The purchase price was £20,000 cash paid to the local owners, and 60,000 common shares paid to the Le Roi No. 2 company. At first, the company continued to send the ore to the Wakefield mill for concentration, but this arrangement ceased in August 1910. Subsequently a new mill was built on the other side of the mountain, and an adit driven to deliver the ore; also the aerial tramway was moved to the new position. Operation was resumed on March 15 of last year. The report, covering the year ended September 30, shows that during the 6½ months, 22,427 tons of ore was sent to the concentrator, averaging 3.74% lead, 7.8% zinc, and 9.46 oz. silver. The production was 1214 tons of lead concentrate, averaging 65.3% lead, 9.1% zinc, and 89.7 oz. silver, and 1598 tons of zinc concentrate averaging 45.5% zinc, 1.7% lead, and 29.6 oz. silver. The tailing assayed 0.1% lead, 4.65% zinc, and 3.26 oz. silver. The profit and loss account shows a debit of £2661. Since the end of the year under review, the company has been making a profit, and the directors and managers are hopeful of the future.

According to *The Engineer*, foreign patents are being applied for by Chr. Oftedahl, of Christiania, for a chemical process whereby he claims that iron and steel plates may be hardened and made unpierceable, while at the same time their normal elasticity is maintained. The inventor claims that the chemical substance required can be added during the actual process of rolling. Experiments are contemplated at the mills of a large foreign works.

Geology of the Pis Pis Mining District in Nicaragua

By Oscar H. Hershey

The Pis Pis mining district in Nicaragua comprises an area about 11 miles long in a northeast direction, and about 1¼ miles wide. It is situated in the valley of the Pis Pis river (a tributary of the Waspuc river), on the divide which separates that stream from the Tunkey and Banbana rivers (tributaries of the Prinzapulca river), and in the basin of the Tunkey river. Its exact situation is not known, but it has an estimated distance from Cape Gracias á Dios of about 225 miles by the Wanks, Waspuc, and Pis Pis rivers, and from Prinzapulca of about 195 miles by the Prinzapulca, Banbana, and Tunkey rivers.

In the spring of 1910 I accompanied a party of mining engineers to the Pis Pis district and spent about 15 days in it. The general character of the rocks was evident in the field, but to get an expert petrographer's opinion on the names that should be applied to them, a set of thin sections was submitted to A. C. Lawson, of the University of California. They were studied by a student at the university, but his report was reviewed and amended by Mr. Lawson. The detailed descriptive notes have been incorporated in a paper entitled 'Geological Reconnaissance in Northeastern Nicaragua' which was read by title at the March 1911 meeting of the Cordilleran Section of the Geological Society of America and will be printed in the bulletin of that Society. It is not my purpose to go at length into the general geology, but to treat the subject rather from an economic standpoint.

The greater portion of the district is occupied by a thick series of andesite lavas and fragmental rocks, to much of which the term augite-andesite may be applied. Scattered through this are dikes and irregular masses of a harder andesite, to which also the term augite-andesite is applicable.

The northeastern portion of the district is characterized by a mass of intrusive rhyolite about 4 miles long and 1 mile in maximum width. Rhyolite also occurs in a narrow band of hard, flinty-appearing rock that has given rise to the Big falls on the Pis Pis river. A portion of the foot-wall of the Bonanza vein has an appearance suggesting a partly decomposed diorite, but no material fresh enough for microscopic study could be secured. The approximate distribution of these rocks will be given in a map that will accompany the paper mentioned above.

The Pis Pis district is traversed by a remarkable system of large gold-quartz veins. All the larger veins have a northeast-southwest course and dip northwest at angles varying from 45 to 75°. Some of the smaller veins are transverse to the large ones. All have resemblances which indicate that they are members of one system, but each has some character distinguishing it from the others. They were deposited in actual open fissures which were probably reopened from time to time, producing a fairly definite ribbon structure. The gangue is generally a fine-grained quartz, in part hard and barren, and in part impregnated by sulphides. Crustification is common, and there are many crystal-lined vugs. Generally there is no evidence of metasomatic replacement, but in places there are fragments of country rock in the vein which may in part have been replaced by quartz and sulphides. In the Bonanza and neighboring veins much of the unoxidized ore has a green stain, evidently due to chlorite.

The sulphides almost invariably present below the zone of oxidation are pyrite, galena, sphalerite, and chalcopyrite, in greatly varying proportions. The mines are in two groups, the northeastern and southwestern, with a space of about 3⅛ miles between, in which the veins are present, but not denounced and developed. The northeastern mines (except the Lone Star and Panama) including the Bonanza, Mars, and Neptune are grouped about the rhyolite area. They are relatively rich in quartz and low in sulphide content. The Lone Star is in intrusive augite-andesite at some distance from the rhyolite area, and it shows an increase of sulphide, particularly galena. The southwestern group, including the Siempre Viva, Constancia, Concordia, and Trinidad mines, is in andesite, and relatively rich in sulphides. The veins of this group are characterized by the presence of a large quantity of fine-grained hematite (specularite). Thus I have gained the impression that the veins cutting the basic rocks are richer in sulphides and other basic minerals than those in and near the rhyolite area, making it more difficult to extract the gold from the sulphide ore. The Bonanza and Mars veins are quite favorable in this respect.

The country rock bordering the large veins abounds in seams of quartz extending 30 to 100 ft. from the vein proper. They consist of the same kind of quartz and sulphides as the large veins, and doubtless carry gold, but it does not appear that they have made any important orebodies. These stringers are best developed in the extrusive andesite, least in the rhyolite.

Aside from these facts, I cannot see that the country rock has had any important influence over the veins. They are developed in all the formations of the district and pass readily from one to another. I could not secure any good evidence that the deposition of the gold has been controlled by the wall-rock. The large veins are in the form of a succession of lenses which may be 50 to 500 ft. long and 10 to 85 ft. in maximum width, connected by short stringers of quartz 6 in. to 3 ft. thick. It is a rule throughout the district that the wider portions of the veins are richer in gold than the narrower portions; but the smaller veins, called *hilos* (threads), 2 to 5 ft. thick, and which are often spurs from the large veins, are generally of higher-grade ore than the large veins. Mine-owners in the district try to connect the Siempre Viva, Lone Star, and Mars veins as one vein about 10 miles long, but I think the large veins are only 1 to 3 miles long, dying out into a group of stringers.

Although the veins are in strong fissures, there is not much evidence that they are due to faulting. Strong gouges are not often present along the walls, and the gouges present are as likely to be within the veins as on the walls, and are perhaps due to comparatively recent movements. The distribution of the wall-rocks along the veins in a few cases indicates some displacement, but I believe that in general faulting has not been an important feature. As to transverse post-mineral faulting, there has been little of it; only one important fault of this nature was detected.

I can see no reason why, at any depth at which these veins are cutting the same formations as appear at the surface, they should not be as strongly developed and carry the same content in gold and silver as they do in the upper part of the sulphide zone, except possibly such decrease in value with depth as may be common to gold-quartz veins in general. I can see no evidence of secondary enrichment below the zone of oxidation. When the veins pass beneath the volcanic series they may traverse sedimentary formations, and some change may be expected. For reasons too elaborate for this paper, I anticipate that this will not occur short of at least 1500 ft. in depth. Besides, veins which, like the Bonanza, probably pass into the rhyolite mass, may traverse it to such depth that the base of the andesite may not figure seriously in the future of their mines. The vein system is strongly developed in the extrusive andesite on both sides of the Pis Pis district, but from the fact that mines have not been opened on it beyond the district (except in far-distant localities), I presume that it carries much less gold. This suggests to me that the gold is not so much due to the extrusive

andesite as to the extrusive rock present in the district, are carried further, I arrive at the pyrite-impregnated country as the probable source of the gold. It may be present at depth under the Siempre Viva mine.

Near the surface the sulphides are generally thoroughly oxidized to limonite, with irregularly distributed pyrite, covellite, cerussite, and malachite in small amounts. The gold which was associated with the sulphides chiefly (hard white quartz is practically barren) is then freed and may be seen in the pan as very fine grains. As a general rule the most porous rock is the richest. In the southwestern group, the hematite remains unchanged to near the surface. Very close to the surface the thoroughly decomposed wall-rocks fail to support the vein, and it falls to pieces of quartz imbedded in red clay, forming the so-called *manta*. This works down neighboring slopes and may form an irregular sheet from 2 to 10 ft. thick. The Bonanza mine has the strongest development of *manta* because the vein outcrops on the crest of a low broad ridge. Where the slope is very steep, as at the Lone Star mine, there is no workable *manta*. Most of the mines have worked some *manta*, but much more of the vein in place. The mines pass rather rapidly from the oxidized to the unoxidized zone, there being no strongly marked zone of mixed sulphides and secondary oxidized minerals. To this I must make the exception that certain compact portions of the veins may remain unoxidized to the surface. At the Bonanza mine sulphide ore appears at a number of places in hard compact portions of the vein within 30 ft. of the surface as it was before mining began. Some oxidation may extend down along seams to a depth of 100 ft., but I believe the bulk of the vein is unoxidized at 50 ft. from the nearest point on the surface, or say 100 ft. from the outcrop. In the Neptune vein sulphide ore occurs in places practically at the surface, and the oxidized zone is probably nowhere deep enough to be seriously considered. The Mars mine is not developed to the sulphide zone proper, but bunches of unoxidized ore occur within 50 to 75 ft. of the surface. The Lone Star mine has hundreds of feet of adits in the sulphide zone. In disregard of its outcrop high above neighboring creeks, and the relatively high sulphide content favoring oxidation, the zone of oxidation probably nowhere extends more than 100 ft. from the nearest point on the surface and the weathering of the country rock to a not much greater depth. At the big vein at the Constancia mine, outcropping on the crest of a high ridge, sulphides are appearing in bunches at 160 ft., and on the La Leticia vein only sulphide ore comes from the bottom of a shaft 100 ft. deep. The zone of oxidation in the Siempre Viva vein along the 2300-ft. length developed in the Siempre Viva mine, extends down 50 to 200 ft., generally 100 to 150 ft. The Concordia mine, on the same vein, had not reached sulphides at 60 ft. At the Trinidad mine, also on the Siempre Viva vein, the zone of oxidation extends from 75 to 150 ft. deep.

These observations prove beyond doubt that nowhere in the district does the zone of oxidation extend very deep, rarely to 200 ft.; probably 100 ft. would be near an average. The humidity of the climate and the protection afforded by the stiff clay covering are the reasons for this shallow depth of oxidation. Hence, any proposed extensive mining operations must take the sulphide ore into immediate consideration, and milling plants should be planned on this basis.

The question of the tenor of the sulphide ore is interesting the mine-owners. Its importance lies in the fact that the grade of the oxidized ore at most of the mines is so low that, in view of the probable lower extraction and increased cost of working, any considerable decrease in the average content of the ore in passing from the oxidized to the unoxidized zone would be fatal to the future profitable operation of the mines. In fact, at several of the important mines the end of the oxidized ore is in sight, and the managers realize that they are approaching the time when they must face the problem of working the sulphide ore; hence, they have given some thought to the subject and have some impressions. As I have reason to believe that one of these managers will shortly treat this subject at length in a public communication, I will confine myself to the remark that after due consideration of all the expressed opinions, statements of assays in various places, and the result of sampling at the most important mine, I have concluded that the sulphide ore will average as much lower than the oxidized ore as would be expected from the lessening in weight of the former by leaching of the sulphides and other basic minerals except the hematite. The exact percentage of decrease will have to be determined for each vein by elaborate development and sampling. I do not think that it will reach 10%, in any important case.

It is not my purpose to give specific and detailed information about the individual mines as mining ventures, but a few brief notes on them will be in order. At the Bonanza mine the vein has been pretty thoroughly exposed along a distance of about 1800 ft. by extensive cuts and several adits. It has a northeast course and has a northwest dip of 45 to 50°. The foot-wall toward the northeast is diorite (?), toward the southwest andesite. The hanging-

INDIANS POLING A PITPAN IN EASTERN NICARAGUA.

wall rock toward the northeast is andesite, toward the southwest rhyolite. The large rhyolite area lies close to the vein on the north. The vein is made up of four large ore lenses varying in length from about 200 to over 500 ft. and in maximum width from 13 to 19 ft., separated by low-grade portions where the vein is narrow. The Neptune vein is entirely in rhyolite, and dips northwestward 35 to 50°. It has the usual lenticular form, the lenses best developed running from 3 to 25 ft. in thickness; they may average between 10 and 15 ft., not all good ore, but all vein quartz and sulphides. The Neptune may be a portion of the Bonanza vein faulted by what I have called the Ribabaones fault.

The southwestern portion of the Mars vein is in rhyolite, is only 3 to 5 ft. thick, dips northwest 30 to 60°, and although some portions of it assay well, it has not been milled to any important extent. Near the point where extrusive augite-andesite appears in the hanging wall, the vein rapidly thickens to about 15 ft., and thence northeastward it is one of the large veins of the district and has been extensively mined in open cuts. It continues to have an andesite hanging wall and rhyolite foot-wall nearly to the point where it splits into two large branches, of which the right-hand branch is 10 to 15 ft. thick. The two branches probably reunite at about the summit of Mars peak, forming a vein 25 to 35 ft. thick horizontally. This part has andesite and rhyolite so mixed in both walls that I have concluded that the country is mainly andesite, abounding in small rhyolite dikes. The dip of the vein here is 70°. Not all of the quartz is ore, but large bodies of it reach a fair milling grade. It is my impression that the unoxidized ore will have a smaller percentage of and simpler sulphides than any other important mine in the district.

The Venus is a strong vein, of which the outcrop has produced a sharp ridge leading to one of the highest peaks of the district. The lenses may reach a thickness of 10

to 15 ft. normal to the dip, which is 70° northward. The vein has not been worked, but is interesting from the fact that it passes from the intrusive augite-andesite into the rhyolite without any change in the gold content.

The Lone Star mine has two veins, which are developed by a number of adits aggregating several thousand feet. The Lone Star vein seems to run from 6 in. to 17 ft. wide (horizontal measurement) and for a considerable distance may be 10 to 15 ft. wide. The profitable ore is in lenticular shoots which have been developed down into the sulphide zone. The Highland Mary vein lies mainly about 100 ft. northwest of the other and is supposed to unite with it at the top of the ridge. The principal working on it is in the centre of a large lens; from an open cut the quartz seems to have been quarried 30 ft. wide for a distance of 200 ft. On No. 6 level the ore is said to be 86 ft. wide in one cross-cut. Both veins are in intrusive augite-andesite.

The Constancia property, all of which is underlain by andesite (aside from the vein quartz), has the large El Vesuvio vein, apparently developed by over 2300 ft. of adits and drifts. It seems to be 30 to 40 ft., and in one place probably 75 ft., wide horizontally. It dips to the northwest 70°. However, mining operations have been carried on chiefly on a group of smaller and richer veins lying north of the big vein. The La Leticia vein averages 3 to 5 ft. wide, with a maximum said to be 14 ft. It is a well defined fissure vein dipping northward about 75°. It seems to abut on and end at the La Constancia vein, workings on which are caved, but which is described at 5 to 6 ft. wide, 500 ft. long, running through a hill 60 ft. high between two creeks and not found beyond them. Several other veins occur on the property.

The Siempre Viva, one of the oldest and best developed mines of the district, is opened on a zone of brecciation 35 or 40 ft. wide, trending northeast and dipping northwest 65°. The hanging wall as exposed in the New adit is a very hard, fine-grained augite-andesite, and the foot-wall rock an extrusive andesite of different appearance. The breccia is cemented by fine-grained quartz and hematite in black grains. This material is said to be nearly barren of gold. It is traversed by veins of quartz which, below the zone of oxidation, are rich in hematite and pyrite, with some chalcopyrite and traces of sphalerite and galena. Quartz stringers come in obliquely from the hanging wall, enlarge in the brecciated zone, and trend with it for hundreds of feet. The quartz seen underground is generally 3 to 5 ft. wide, opening into bulges as much as 15 ft. wide. Going northeastward the vein splits, the left-hand branch pretty certainly going to the Trinidad mine where, with the exception of one place where it is pinched to a mere gouge, it is generally 3 to 5 ft. thick, bulging to 10 ft. in short sections. The vein is said to have some 'coarse gold', but that does not mean grains as large as a pinhead. In the opposite direction, the Siempre Viva vein goes to the Concordia mine, where the quartz is in streaks 3 to 10 and even 15 ft. thick distributed through breccia.

The Hidden Treasure is an old mine on a vein in the rhyolite in the northeastern part of the district. At the Morning Star mine some ore has been milled from a vein 2 to 4 ft. thick (reaching 6 ft. in one place), cutting andesite. Free gold can be seen readily in some of it. At the Panama mine the main vein as exposed in a 120-ft. adit is 6 ft. wide, is of ribbon structure, quartz and sulphides (chiefly galena, with some sphalerite, pyrite, and chalcopyrite). Some layers ¼ in. thick are solid sulphides, and the ore, which is andesite, is rather rich in sulphides.

There is a remarkable uniformity of gold content throughout the district. None of the companies mill much ore carrying over $10 per ton. With careful mining, $8 ore would probably be a common monthly average. Nearly the whole of such veins as the Bonanza, Lone Star, Highland Mary, La Leticia, and the quartz of the Siempre Viva probably carries at least $3 to $5 per ton. This comparative uniformity is related to the uniformly fine-grained character of the gold and its association with widely disseminated fine-grained sulphides. In other words, the ores are not 'pockety,' as the term is commonly used.

The vein quartz will be very hard at depth, that of the northeastern group, except the Lone Star, harder than the Lone Star and the southwestern group. The wall-rock at depth will be hard, the intrusive andesite and certain portions of the extrusive andesite extremely hard. I think these walls will stand well and the mines not require much timber. I expect them not to be unusually wet at depth. In short, the geology of the Pis Pis district is generally favorable to the future of its mines. In fact, it is at present their most favorable feature. The economic conditions——but that's another story, which, I believe, will be discussed at length by an engineer who has lived long in the district.

Tasmanian Gold Mine

The gold mine in Tasmania controlled by John Taylor & Sons is giving disappointing results. The company, called the Tasmania Gold M. Co., was formed in 1903 to acquire properties at Beaconsfield, Tasmania, that had been previously operated by a local company. These mines had been successful gold producers, but owing to the increase of the flow of water in depth, the continued working of the property involved a far greater expenditure on pumping plant than the local owners could afford. This capital was provided on the flotation of the London company, and the plant laid down is one of Henry Davey's best examples of the modern Cornish pump. The water trouble has not, however, been the only drawback, for the lode has proved of irregular content in depth. In 1909 the grade fell seriously, and in October 1910, it was found necessary to reconstruct the company in order to provide new capital. The nominal capital was then reduced from £500,000 to £250,000 by altering the denomination of the shares from £1 to 10s., and the new shares were issued credited with 7s. 6d. paid, thus carrying a liability of 2s. 6d., sufficient to provide £62,500 in cash. The reconstruction of the company was successfully carried through, and one shilling per share has been called up. During the period under review, 53,968 tons of ore was raised, from which 23,143 oz. gold was recovered, realizing £97,820. The expenditure at the mine and in England amounted to £101,913, leaving a loss of £4020. The development work has been actively carried on at the deeper levels, especially on the 1370-ft. level east. The results have not been altogether satisfactory, owing to the presence of a horse of country rock. The shaft tapping the lower levels has been sunk to 1530 ft., and a drift is being started at 1500 ft. The results here obtained will determine the future of the company. The ore reserve above the 1370-ft. level is estimated at 43,084 tons, in addition to which 27,228 tons is 'partly developed,' and 30,000 tons is 'probable.' The company has never paid any dividends up to the present.

Porcupine Development

The cross-cuts from the 200-ft. station of the Porcupine Gold Mines Co. have intersected No. 2 and 3 veins. Up to January 15 about 100 ft. of driving had been done on No. 2 vein on the 200-ft. level. The installation of the 10-drill compressor and the 40-hp. hoist mentioned in the report of November 6 have been completed. Mill machinery should begin to be delivered at the mine soon after the middle of February, and it is hoped that it will be erected and in operation soon after April 1. The mill is being constructed by the Canada Foundry Co., Ltd., under a guaranteed minimum capacity of 100 tons per day. It is expected that this tonnage will be considerably exceeded. The railway is completed to within one-half mile of the district.

Miners in southern British Columbia will petition the Government to establish an assay office and a gold buying station at Trail. They say that several thousand dollars per year could be saved to miners, which is now being paid in express charges to distant assay offices.

Putu Placers

By An Occasional Correspondent

If you are starting to Putu, land at Valparaiso, Chile, take the tram to Santiago and from there to Talca. Here a branch line starts for Constitucion. From Valparaiso to Santiago is four hours, and from Santiago to Talca is five hours, and from Talca to Constitucion is four hours. The connections are not close, hours being lost at each point. From San Francisco to Panama by way of New Orleans requires nine days, and from Panama to Valparaiso requires from fifteen to twenty days, depending on steamer connections.

Gold was found at Putú in 1911 and created excitement all up and down the West Coast. The first gold found was in a boulder bedded in an old foundation—how old, no one knows. Some say it was buried there to hide it from the early Spaniards, some say it was found on an ancient sea beach, and others say the gold grew right there in the rock after it was placed in the foundation. The finder of the boulder told others, so the population of the entire town stampeded to find more. They found it. The conservative estimate made last fall places the amount at $100,000. The first locator was Sr. Rodriguez. He and his friends formed a prospecting company and began looking for the vein. They found it after barely two weeks search.

I visited the place among the first, expecting to sell some machinery, but if all the rock found contains 50 to 90% of gold, machinery will be at a discount. One of the members of the original prospecting company wanted to know what kind of machinery I recommended, after seeing the ore, and after I explained that not much machinery was required beyond a melting pot, he insisted that machinery was used in California, Alaska, and South Africa to get the rock off the gold, and would I kindly tell him how they were to get this rock off if they did not use machinery? They also wanted to know what system was used in the states to prevent thefts of gold.

At first the specimens were sold at much less than their value in weight of gold, the local people feeling not certain that they were really selling gold. Now that the conviction is forced upon them that it is really gold, the price has reached about $40 per ounce, with eager buyers. There are no other mines in the neighborhood and no placer ground close, though within fifty miles there are several of both. The country is attractive, so far as prospecting is concerned, the hills being red with iron and the country rock being soft, nearly vertical slate, cut with parallel and transverse stringers of quartz. Several lash cliffs of slate along the road from Constitucion to Putú (a two-hour canter) indicate that it is a 'likely' gold country, if that means anything.

Before the shares of the new company of prospectors were printed, they were being speculated with on the Exchange. The shares have a par value of $200, and as I left Santiago they had dropped to $100, due to the easy discouragement of the members of the farming community where the float was found. If the vein has really been found, some will be sorry. The new company will have no one knows. Some say it was buried there to hide it from the early Spaniards, some say it was found on an ancient sea beach, and others say the gold grew right there in the rock after it was placed in the foundation. The finder of the boulder told others, so the population of the entire town stampeded to find more. They found it. The conservative estimate made last fall places the amount at $100,000. The first locator was Sr. Rodriguez. He and his friends formed a prospecting company and began looking for the vein. They found it after barely two weeks search.

TRANSPORTATION AS IT IS NOW.
WORK OF THE PUTUENOS.

ON THE WAY TO PUTU.
LANDING AT CONSTITUCION.

I visited the place among the first, expecting to sell some machinery, but if all the rock found contains 50 to 90% of gold, machinery will be at a discount. One of the members of the original prospecting company wanted to know what kind of machinery I recommended, after seeing the ore, and after I explained that not much machinery was required beyond a melting pot, he insisted that machinery was used in California, Alaska, and South Africa to get the rock off the gold, and would I kindly tell him how they were to get this rock off if they did not use machinery? They also wanted to know what system was used in the states to prevent thefts of gold.

At first the specimens were sold at much less than their value in weight of gold, the local people feeling not certain that they were really selling gold. Now that the conviction is forced upon them that it is really gold, the price has reached about $40 per ounce, with eager buyers. There are no other mines in the neighborhood and no placer ground close, though within fifty miles there are several of both. The country is attractive, so far as prospecting is concerned, the hills being red with iron and the country rock being soft, nearly vertical slate, cut with parallel and transverse stringers of quartz. Several lash cliffs of slate along the road from Constitucion to Putú (a two-hour canter) indicate that it is a 'likely' gold country, if that means anything.

Before the shares of the new company of prospectors were printed, they were being speculated with on the Exchange. The shares have a par value of $200, and as I left Santiago they had dropped to $100, due to the easy discouragement of the members of the farming community where the float was found. If the vein has really been found, some will be sorry. The new company will have plenty of water-power or wood fuel, as they prefer. The prospector for more mines will find ideal climatic conditions, reasonable food prices, cheap labor (60c. per day), and plenty of grass for the burro. Many small prospecting parties are in the field, and as Chileans lean more toward agriculture than mining, the foreigner will probably be the first and most successful in the field. It is a long way to come to prospect. The traveling expenses one way from New York to Putú will not be far short of $500. And with labor at the price it is, there is no opportunity to go to work after using up the grubstake. Chileans appreciate Americans above their true worth, so personal relations will always be pleasant; and Chileans can be compared in every way with American, English, or French, so don't think you are coming among savages that still wear feathers.

The board of the Mining Companies Association of southern Russia states that coal mined in the Don basin for the first seven months of 1911 aggregated 1,647,000 tons of anthracite and 10,332,000 tons of bituminous.

Asbestos was mined in 1910 only in the four mines of the First Siberian Association, situated in the Angara mining district, the production amounting to about 33 tons, which was sold at $93 per ton at the mines.

High-Duty Gravity Stamps

By H. Stadler

*The primitive structure of gravity stamps, their clumsy appearance, contrasted with a compact and sweet-running dynamo, has been a perpetual temptation to the mechanical engineer to replace them by some more ingenious machinery. While all new appliances invented for the purpose have so far ended on the scrap heap, even before the 'puffs' proclaiming 'the passing of the stamp' had made the rounds of the press, the stamp still shows a vigorous vitality readily explained by the following considerations:

1. The countless alternations of stresses, inevitably produced in breaking hard rock, loosens all the parts of complicated machinery in time, and only the toughest and bulkiest materials can stand the destructive effect of resilience in the long run.

2. The great adaptability of the stamp to varying working conditions and its range of duty, especially with regard to size of feed. It is helped in this direction by a most satisfactory automatic feeder, a 'thinking' mechanical device which regulates the feed according to the digestion of the stamp.

Table I

Distribution of Gold contents over Grades in Battery pulps.

Grade.	Apert.	600 mesh. Orig. 5·4 Dwt.		Ton Cap. (·216in. x ·446in.) Orig. 3·9 Dwt.	
		Weights.	Ass. Val. per ton.	Weights.	Ass. Val. per ton.
	in.	%	Dwt.	%	Dwt.
+30	·0197	9·75	1·4	53·25	2·2
[illegible]	[illegible]	20·50	2·0	5·25	3·5
50	·010	8·50	2·8	7·75	3·8
+80	·006	17·0	5·1	7·25	7·6
−80	·006	44·25	8·1	26·50	6·3
		100%		100%	

3. Its 'life' is practically unlimited, as all its parts can continously be replaced by repairs made by mine workmen.

4. Crushing by impact, as done by stamps, is extremely well suited for freeing the metallic gold and pyrite from their gangue. The enrichment of the finer grades in gold content, as illustrated by the following figures, explains the great amenability of battery pulps to amalgamation.

In an appreciation of the undoubted merits of the Nissen stamp it is to be regretted that it has not been given a more thorough test. The summary of the 'exhaustive' tests carried out at the City Deep, Ltd., by the Central Mining & Investment Corporation, Ltd., consists of but a few picked tests made under working conditions, which vary just enough to allow a correct conclusion to be drawn as to the effect of these variations. My method of computing crushing efficiency, as practised during the last three years in the experimental work carried out on behalf of the Mines Trials Committee, has been proved to give highly satisfactory and reliable results, and it is therefore gratifying to me to have it confirmed by H. S. Ball,[1] who tells us that after careful examination "it was unanimously decided that this method would be applied to all crushing tests of the McGill University." However, here in Johannesburg, the Central Mining & Investment Corporation, Ltd., which contributes to the costs of the Mines Trials Committee, and is largely represented in that body, seems to give a too liberal interpretation to the maxim of the Lord, not to let your right hand know what your left does. In order to make the data of the summary of Mr. Nissen's paper more legible, the gradings have been replaced by the one representative figure of their mechanical value, and the three factors determining the energy invested in the stamps by the one value of foot-pounds per second.

*Author's revised copy of paper printed in *The South African Mining Journal*, December 2, 1911.

[1]"The Economics of Tube Milling," Bull. Inst. Min. & Met., August 30, 1911; *Mining and Scientific Press*, September 23, 1911.

The mechanical values of the gradings are practically indentical for both types of stamps and exactly correspond to those of the curve established for varying coarseness of battery mesh. This confirms the statement made in 1909[2] (referring to lighter stamps) that the gradings of screen pulps are not materially affected by varying working conditions of stamps, but are practically exclusively determined by the mesh aperture, and it shows that the principle also holds good for heavy stamps, at least within the range of the coarse meshes used in the above tests. The horse-power consumption has been calculated from the value of the foot-pounds per second, with an allowance of 25% for loss in friction (in an old mill 30% is nearer the truth). By this method the power consumption works out lower, in all tests, for the ordinary stamps, while the table of the Central Mining & Investment Corporation, Ltd., with one exception, gives lower values for the Nissen stamp. Since the mechanical arrangements for lifting the stamps are practically the same in both types, the horse-power (as theoretically established) must be taken as giving more correct relative values than those obtainable by unreliable direct measurements. A possible error made by taking exactly the same height of drop for both cases would be in favor of the Nissen stamp, which, being heavier, might have its lift a little increased in consequence of a greater compression of the rock-bed. Until satisfied that all necessary precautions have been taken for exact tonnage measurements, the duties given in the table must be accepted with reserve. In truth, they are in some cases not logically related to one another, nor to the conditions of the individual tests. The greatest drawbacks for such tonnage measurements are the continuous fluctuations in the proportion of 'fines' contained in the feed. From the following complete grading of a battery feed it will be noted that, while the mechanical value of the total feed is 0.424 E.U., or say 0, the + inch portion (about ⅔), taken alone, works out at −3.0 E.U. (the − indicating coarser than the one-inch, or 0− grade), and the − inch portion at + 7.5 E. U. (Table II).

Table II

Example of full Grading of an Average Battery-Feed

I.M.M. Mesh.	Mesh. Value of Grade.	Weights.	Mech. Value.	Gradings reduced to +1in., and −1in. portion.	
				Weights.	Mech. Value.
	E.U	%	E.U	%	E.U.
—	4·73	27·97	1·323	41·5	1·963
—	[illegible]	13·15	0·381	19·3	0·560
—	2·16	7·93	0·171	11·8	0·255
—	1·56	5·22	0·081	7·8	0·122
—	1·08	3·76	0·040	5·6	0·060
—	0·50	5·01	0·026	7·5	0·038
Apert.	0·08	4·17	0·003	6·5	[illegible]
+1in.	0	67·21	−2·024	100%	−3·003
—	1	7·10	0·071	21·7	0·217
½in.	2	—	—	—	—
—	3	7·93	0·238	24·2	0·726
¼in.	4	—	—	—	—
—	5	3·55	0·178	10·9	0·545
⅛in.	6	—	—	—	—
—	7	3·34	0·234	10·2	0·714
⅛in. holes	8	—	—	—	—
5	9	2·33	0·210	7·2	0·648
—	10	—	—	—	—
8	11	1·90	0·209	5·9	0·549
—	12	—	—	—	—
12	13	0·81	0·105	2·5	0·325
—	14	—	—	—	—
20	15	0·91	0·137	2·8	0·420
—	16	—	—	—	—
30	17	0·77	0·131	2·4	0·408
—	18	—	—	—	—
50	19	0·92	0·175	2·9	0·551
—	20	—	—	—	—
+80	21	0·97	0·204	3·0	0·610
−80	27	2·08	0·556	6·3	1·701
—	—	100%	+2·448	100%	+7·514
Less Mech. Val. of + 1in. Grades			2·024		
Mech. Value of total feed			0·424		

Assuming as an extreme case that temporarily only the

[2]Mines Trials Committee, second report of Sub-Committee.

one inch portion (about ⅓ of the total feed) goes to the mill, the work done by the stamps must be credited with those additional energy units (E.U.). On the other hand, if the inch portion (about ⅓) is considered alone, 7.5 E.U. should be deducted from the mechanical value of the screen pulp as work already done by the preliminary crushers. Stamps dealing with such a fine feed necessarily, therefore, have a correspondingly increased duty. In the Giesecke mill tests, where exact tonnage and power measurements were possible, it was ascertained that the variations of the percentage of 'fines' easily affected the duty by about 2 tons per hour, or 1.5% of the duty. Without special arrangements and precautions the obtaining of representatives average samples of a day's run is practically impossible, and for comparative tests it is just as accurate or inaccurate, if you like, to assume the feed to be uniform and of the 0 grade.

As stamps under exactly similar conditions do invariably the same class of work, it is more advisable to extend experimental tests over comparatively short periods only, during which the working conditions can be perfectly controlled and maintained. By making tests in one series for each variable, the use of the regular curve obtained is not only a valuable check, but also the only way to arrive at definite conclusions as to the effect of the variables on crushing efficiency. Allowing for all these uncertainties in the data given, the fact remains that the Nissen stamp shows a decidedly higher efficiency than ordinary stamps.

In contrast to life, which is created by life, but doomed to pass away into spheres hitherto inaccessible to human research, matter and energy can neither be produced nor destroyed, but only converted. Theoretically, no efficient machines exist, and what we call in practice efficiency is only the relative amount of useful work done with regard to the special purpose for which the machine has been designed. With this reserve the greater efficiency of the Nissen stamp, or the relative loss of energy in the old stamps, may be explained as follows:

1. The roundish shape of the particles leaving a 5-stamp battery proves that a certain amount of the reduction work is done by attrition and abrasion during the shifting and knocking about of the particles in the mortar box. In the one-unit Nissen stamp the particles are less subject to this action and less energy is lost by useless water churning.

2. The radial arrangement of the screen allows an immediate rejection of the already finished product, leaving behind a clean material, which, since an ample percentage of its apparent volume is free interstices, is not subject to cushioning.

3. The accumulated energy at the moment of the impact of a falling stamp is not only distributed over the surface area of the shoe, but it is also transmitted in depth. With a too thick or uneven rock bed, the amount of energy absorbed in packing the material, before crushing by compression can take place, may be so great that the crushing work done by direct impact becomes almost nil. The maintenance of an even surface of shoes and dies and the facility for weighing the shoes as they wear, are far-reaching factors of inefficiency hitherto beyond our control.

4. The blows of a one-unit Nissen stamp are bound to be harder and shorter, as the mass of the anvil formed by the thick and heavy bottom of the mortar box, placed in the centre of the foundation, is certainly more solid and rigid than in the ordinary 5-stamp mortar boxes, where rocking may take place. The vibrations due to the shock being shorter, less energy is lost in shaking the building and surroundings.

The lower efficiency shown by the ordinary stamps is partly due to energy lost in deformation within the limits of elasticity, or permanent deformation before reaching the breaking point. To some extent, however, the loss of efficiency is only apparent, as the lower duty is to a certain extent balanced by a larger amount of crushing work performed in the very finest grades as a consequence of the attrition and abrasive action. By taking for the mechanical value of the -200 grade a standard value of 28 E.U., the work done in producing ultra fine slime is not accounted for, but this is quite justified, as, for Rand ore, grinding finer than to 200 mesh is mere waste of energy. From these premises may be made the deduction that the superiority of the Nissen stamp would be still more pronounced when crushing through finer mesh. The policy of ultra fine grinding by wholesale tube-milling, just now in fashion in the metallurgical department controlling the Rand Mines, has been, unfortunately, no inducement to them to extend their 'exhaustive' tests in this direction, and the Nissen stamp has therefore not been given the chance of demonstrating its great possibilities as a fine grinder.

TABLE III

	Tyler T.C. 9 Mesh. 0.205 by 0.536 in.		9 Mesh. 0.277 in. sq.		⅜ in. sq. Mesh. 0.375 in.			
	Nissen Stamp.	City Deep.	Nissen Stamp.	City Deep.	Nissen Stamp.	City Deep.	Nissen Stamp.	City Deep.
Ft. lb. sec. per stamp	23.49	21.99	23.43	21.94	24.23	20.95	28.11	22.54	24.21	20.92
*Power consumption per stamp, hp.	5.34	5.00	5.33	4.98	5.51	4.76	6.39	5.12	5.50	4.75
Duty per 24 hr. per stamp, tons	24.47	18.26	23.73	19.90	29.81	20.95	36.69	22.72	27.74	24.34
Duty (theoretical)	(24.50)	(23.00)	(24.50)	(23.00)	(24.50)	(21.00)	.....	(24.00)	(26.00)	(22.50)
Mech. value of pulp, E.U.	17.25	17.44	17.31	17.52	16.97	16.88	16.88	16.57	16.28	16.31
†Relat. mech. efficiency per hp.	79.00	63.69	90.00	70.00	91.80	74.30	108.40	73.50	111.70	83.60
Increase in efficiency	24.4%		28.6%		23.5%		47.5%		33.6%	

* $\frac{\text{Ft. lb. sec.} + 25\%}{550}$ hp. †Rel. mech. effic. $= \frac{\text{Duty (tons per 24 hr) by mech. value}}{\text{hp.}}$

Hearty thanks are due to P. N. Nissen for his able and interesting paper, which, I think, leaves on all the impression that this stamp marks a great and real progress in stamp-milling. The new departures are based on sound and theoretically correct principles, and the details of the mechanical arrangements are practical and handy. This is confirmed by the best judges of new inventions in this connection—by the shiftmen, the men who have to work with it. The calculations of comparative working costs and capital expenditure may be open to criticism, but, compared with the other great advantages claimed and proved, the differences are too small to justify protracted squabbling about the matter.

Cultivating Dredged Areas

In further proof that the ill-effects of dredging operations have been greatly exaggerated, as had been already shown by the successful culture of black-wattle and other trees on the ground which had been declared ruined, J. D. Bromley, dredgemaster, of Harrietville, near Bright (V.), has succeeded in raising magnificent crops of grass and clover on similar ground. Mr. Bromley tried a variety of seeds in order to decide which crop gave the greatest guarantee of successful results. In several cases, the results have surpassed all expectations, and the general result goes to show that if, instead of appealing to the Minister of Mines to restrict the work of gold-winning, on which the previous prosperity of the Bright district was founded, the farmers would put their shoulders to the wheel, they might even be the gainers through being driven to reclaim the land. The grasses which gave the best returns were *paspalum* and cow-grass; the latter grew to a height of 2 ft.; red clover also gave excellent results, and it is said that during the recent hot weather, Mr. Bromley's crops stood out in marked contrast to those around them, as well as in other parts of the country.—*Australian Mining Standard.*

The Wisconsin Zinc District

By P. K. Kelley

Production

A striking increase in production from the Wisconsin zinc district is evidenced by the figures for 1911 compiled by J. E. Kennedy. The tonnage sent to the smelters was 75,000, as against only 63,000 for 1910, an increase of almost 20 per cent.

In the Missouri-Kansas district, which is the principal producer of high-grade zinc ore, there was a decrease in 1911 of 28,000 tons from the production of 1910. When this is considered, it is indicative of the excellent condition of the Wisconsin district that its production has shown an increase of 12,000 tons in the same period. These favorable statistics are more remarkable in the face of the numerous fires that have visited the district. Several mining plants have been totally destroyed by fire, but the loss of two of the important separating works has had the most serious effect upon operations of the district as a whole. In addition to the separating plants that were destroyed by fire, the mills at the Minnie, Mound City, and Coker mines, and one of the Kennedy mills were burned.

An impressive fact regarding Wisconsin zinc-ore production is that the average assay of concentrate shipped in 1911 was 34.68% zinc. In 1910 this average was 37.52%. Two inferences can be drawn from this comparison. One is that cost of producing ores has been lowered so that a lower-grade concentrate can be put on the market at a profit. The other is that mines producing ore assaying under 36% have contributed more to the increase of production than have those properties turning out ores of higher grade.

The following table shows total shipments of zinc ore in 1910 and 1911 by towns, excepting shipments from separating plants direct to smelters.

Town.	1910. Cars.	1911. Tons.
Highland	215	4,457
Linden	164	8,184
Harker	154	4,173
Mineral Point	82	1,173
Montfort	44	1,790
Livingston	226	6,483
Rewey	74	2,851
Platteville	461	14,684
Cuba City	185	2,201
Benton	618	25,466
Hazel Green	384	20,121
Shullsburg	42	4,705
Galena	257	10,766
Dodgeville	9	200
Dubuque	5	.....

	1910.	1911.	Increase.	Decrease.
Production zinc ore, tons	102,070	107,187	5,117	.....
Surplus in bins (Est.)	24,000	29,000	5,000	.....
Net increase in zinc ore			10,117	.....
Total shipments of lead, pounds	11,276,265	9,002,025	.....	2,274,240
Total shipments of pyrite, pounds	28,122,850	28,679,030	556,180	.....

Operation

Facilities for handling zinc ores have been greatly increased in the year just past. The Mineral Point Zinc Co. has increased its roasting capacity by rearranging the plant at Mineral Point. More important, however, is the completion of the new zinc oxide works. Several hundred thousand dollars have been spent in making this the largest single ore-treating plant in the district. For manufacturing oxide they operate four blocks of 12 furnaces each and treat daily 90 tons of ore. Electrical automatic machinery, cranes, conveyors, hoists, mixers, and trams have been introduced. At Cuba City the Campbell Separating Co., after running an experimental plant for two years, has completed a roasting and separating works, which has a daily capacity of 100 tons. The process is unique as well as important. The ores are subjected to

MAP SHOWING RELATION OF WISCONSIN DISTRICT TO COALFIELDS AND SMELTERS.

only a slight roast, and, in addition to making a high grade zinc product, pyrite is saved as a by-product that is useful in making sulphuric acid. A Mathey roaster, handling 40 tons per day, was put in operation at Benton by the Wisconsin Separating Co. At the Lucky Twelve mine a Mathey roaster was erected, and the two kilns at the mills and the one at the Murphy mine were again started. At Platteville the Wisconsin Zinc Co. is at present making additions to the roasting equipment at the Empire mine. In addition to plants built for roasting and separating purposes, a normal amount of construction work on milling plants was accomplished. The Minnie and Coker mills, which were burned during the year, have been rebuilt on a much larger scale and have resumed shipments. Besides these, the Wallace, Dodger, Homestead, Murray, Fox, Winskell, Cleveland, Wilkinson, Rowley, and Merry Widow have completed new mills.

Market Conditions

The year opened with the price of 60%, ore at $42 and spelter at 5.35c. The ore market held at about that figure until nearly April, when the price dropped slightly below $40 and hovered around that point until June. Then it started to climb gradually, and by September had reached $44. In November the high price of $46 was reached, and the year closed with ore selling for $44. The price of spelter weakened slightly after the first of the year, but regained its strength in February. The market suffered another slight fall in April which continued well into June. A steady increase in this metal set in at the middle of the summer, and by October spelter was selling at St. Louis for 6c. per pound. From this point the price kept mounting until 6.90c., St. Louis, was reached. At this point the market had a sudden slump and the price fell to 6.20c. within a week. It remained about 6.20c. for about two weeks, and the year closed strong at 6.25c. per pound.

Outlook

Everything points to a good year in 1912. The American Zinc Ore Separating Co. will probably rebuild its separator either in this district or in southern Illinois. The Joplin Separating Co. will have its new plant completed by March 1 with an added capacity of 40 tons per day. The National Zinc Separating Co., a subsidiary of the Vinegar Hill Zinc Co., has broken ground for a roasting and separating plant near Cuba City which will start with a capacity of 60 tons daily. There is every indication of a continued increase in tonnage. Several new mines are being opened, and concentrating mills will be built. A number of mines, practically non-producing in 1911, are now prepared to make weekly returns. It has been necessary of late to restrict the amount of output at some properties, but, with the new separators operating, production will again be brought to a maximum. It is probable that the smelters will shortly be more actively in the market for the high-grade ores. The smelting capacity throughout the country is rapidly being increased, and before the year is half over the new smelters, and those with increased capacity, will be in need of much greater tonnages than are now being purchased. This increased demand for smelting ores should have its good effect on the ore market. There is every reason to believe that the year 1912 will be one of satisfactory ore prices.

Needs of District

Prospecting by drill has not been carried on for several years with the impetus that it deserves. The district includes an area extending north and south over 50 miles, and east and west 35 miles, a total of more than 1,000,000 acres of land, much of which is favorable for prospecting. Why is this enormous area allowed to go unprospected? The fault lies with both the operators and the land-owners. The former hesitate to undertake prospecting a lease that has no surface indications of ore. Operators prefer to proceed with a property upon which a certain amount of preliminary work has been done. How then can the land-owner, whose land has never been prospected, interest com-

EMPIRE MILL, PLATTEVILLE, WISCONSIN.

OXIDE WORKS OF MINERAL POINT ZINC CO., BEFORE RECENT REBUILDING.

panies to the extent of making detailed exploration with drills? There is a solution, and a fair one. Many land-owners have reason to believe that mineral is present on their land in sufficient quantities and of high enough grade to warrant a mining company spending a thousand dollars or so in drilling. Such an owner should be willing, himself, to invest two or three hundred dollars in making preliminary investigation. Suppose he, the land-owner, puts down two or three holes on his farm and finds 'jack' in attractive quantities. It would then be an easy matter for him to get any operator to proceed with exploration work. Such small investment would surely be worth while in view of the possibility of the enormous royalties that would be paid to the land-owner if a mine is developed. In reality it is a matter of competition among land-owners. A farm favorably situated or partly prospected has a great advantage over a poorly placed one. Do the owners of prospective mining properties realize that this competitive condition exists? With a state mining school in the district, any land-owner has at his command expert advice to guide him in doing this preliminary prospecting. It is possible to have records made and kept, showing the progress of drilling operations. The owner of property may be certain as to the authenticity of these records and likewise he has a record to show the prospective operator which can be considered absolutely reliable.

Another difficulty exists in this district that can be met if the mine operator and land-owner look at it in a fair manner. The cost of mining a ton of crude ore and bringing it to the mill for concentration is the same whether the amount of mineral is great or small, and whether the grade of concentrate produced is high or low. These questions of amount of mineral in crude ore and grade of con-

centrate are the vital ones, and make for profit or loss. It is clear that a property in which the ground is lean cannot operate at a profit and pay as high a royalty as one in which the ground is rich. Likewise, a mine selling a low-grade concentrate cannot in many cases receive a sufficient price per ton for the ore to cover operating cost and still pay the same royalty as a mine producing a high-grade concentrate. Would it not be better to institute a sliding scale of royalty to be determined both by the richness of the ground and the grade of concentrate, rather than fix the royalty rate arbitrarily and thereby prohibit operations at a profit? It would be better to receive a royalty suited to the character of the ground rather than to eliminate operations entirely and thus 'kill the goose that lays the golden eggs.'

A condition also exists in the Wisconsin zinc district that must be remedied by the railroad companies. Such remedy can only be brought about by the concerted action and activities of the community as a whole. Railroad facilities are inadequate, and on account of this the operators of the zinc mines are greatly hampered. It is an undeniable fact that all the large operators could, with better condition of train service, prospect and develop fully half again as many properties as they are now directing. The community in general must cope with this condition if it is anxious for increased development of the mining industry.

Power on the Rand

At the present time the Victoria Falls Power Co. has three stations supplying power to the mines: one at Brakpan, another at Simmer Pan near Germiston, and the third at Rosherville, midway between Germiston and Johannesburg. A large power-station is also being constructed at Vereeniging, some thirty miles south of Johannesburg. To give an idea of these stations, a short description of the Rosherville plant, the largest in use, may be interesting. The steam is supplied by 24 Babcock & Wilcox boilers, marine type, fitted with superheaters, chain-grate stokers, and Pratt's system of induced draft. The fuel used is the dust coal from collieries in the Middelburg district, which was formerly regarded and treated as waste. The actual evaporative power of this cheap fuel is 6½ lb. of water to one of coal. The boiler pressure is 220 lb. per square inch, and the evaporating capacity of each boiler 30,000 lb. per hour. There are five turbo-generators, each of 12,000 k.v.a. capacity, running at a speed of 1000 r.p.m., designed to deliver 3-phase current at a frequency of 50 periods per second, with a pressure of 5000 volts at the machine terminals. The turbines work with steam superheated at 350° C. and are connected to surface condensers placed immediately below the exhaust end of the turbine. The air-compressors are of the rotary type, driven by direct-coupled turbines, running at a normal speed of 3000 r.p.m., capable of converting 590 cubic metres of free air to an absolute pressure of nine atmospheres. The compressors are multi-stage, divided into high and low-pressure cylinders, the air being led through a cooler when passing from the low-pressure to the high-pressure cylinder. The electrical supply is sent out at two pressures, 20,000 volts through underground cables and 40,000 v. by overhead lines. These pressures are obtained from Siemen's transformers, each of 12,500 k.v.a. capacity, which receive current from the generators at 5000 v. and deliver it to the main bus-bars at 20,000 or 40,000 v., as may be required. Coupling transformers are provided between the 20,000 and 40,000-v. bus-bars for the regulation of supply. All switches are operated by a remote control from the main operating board which overlooks the turbine-room. The Rosherville power station here described is the largest in capacity of any of the three stations at present run by the Victoria Falls Power Co., but the Vereeniging station now in course of erection will surpass it. The demand for power at the mines has, however, so far exceeded anticipations that preparations are being made to considerably extend the Rosherville power station. The whole of the power generated by the three stations of the company is, in its distribution over the Rand, entirely and solely controlled from the Simmer Pan station.

The scale of prices charged to consumers is as follows:

Load factor. Percentage.	Price per unit until Sept. 30, 1912. Pence.	Price per unit after Oct. 1, 1912. Pence.
10	2.512	2.475
15	1.754	1.717
20	1.375	1.338
30	0.995	0.958
40	0.807	0.770
50	0.692	0.655
60	0.617	0.580
70 and over	0.561	0.525

In addition to the power stations owned by the Victoria Falls Power Co., several others, the property of gold-mining groups, have either been enlarged or come into work during the year, so that, as before remarked, electrical power has become an important item on the Rand. At Randfontein Central the capacity of the electrical installation is now 20,000 kw. The current is generated at 6600 v., 3-phase, 50 cycles, by two 1000-kw., three 2000-kw., and two 6000-kw. sets. The steam is generated by 24 boilers of 17,000 lb. steam capacity per hour, at a pressure of 140 lb. and superheated to 500° F. The boilers are fitted with chain-grate stokers and equipped with economizers, superheaters, and induced-draught plants. The cost at the switchboard is a third of a penny per unit. At the East Rand Proprietary Mines 3-phase current at 3000 v. is generated at a frequency of 25 cycles, and so satisfactory is the power that the works are being augmented up to 19,500 kw. capacity. Here the directors announce that the action of the group in equipping its own station has, as at Randfontein, been justified by the results. At Kleinfontein, too, a power station on similar lines to that at the East Rand Proprietary Mines has during the year been brought into use; in fact, it is intended in the future to couple up those two power stations. At the present time the load factor at the Kleinfontein power station is a very low one, but nevertheless the cost of production is stated to be less than the 40% load factor charge of the Victoria Falls Power Company.

Old Mines at Alamos

In the Alamos district of Sonora, described recently by G. L. Sheldon, there are many old mines, of which the Promontorio is perhaps the best known. At the south end of the district beyond that mine, three-fourths of a mile up the side of the mountain a short distance above the level country, three or four years ago a foreigner made some locations in line with the Promontorio vein and sank a shaft, discovering good ore. There was nothing whatever on the surface to warrant exploration, but he was simply lucky in taking a long chance. A few miles west of there in the vicinity of Arrastras, Clemente Ibarra has several properties. The Promontorio vein is called the 'mother vein' of the country; it is claimed that it can be traced to the Yaqui river, a distance of over a hundred miles. At the north end near the river in recent years a good silver mine has been opened. At Bacauri about half way is a gold belt several miles in length on the same vein. The old Plank mine had a record eighteen to thirty years ago of $1,200,000 gold, according to the Mint returns at Alamos. It is only 600 ft. deep and is on the contact between granite and andesite. The old mill was on the Cedros river, two miles east of the mine in a short gulch 100 yd. above the river. Five years ago Zeigler Bros. purchased the old tailing, of which there appeared to be only three tons, for ₱300, and cyanided it. It proved that a cloud-burst had covered the tailing with wash and they obtained, and treated, 12 tons which netted upward of $75,000.

Immigrant Gold Mine Workers in Amador County, California

By W. J. Lauck

It was planned by the recent Federal Immigration Commission, as a part of its extensive investigations on the Pacific Coast, to make a comprehensive study of the labor conditions in metalliferous mines in California. Unfortunately the work of the Commission was suspended before this investigation was completed, but sufficient data had been secured from gold-mining companies in Amador county to afford an interesting insight into the conditions of employment in that locality.

Racial Composition of the Gold-Mine Workers.—Four-fifths of the employees of gold mines in Amador county were found to be of foreign birth, chiefly of races of southern and eastern Europe. The principal races represented were the Dalmatian, North and South Italian, Herzegovinian, Spaniard, and Montenegrin. There were also a considerable number of English miners. About one-tenth of the operating forces were native Americans, and an equal proportion were of native birth, but of fathers who had been born in England, Ireland, or Italy. The most recent immigrant employees were the Spaniards and Montenegrins. About three-fifths of the southern and eastern European mine-workers, however, had been in the United States less than five years.

Characteristics.—Only about two-fifths of the recent immigrant employees, as contrasted with one-half of the native American employees, were married. The significant feature of the situation was, however, that of the immigrant mine-workers who were married, the greater number had left their wives and families in their native countries. Out of a total of 137 married males of foreign birth, 74 reported their wives to be abroad. All races, except the English, reported a majority of the wives living abroad. The English reported 31 of 36 wives living in the United States. The North Italians reported the wives of 25 of their number as living in the United States, but those of 45 as living abroad. As regards ability to use English, of the 331 immigrants of non-English speaking races for whom data were secured, 148, or less than one-half, had learned to speak the language, and only 51 could read, and only 38 both read and write it. Few of the immigrants of any race could read or write English, a fact which is significant as regards the degree of facility in the use of the spoken language. Of the foreign-born employees who had been in the United States five years or longer and who were 21 years of age or over at the time of coming, 93 reported their political status. Of these, 33 had their second naturalization papers, 31 had their first papers, and 29 were still aliens. Most conspicuous among the last named were 18 of 43 North Italians who afforded a sharp contrast with the 23 English, none of whom were aliens.

Racial Displacements.—Originally employees of the mines were Irish, with a few English, Germans, and Italians forming the remainder of the labor force. Race changes during the past twenty-five years have consisted largely in the gradual withdrawal of the Irish, the increase of the English and the Americans, followed in turn by their gradual withdrawal and the replacement of these earlier laborers by recent immigrants from the south and east of Europe. The withdrawal of the Irish, English, and the Americans was due chiefly to the attraction of higher wages which prevailed in newer mining camps in Nevada, Arizona, and Montana, and to the increasing opportunities to secure more remunerative or more congenial employment in the locality of the mines or in the larger cities of the state.

Occupations.—All of the foremen and most of the engineers and mechanics at the mines investigated were either native-born Americans or English. Only one-fourth of the miners or general laborers, on the other hand, were members of these races, the great majority being immigrants from Austro-Hungary and Italy, with a small number from Spain and Montenegro. Of the immigrant employees, only 1% , consisting entirely of Englishmen, were foremen, and only 3% were engineers or mechanics, while 97% were miners and general laborers. The contrast between the occupations of native Americans and English on the one hand, and the recent immigrant workmen on the other, is due to three causes: (1) Most of the English were experienced miners when they came to the locality, while few of the immigrants from the south and east of Europe had had any experience in the industry; (2) most of the native-born and English engineers and mechanics had learned their trades before seeking employment in the mines; (3) the native Americans and the English were, as a rule, older men who had been employed in the mines for a greater length of time than the south and east Europeans, and were consequently better fitted both by age and local experience than the latter for the more responsible positions in the labor force.

Hours and Earnings.—The hours of labor ranged from 8 to 12 per day. The working week was 6 days for some occupations, 6½ for others, and 7 days for still others. The men employed underground worked only 9 hours per day. The hours of labor above ground, were, as a rule, 8 per day for 7 days in the week for engineers and roastermen, 10 per day for 6 days for blacksmiths, carpenters, and other mechanics, 10 or 12 per day for 7 days for foremen, and 12 per day for 7 days for stamp-mill employees and firemen. Wages ranged from $2.25 per day for common laborers to $5 per day for foremen. Miners' helpers were paid $2.25 per day; carmen, teamsters, lime-pit men, and log-rollers were paid $2.50; and miners, $2.50, $2.75, and $3. Foremen received from $3.75 to $5 per day, mechanics from $2.50 to $4, and stationary engineers from $3 to $3.50. Among the foreign-born mine-workers, the English were found to the greatest extent in the higher wage groups, but to a considerably less extent than the native Americans. About one-third of this race earned $3 per day or more, as compared with about one-half of the native-born. After the English, the South Italians showed the highest percentage earning $3 per day or more. The lowest earnings reported were those of the Dalmatians, Herzegovinians, Montenegrins, and Spaniards, all of whom were employed as miners or general laborers. The North Italians averaged somewhat higher earnings than those of the races last named, but lower earnings than those of the English or South Italians. At work the races employed are purposely mixed in order to secure the benefit of race competition, but at boarding and lodging houses they usually segregate themselves. Socially there are few opportunities for the members of the different races to meet, except those found in the saloons, and the Slavs as a rule patronize saloons conducted by members of their own race. Even the Slavs do not associate freely among themselves. Considerable friction exists between those who are Greek Catholics and those who are Roman Catholics.

THE ELECTRIC STORAGE-BATTERY locomotive which is being tried out in the Berkely mine of the Anaconda company is giving every satisfaction so far, but some time will yet be given over to tests before any decision is reached regarding it. While the storage-battery locomotive is quite expensive, if it is adopted the necessity of wiring will be done away, which in itself is a very large item. The work of installing the trolley system into the mines not yet wired has been stopped.

THERE were 635 mining concessions granted by the Government of India during the year 1910, against 693 in 1909. The decrease was doubtless due to the fact that only six mining leases were taken out for chromite in Baluchistan, as compared with 76 in 1909.

Characteristics of Fuse

*The rates of burning of the various kinds of fuse sold in this country vary from 18 to 40 seconds per foot in open air. However, the miner or shot-firer seldom knows the rate of burning of the different kinds of fuse. It is true that some fuse is marked slow or fast, and is even distinguished by the color of the paper wrapper, but this is not always the case. Without such information, a miner who is accustomed to a certain brand of fuse may use another that burns faster, with the result that a charge may explode prematurely and menace all connected with the work. However, it is believed that the rate approved by the Bureau of Mines—namely, 90 seconds per yard—will meet the various mining conditions in this country.

Careful tests should be made of the rate of burning of fuse whenever there is any doubt as to its soundness. The manufacturers may produce a fuse with a regular rate of burning, but the rate may be changed by bad handling, for instance, by squeezing the fuse so as to disturb the powder train, or by suddenly and roughly opening the coil when it is stiff from cold so as to crack the fuse; or the fuse may be bruised by rubbing against the rough surface rock.

Fuse should be carefully handled and never laid in a damp place before using. In cutting the fuse and in fitting it into place, care must be taken that the powder core does not run out of the fuse, for that might cause a misfire. The fuse should be cut straight across with a sharp knife just before placing the end in the detonator. In a humid atmosphere at least 1 in. should be cut off the fuse before insertion in the detonator. The fuse should be fitted gently and then the detonator should be crimped on the fuse by the proper crimper.

When fuse has been subjected to such conditions as produce acceleration or retardation in its rate of burning it becomes dangerous. Acceleration of the rate of burning increases the liability of a shot going off before the miner has left the face; retardation increases the chance of the flame in the fuse progressing so slowly that the miner will be injured by a delayed shot when he returns to the working face. All conditions that bring about any marked change in the rate of burning of time fuse are dangerous, and from a study of the list of accidents in mines and quarries each year, injury and loss of life are seemingly often brought about by such conditions.

Under ordinary conditions nearly all types of fuse show great uniformity in the rate of burning. Practically all types of fuse examined in connection with the preparation of this report had a total variation in their burning under normal conditions of less than 20%, and all would have been passed under the allowance of "no variation greater than 10% above or 10% below the average rate of burning."

Climatic conditions affect to a considerable extent the rate of burning of the less waterproof types of time fuse. Damp fuse burns more slowly than normal fuse, and fuse that has been wet and thoroughly dried tends to burn at a rather slow rate, and may even cause delayed shots by smoldering for a considerable time. Fuse containing several wrappings of tape saturated with tar or asphalt resist moisture to a considerable extent, and may be used for firing shots under water, provided the fuse is not allowed to remain too long a time in contact with water before the shot is fired.

*Abstract from 'Investigation of Fuse and Miners Squibs' by C. P. Hall and S. P. Howell, and 'The Rate of Burning of Fuse' by W. O. Snelling and W. C. Cope; Technical Papers No. 7 and No. 6 of the Bureau of Mines.

Coal Deposits of Southern Nigeria

The work of the year of the mineral survey has been concentrated on the further examination of the extensive deposits of coal at Udi, which are found to stretch more than fifty miles to the north of that place. The tests carried out by the Government and the analyses at the Imperial Institute have proved that the surface samples give results equal to two-thirds that of the best Welsh coal. It is reasonable to expect that if the seams are worked the coal that has not been exposed to the weather will be of still better quality. The question of the construction of a railway to connect this coalfield with the river port of Onitsha is under consideration. Sanction for the construction of this line may be given, as the importance of cheap fuel to the two Nigerias, with their combined railway system, already over 800 miles in length, is very great. The price now paid for Welsh coal is, at the coast, 34s. 6d. ($8.39); at Baro it costs about 52s. ($12.65), and at Jebba 62s. ($15.08). It should be easy to deliver Udi coal at Onitsha at 12s. ($2.92) per ton. Besides the railway requirements, the importance of local coal for river and ocean shipping is very great, and is even of imperial importance. The lignite deposits to the west of the Niger are also very valuable, and those at Okpanam, only ten miles from Abasa, the Niger port opposite Onitsha, vary from 10 to 15 ft. in thickness. The total trade of Southern Nigeria in 1910 exceeded $55,000,000, whereas it was scarcely over $20,000,000 in 1900.—From Annual Report of the Governor.

Steam-Shovel Records on the Panama Canal

During the month of December the total amount of material excavated in the central division, according to the *Canal Record*, was 1,361,891 cu. yd., of which 164,252 cu. yd. was classified as earth, and 1,197,639 cu. yd. as rock. Of this quantity, 1,351,082 cu. yd. was removed by steam-shovels, contractors removed 2337 cu. yd. by sluicing, and 8472 cu. yd. by hand.

The high record for the month was made by shovel No. 219, working 25 days in the Culebra district, which excavated 46,322 cu. yd. of rock. The second best record for the month was made by shovel No. 207, working 25 days in the Culebra district, which excavated 45,223 cu. yd. of rock. The best record for a shovel of the 70-ton class was made by shovel No. 126, working 25 days in the Culebra district, which excavated 33,040 cu. yd. of earth. Shovel No. 212, working in the Culebra district, made a high record for one day by excavating 3204 cu. yd. of rock on December 4.

Except where noted, monthly reports are computed by place measurement, while the daily reports are based on car measurement. The best records for the month and for one day are shown below:

BEST RECORDS FOR THE MONTH

	Earth. (Cu. yd.)	Rock. (Cu. yd.)	Total. (Cu. yd.)	No. of days at work.
Empire District:				
Shovel No. 211	.....	40,656	40,656	25
Shovel No. 253	.....	38,325	38,325	25
Shovel No. 215	18,543	19,767	38,310	25
Culebra District:				
Shovel No. 219	.....	46,322	46,322	25
Shovel No. 207	.....	45,223	45,223	25
Shovel No. 217	.....	44,589	44,589	25
Pedro Miguel:				
Shovel No. 122	8,000	6,718	14,718	21
Shovel No. 231	5,000	14,084	19,084	12½

BEST RECORDS FOR ONE DAY

Shovel No.	Working Place.	Date.	Material excavated.	Cu. yd.
211	Empire	Dec. 6	Rock	2473
253	Empire	Dec. 8	Rock	2432
228	Empire	Dec. 22	Rock	2297
212	Culebra	Dec. 4	Rock	3204
204	Culebra	Dec. 16	Rock	3156
203	Culebra	Dec. 27	Rock	3135
231	Pedro Miguel	Dec. 20	Rock	1900

The total steam-shovel excavation on the re-located line of the Panama railroad amounted to 345,520 cu. yd. The best month's record was made by steam-shovel No. 257, working on the Gatun section, which excavated 58,380 cu. yd. of solid rock. In the 70-ton class the best month's work was made by steam-shovel No. 123, working near Empire, which excavated 19,260 cu. yd. of earth and 12,500 cu. yd. of solid rock, a total of 31,760 cu. yd. The best day's record for shovels with a 5-yd. dipper was made by steam-shovel No. 262, which excavated 3400 cu. yd. of rock

on December 2. The best day's record for shovels with a 4-yd. dipper was made by steam-shovel No. 117, which excavated 2100 cu. yd. of rock on December 11. Month's records are place measurement, and day's records are car measurement. All material was loaded in 10-yd. Western dump-cars.

BEST RECORDS FOR THE MONTH

Shovel No.	Working Place	Days worked	—Cubic Yards by Cross Section— Earth	Rock	Total
7	Gatun	25	. .	58,380	58,380
262	Monte Lirio	24		54,180	54,180
12	Empire	25	19,260	12,500	31,760
121	Paraiso	25	29,355	. .	29,355
117	Gatun	25	18,800	8,060	26,860

BEST RECORDS FOR ONE DAY

Shovel No.	Working Place	Date	Material excavated	Cu. yd.
262	Monte Lirio	Dec. 2	Rock	3100
257	Gatun	Dec. 9	Rock . . .	3230
267	Paraiso . .	Dec. 27	Earth and rock . .	2260
268	Paraiso . .	Dec. 16	Earth and rock . .	2100
117	Gatun	Dec. 11	Rock	2100
110	Empire	Dec. 22	Earth	1910

Total steam-shovel output during the month of December, 345,720 cubic yards.

Total number of steam-shovel working days, 260.

Average output per working day, 1329 cubic yards.

Ray Central Copper Mining Company

The property of this company comprises 28 claims, aggregating 420 acres, in the Ray mining district, Pinal county, Arizona. They are divided into four groups, the Globe Isabella, Little Frank, Calumet, and Copper Zone. About one-third of the area is patented land. The Globe Isabella group is in the heart of the great orebody now being mined by the Ray Consolidated, which company, according to latest reports, has developed 80,000,000 tons of ore averaging 2.17%, the greatest proved orebody in the Southwest. The Calumet is the oldest location in the district. High-grade ore has been shipped from its mineralized fault fissures and there are probabilities of disseminated orebodies within its limits. Work is now being done on this group to prove its real value. Three or four drill-holes will be put down before underground exploitation is continued further. The Little Frank group is favorably situated for the finding of the eastern extension of the great Ray orebody on its western claims. The work of proving this will follow that now being done on the Globe Isabella and Calumet. The Copper Zone group was purchased, not only for its mineral possibilities, but because of the millsite which the slopes of Rustler gulch offer. The Ray townsite, on the east end of the Globe Isabella, is a steady source of income to the Ray Central company. The district offers exceptional facilities for cheap mining and low cost production.

The ore occurrence at Ray is identical with that of the Miami-Inspiration belt. Certain portions of the great mass of Pinal schist have been commercially mineralized with disseminated chalcocite ores. The primary mineralization was initiated by the intrusion of masses of diabase and granite-porphyry, which, by processes of oxidation and enrichment, have resulted in workable orebodies today. That part of the schist area which is ore-bearing is clearly defined by characteristic indications. Schist, diabase, and granite porphyry carrying chalcocite, will all be mined. The orebody is a tabular mass dipping gently toward the southeast, of variable thickness and undulating contour. The overburden (leached zone) will average about 100 ft. thick. The average grade of ore throughout the camp is about 2.2%. The ores are amenable to simple concentration, and a 70 to 75% extraction should be obtained.

The Ray Central will have the benefit of the results of the Ray Consolidated, Miami, and Inspiration, in the working of these low-grade deposits, both mining and milling. One or the other of the several block-caving systems is proposed, and no serious trouble is anticipated from the water of Mineral creek, which traverses the east end of the Globe Isabella group. The location of the permanent shaft through which to mine the orebody will be determined on the completion of the fourth level work and drilling under the townsite. The experimental mill-tests already made are satisfactory, 70% of the contained copper being obtainable as concentrate. This will probably be improved upon in actual mill practice. Until the Globe Isabella, Little Frank, and Calumet claims are more fully developed, the erection of even a small capacity plant is inadvisable. Cost of production decreases with tonnage handled up to 5000 tons daily capacity. However, when operating on a 1000 ton per day basis, there is a good margin of profit. With 70% mill extraction and 5% smelting loss, 2.15% ore should yield 28.6 lb. of copper per ton. As an outside figure, assuming only 1000 tons per day treated, the estimated cost of production would amount to a copper cost of 10.38c. per pound. Should the orebodies anticipated on outside claims and on the Globe Isabella justify a daily output of 3000 tons, a production cost of 10.07c. per pound might be attained.

	1000 tons per day.	3000 tons per day.
Mining, per ton	$1.25	$0.90
Transportation	0.70	0.60
General expense	0.10	0.15
Smelting	0.35	0.35
Refining and marketing	0.57	0.57
Total, per ton	$2.97	$2.57

On this basis the property should produce, working 320 days per year, 27,500,000 lb. of copper per year.

*Excerpt from a report by W. H. Weed and F. H. Probert.

A Safeguarded Hook

The illustration shows a design of safety hook for cranes or other lifting apparatus, intended to make it unnecessary for a man to get his hands or fingers into the danger zone

of the hook when adjusting the latter to a chain sling. It will be apparent that the body of the swell of the hook has been carried further than necessary so as to give a leverage and grip at the back above the reach of the nip of the chain. The hook can be much better guided in any direction also from the back, and both convenience and safety are secured.—*Jour. Indust. Safety.*

THE large deposits of saltpeter found on Cabinet land, near the village of Doroninskaia in the Herchinsk mining district of Siberia, are now being examined by the chief chemist of the district and five English chemists, the latter representing an English syndicate whose intention it is to establish large works for the manufacture of soda.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Laboratory Cyanide Tests

The Editor:

Sir—The description of apparatus for use in making cyanide tests, published in your issue of December 30, calls for comment in spite of the fact that the author, George A. James, states that the duplication of the conditions obtaining in actual practice was aimed at.

In the leaching of gold-silver and, more especially, silver-gold ores the ratio of depth of sand to satisfactory extraction is an important question. The dimensions of Mr. James' apparatus limit the practical application from any results obtained to a depth of sand of about 3 ft. To carry out experimental work on 3 ft., or less, and to expect similar extractions with 10, 15, or even 20 ft., is a common mistake. In many instances the residual content varies directly with the depth leached, and exceptional cases have been known where a residue sample taken from the bottom of a leaching vat, after prolonged treatment, has been found to contain a higher metal content than did the original charge. My own opinion is that the great majority of estimations made to determine possible extraction by leaching are of little value on account of the absurdly small amounts of sand taken for treatment in the preliminary experimental work, and the production of data obtained from investigations on a depth of material too shallow to demonstrate the chemical changes in the solution, and resultant effects on extraction, occurring in an ordinary leaching vat.

The second point needing comment is that Mr. James' arrangement, in avoiding "the contamination of the solution by the laboratory gases", prevents its frequent aeration by natural means. Where reducing action is evident, an advantage is gained by the periodic draining of the charge, and the intermittent application of solution washes.

The third point to which I would draw attention is that Mr. James' apparatus possesses no contrivance by which the effluent can be shut off, or by which the rate of leaching can be controlled. The preliminary 'soaking' of the ore in strong solution necessitates some valve arrangement, and if Mr. James' method of uncontrolled gravity leaching were adopted in practice with a coarse clean sand the pumping expense would be prohibitive. The determination of *maximum* percolation rate is of secondary importance to the determination of *efficient* percolation rate, since the rushing of solution through a bed of sand results in the handling of, and precipitation from, large quantities of low-grade solution, the production of base precipitate and its attendant expense and trouble.

I am indebted to my early laboratory training in such work and I have never departed from the use of ordinary 4-in. piping in the experimental determination of cyanide extraction by leaching. The pipes are fitted with bored flanges, at one end for suspension and at the other for the filter bottom. The latter is kept in place by a third flange with insertion joint, and fitted with a plug tapped for a small leaching-control pipe, an arrangement incidentally providing for the upward charging of strong solution. The pipes should be cut or compounded of a length equal to the height of the vat it is proposed to use in practice; or, if the dimensions of the latter have not been decided upon, experiments should be made with various lengths. In all cases, and at the conclusion of treatment, bored samples should be taken at the top, and also at the bottom of the pipe, and the assay results compared. Equality of residual content would indicate the possibility of treating larger bulks of ore by an increase in the height of percolation. A higher residue at the bottom than at the top would indicate the necessity of reducing the leaching depth, or of resorting to double treatment. In most cases the latter method is preferable to single treatment. Head and tail samples should be taken after the charge has been thoroughly mixed, before and after treatment.

While regretting the destructive nature of the criticism on the article, I would like to add my agreement in the matter mentioned by Mr. James as to the importance of the re-use of barren, and not freshly prepared solution, in experimental work; and I take this opportunity of adding that cyanide consumption estimations should not be calculated experimentally in the manner advocated in treatises on cyaniding, but should be based on methods involving the titration for total cyanide percentage in the solution before treatment, and after treatment *and precipitation of metals;* the experiment should be made, not with distilled water and pure potassium cyanide, but with barren solution containing the normal amount of the double cyanide of zinc and potassium, and any other salts induced by the continued use of the solution in the treatment of similar ore; and the actual amount of commercial cyanide, of analyzed KCN content, needed to re-standardize the solution should serve as a check on the titration difference.

London, January 15. A. W. ALLEN.

How Can Alaska Be Developed?

The Editor:

Sir—I have resided continuously in Alaska during the past eleven years. I have sought during that time all available information concerning the country and have labored to keep posted on the opinions of all who have expressed their views on Alaskan matters. So far as I am aware, not a single article appearing in the public press has been written favoring so-called 'conservation' as applied to Alaska by anyone personally familiar with the paramount facts concerning the country; a knowledge of which is essential to the formation of a reliable opinion as to its real needs. The country at large has based its opinion as to the course the Government should pursue in Alaska upon information much of which is misleading. That all honest American citizens desire to see the vast mineral resources of the 600,000 square miles comprising Alaska developed as rapidly as possible, may be safely asserted. The vital question is, how is this to be accomplished? It is manifest that while there can be only one best way, there are numerous courses which must lead to partial or complete failure. A glance at a few of the conditions prevailing in Alaska will give some idea of the vast difference there is between it and all other parts of the country, and which make impossible development along the industrial lines which have become standardized in other districts. In order to understand the local situation it is necessary to note the following facts:

1. That most of the mineral wealth of Alaska is wrapped in ice and snow, and that the remainder is covered with a blanket of thick moss, impenetrable to the human eye and forming a severe obstruction to travel.

2. That the length of days and nights is unfavorable to the performance of the usual maximum day's work.

3. That in the absence of good wagon-roads and railroads, the transportation of food and other supplies must be conducted in the winter when the days are shortest and the cold most intense.

4. That cost of transportation to the interior varies from about $100 to $1000 per ton, depending on distance from supply points.

5. That supplies even at supply points necessarily are high in cost.

6. That outdoor work, when the thermometer runs down to from 50° to 70°F. below zero, which often occurs every winter and for long periods, is unavoidably difficult as well as costly.

7. That large quantities of fuel at high cost are necessary to any industrial undertaking.

8. That all prospect and mine work must be done in frozen ground, and is done by thawing.

9. That the wagon roads and railroads of today are of too limited mileage to materially assist in developing so large an area as comprises all of Alaska, and that it will require many decades to construct a sufficient mileage to meet even the most pressing needs of even the one-fifth of Alaska that has been geologically surveyed by the Government.

10. That, according to Government geological reports, each of the ten districts comprising the already surveyed one-fifth of Alaska contains large areas of coal or lignite suitable for local use. None of the coals, except those near tidewater and of high fuel value, will ever stand the cost of ocean shipment. The coals, scattered far and wide over the interior, are absolutely essential to the development of the mines of the interior and the local treatment of ores, and the local operation of allied industries, including domestic consumption.

The foregoing are only a few of the controlling facts that must be reckoned with in determining the best course to pursue by the Government in its difficult task of developing the vast mineral and agricultural resources of Alaska. It is no boy's job—nor yet is it the task of any one or all of the theorists of the country. In solving the problem 'What shall the country do for Alaska?' conditions must be met for which, as a whole, the history of no nation furnishes any exact parallel. Only the application of the hardest of hard common sense will avail. The United States has surpassed every other nation known to history in rapid development, and this has been done by and through a wise and liberal land policy. It is mainly through this policy that patriotic successful citizens have been made of the vast hordes of foreign immigrants coming each year to our shores from the lands of poverty and oppression. This has been accomplished by attaching the masses to the soil. The progressive citizen is primarily the product of the land he owns. Landlordism is a failure and always has been, and it may be safely asserted always will be. Even the United States Government is not powerful enough to develop Alaska through a floating tenantry. Indeed, this was tried on the public copper and lead lands of our country from 1807 to 1847—forty years—and proved a dismal failure. Notwithstanding all history condemns the leasing system as a complete failure, there have arisen men, said to stand high in public favor, who are strenuously urging a leasing system for all the public mineral domain of Alaska. Why not include agricultural lands also? The reasons for leasing the one are just the same as for leasing the other.

Some of the objections to a leasing system are:

1. The American citizen will not lease. That was the trouble during all the 40 years leasing was tried in the copper and lead districts. The system is distinctly un-American.

2. Any leasing system will effectually eliminate the prospector and pioneer—especially in Alaska, where the hardships are vastly greater than anywhere else. The prospectors and pioneers as a class are the bravest, most industrious, most persistent, and most independent thinking men on earth. They never work for wages, except to secure more means with which to prospect until they find some natural resource to which they can acquire title. They are the only men who will or can open Alaska sufficiently to induce capital to perform its necessary part in developing the country. This is an old, old story to him who has in the least informed himself as to how the deserts and mountains of our country have been conquered and made to yield up their treasures. The history of these men is the history of the development of our entire country. Without them our history would have been like the play of Hamlet with Hamlet left out.

Hard common-sense says, "follow methods which you have always found successful, and do not try an experiment which you have—as all others have—found to be a failure." What Alaska needs to develop it is such a liberal land policy as will induce the prospector and pioneer to find valuable mineral deposits which he can locate, and a liberal offer to farmers to enter and cultivate the agricultural lands in the valleys so as to furnish food for consumption by miners among the adjacent hills. The development of mineral and agricultural lands should go hand in hand, and will do so with proper Government inducements. A leasing system of any sort is condemned by 90% of the residents of Alaska, and it is safe to predict that, under any leasing system, Alaska will shortly be almost entirely depopulated. If the prospector and miner cannot take from the public land timber and coal sufficient to enable him to find and open his mine without subjecting himself to prosecution, he will abandon prospecting and mining in Alaska.

JULIUS THOMPSON.

Katalla, Alaska, January 5.

The Editor:

Sir—It is always a pleasure to read thoughtful discussion, however much the views expressed may differ from your own. With much that Mr. Thompson says I heartily agree. The natural difficulties in the way of development in Alaska are of a sort by no means properly appreciated. It needs but a day's scramble through the 'devil's club' and moss that cover so much of Alaska's hillsides, to bring home the fact that the practical work of prospecting such a country is difficult in the extreme. It calls for a high order of courage as well as of intelligence, both of which have been admirably displayed by Alaskan pioneers. That many of the wrecks of humanity having little but brute courage have floated into the north need not detract from appreciation of the heavy demands made by Alaska upon real prospectors. It is one thing to get a *klooch* and a canoe and camp along a salmon stream till increasing snow makes it necessary to break samples from some well known outcrop, in order to have a suitable basis for a report to the grubstake partner. It is quite a different thing to really explore Alaska and to prove veins and placers. The men who do this work are deserving of rich reward, but I am unable to see that the real economic service that such men perform necessarily requires as its price a return to free-for-all conditions where with a good axe and a sufficiently long list of names, one man was allowed to monopolize a stream or a whole countryside. Neither do I agree that Americans will not lease. They will and do, as may be learned by a little inquiry in any mining district here or abroad in which leasing affords the basis of title. Furthermore, when leasing direct from the United States was in vogue in the lead regions of the Mississippi Valley, Americans took the leases, as is proved by the documents in the case. Leasing was done away with there for the reason that the people wanted something for nothing and were able by fraud and intimidation to wear out the patience of the Government. When internal revenue taxes on whisky were first established, armed insurrection ensued, and for nearly ten years there was actual fighting. In that case, however, the Government stood its ground. Would Mr. Thompson contend that it would have been better to abandon the then 'un-American' internal revenue taxes? At the times these two difficulties arose, conditions were not dissimilar. They seem so now, merely because the Government acted differently in the two cases. I am not among those who believe that a large national revenue can or should be raised by leasing mineral ground, but I do not see that a leasing system for mines is *a priori* either impossible or un-American. The advisability of introducing such a system is a matter to be settled on the merits of each case and with an eye to the particular form of lease that it is proposed to use. Incidentally, and for many years to come at least, I believe that revenue from the mines of Alaska should be employed in Alaska for building roads and for other public uses. More will be needed for such purposes than is likely to result from any reasonable scale of either royalities or taxes. Alaska does not need landgrabbers as much as it needs mines, and I believe a proper leasing system will discourage the one and encourage the development of the other.

San Francisco, January 29. H. FOSTER BAIN.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

GROUND phonolite as a potash fertilizer is causing much discussion in Germany, where active efforts are being made to introduce it into the trade. Authorities claim, however, that it is of little value, containing only 8 to 10% of not easily available potash.

TO disconnect or remove a safety device which has been attached to a machine under the direction of the safety inspector of the state is, according to the law of New York, a misdemeanor, and the fine imposed for an infraction of the law acts as a strong deterrent to carelessness and leads to a decreased number of accidents.

THE appearance of a raw clay is no criterion whatever as to the color of the burned product. The colors of clays vary widely, from the white of kaolin to the dark red, or black, of the red burning clays. The main coloring constituent of clays is iron oxide, and according to the amount present it gives colors ranging from buff to red.

SATURATION is important but difficult to determine in any oilfield. Some lands yield 2000 to 3000 bbl. per acre and others as much as 100,000 bbl. At times, as one operator phrases it, "more oil comes out of a well than there is space in the rock below." Such anomalies are probably to be explained on the basis of fractures tributary to the well.

WHERE the gravel from drift mines has to be brought to the surface through vertical or inclined shafts, the kind of motive power to be employed for the purpose depends on the circumstances. If there is but little material, a hand windlass may suffice; with more, then a horse whim, steam hoist, or water power may be used. Gasoline engines will often serve every purpose, and a small distillate engine will give excellent service.

IN assaying silver bullion containing tin, if the ordinary wet method be employed, much trouble is experienced, varying with the amount of tin present. Even with a percentage as low as 0.05, the end-point is masked by a persistent turbidity, while with amounts ranging from 0.5% upward, the determination of the exact end-point is impossible, owing to the finely divided or colloidal metastannic acid resisting all efforts to cause it to settle, or to give a clear supernatant liquid.

TELLURIUM can be detected in ores by a method recently described by G. T. Holloway, who suggests a method of isolating tellurium from ore for testing purposes, by concentrating it with the gold and silver in a lead button obtained by the ordinary fire assay, it being possible to treat as much as 50 to 60 gm. of ore in this way. The lead button is then dissolved in nitric acid, diluted, and the tellurium precipitated by means of lead foil, the deposit thus obtained being cleaned and tested by concentrated sulphuric acid. If tellurium is present a deep violet color is produced that disappears on further heating. Manganese peroxide, when present, sometimes interferes with this test.

VALUATION of oil wells is difficult and uncertain. In the Appalachian fields, where conditions are better known than is usual elsewhere, it is customary to appraise ground on the basis of daily production, after the property has been operated successfully and the wells have settled down to regular output. On this basis the average sale price of producing fields varies between $800 and $1000 per barrel of daily production. This price covers all the usual field equipment. At these prices the purchaser expects to recover his capital and from 100 to 200% within a period of 5 to 10 years, and often does better. The average price at the well of Pennsylvania oil is about $1.30 per barrel. To apply the same rule in other fields, if it be thought wise, allowance must be made for the difference in price of oil. In Illinois, during the first three years of oil development, producing properties changed hands on a basis that provided for return of capital in 18 months from known production and at current rates.

ADMITTING compressed air into the gas-engine cylinder at the end of the exhaust stroke is proposed in a recent issue of the *Zeitschrift des Vereines Deutscher Ingenieure*. It is recognized that the residual burned gases remaining in the cylinder and mixed with the new charge dilutes the fresh mixture, impoverishes it, and generally interferes with the ignition of the charge, unduly elevates the initial temperature, predisposes the motor to premature explosion, and affects the efficiency of operation. It was there shown by means of diagrams and figures of a number of tests how the efficiency was increased as the result of the adoption of the valve which admits the air under pressure at the end of the exhaust stroke.

LIFE of timber inside a mine varies with conditions of temperature and moisture, as the fungus which destroys timber must have a definite amount of air and water, food and heat, in order to exist. If mine conditions were such that the timber could be always kept wet or always dry, it would never decay. Poorly ventilated gangways and air passages with a fair degree of moisture and a fairly high temperature, such as are especially common in the anthracite region of America, are favorable to fungus growth and hence to rapid decay. Right preservative treatment may reduce disease and decay in mine timbers to a minimum, but it is probably impossible to exterminate the disease and wholly prevent the decay. The enormous quantities of timber consumed by the mines, and the necessity for the replacement of the entire equipment inside the workings of an anthracite mine in twelve to eighteen months, emphasizes the unsuitability of wood for this purpose and the economic waste involved in its use.

FOR ASSAY of gold and silver-bearing cyanide solutions, take, in the case of ordinary mill solutions 10, and in that of barren mill solutions 20 assay tons. Remember that 1 assay ton equals 29.166 grams, or 29.166 c.c., so that 10 A.T. is equivalent to 291.66 c.c. Transfer the necessary amount of solution to a large beaker, add a bunch of zinc shavings about the size of a hen's egg. Warm the solution gently for 15 minutes. Gold and silver will immediately commence to precipitate on the zinc. At the end of the above period, add 60 c.c. of a saturated solution of commercial lead acetate in water. The reaction immediately starts between the lead acetate and the zinc shavings, producing metallic lead and zinc acetate. At first the solution will be milky, but in 30 to 40 minutes it will clear, leaving metallic lead in spongy form, and some undissolved zinc shavings. Keep the solution boiling hot during this reaction. Now, add 30 c.c. hydrochloric acid, which rapidly dissolves the remaining zinc. The lead will settle in a spongy mass at the bottom of the beaker; decant carefully, washing several times with water. Collect the lead first with glass rod and finally with the fingers, forming it into a cube for subsequent cupellation. After a little practice in washing, the operator becomes so proficient that there is practically no chance of losing metallic lead. The lead button is dried, placed in a cupel and cupelled. The resulting bead is weighed and parted, the weight of gold and silver in milligrams representing ounces in 10 or 20 tons of cyanide solution, from which the value per ton is readily figured. The addition of zinc to the cyanide solution causes a precipitation of gold and silver on the zinc in the usual manner. Lead acetate reacts upon the zinc, forming soluble zinc acetate and metallic lead. The metallic lead mechanically collects the gold and silver. The addition of hydrochloric acid dissolves the remaining zinc without interfering with the lead, gold, and silver. Decantation removes soluble salts. Cupellation removes the lead, leaving gold and silver.

Special Correspondence

TORONTO, CANADA

HOLLINGER REPORT ANALYZED. DOME ADOPTS EIGHT-HOUR DAY FOR UNDERGROUND WORKERS. COBALT BULLION PRODUCTION IN 1911. GENERAL NOTES.

The long-anticipated report of Percy A. Robbins, manager of the Hollinger, dealing exhaustively with the physical condition of the property, which made its appearance toward the close of January, proved a disappointment so far as its effect on the stock market was concerned. It failed to arrest for more than a day or two the downward tendency in Porcupine stock; the advance which at first resulted being followed by a rush of profit-taking and a further decline, stimulated, no doubt, by the criticism of experts who disagreed with Mr. Robbins' conclusions. The report is a lengthy and comprehensive document going extensively into details, but the sum and substance of it is that, in the aggregate, the orebodies so far discovered, making conservative allowances for the persistence of the veins below present workings, have an estimated tonnage of 462,000 tons with a gold content of about $10,230,000, which during the next four or five years would yield profits

HOLLINGER NO. 1 SHAFT AND TEST MILL.

amounting to $7,500,000. The estimate is based on the results of extensive sampling, for which about 3000 samples, both from the surface and the underground workings, were taken. The greatest depth allowed for in the estimate of tonnage is 300 ft. (being in most cases 100 ft. below the depth actually reached), and the report goes on to say that every 100 ft. of depth below the 300-ft. level on No. 1 vein will add $2,100,000 to the profit, adding that experience in stockwork formations in other parts of the world has shown that veins continue to depths of 1000 to 2000 ft., so that there can be no doubt as to the conservatism of the estimated depths of the Hollinger veins. This is just the point, as being too optimistic, upon which the critics of the report are disposed to take issue. The cost of the Hollinger mill when completed will be about $275,000, and it is expected to be in operation some time in April. It will have a crushing capacity of about 300 tons per day, with provisions for such increase as may be found necessary, while the cyanide plant is being constructed for a capacity of 500 tons per day. The official announcement is made that the details are being arranged for a merger embracing the Hollinger, the Miller-Middleton, and the Dixon-Gillies properties, amounting in all to 15 claims and that Hollinger shareholders will participate in the new issue.

At the Dome an adit is being run from a point near the mill to No. 1 drift at the depth of 45 ft., as a means of taking out the ore from that level, while leaving shafts No. 1 and 8 free for development work. A double track will be put down, on which cars will convey the ore to the mill. By means of a hoisting drum, trains of six cars can be hauled to the surface, and it will be possible to take out 1000 tons per shift through the adit. The eight-hour system has been adopted for underground workers, the surface men working nine hours per day. Charles M. Hemstitch, formerly manager of the Kimberley diamond mine, South Africa, has been placed in charge of the underground work. The Apex has been closed down until spring, when it will be possible to obtain a sufficient supply of water, as the management does not consider it advisable to install a large pump in order to keep the plant running. The West Dome has considerably limited its operations and laid off most of the surface men. The Little Pet is in good ore at the 100 ft. level and is installing a Jenckes mill with five stamps of a weight of 1250 lb. each. The McIntyre has cut a vein of quartz carrying sulphide and native gold at the 200 ft. level. At the Dome Lake, south of the West Dome, two shafts are going down on a large sulphide vein, which has been traced for 1300 ft. A 6-drill compressor will be installed. The Rea is sinking the shaft from the 300 to the 400-ft. level, where the next station will be cut. The work is being done with small hammer-drills, which have been found more economical than the reciprocating drills at first used. The McEnany has cut an orebody 5 ft. wide at the 173-ft. level, which yields assay returns between $20 and $30 per ton. On the North Dome a 2-ft. vein showing free gold has been found in No. 2 shaft, at a depth of 60 feet.

The bullion production of Cobalt during 1911 amounted to 3,772,920 oz., valued at $2,012,428, of which the Nipissing contributed 2,352,758 oz. worth $1,268,495. The output for 1910, which was the first year in which Cobalt shipped bullion, was 945,702 oz., valued at $501,815. The subsidiary properties of La Rose Consolidated are showing up well. Good ore is found in the winze put down from the 60-ft. level of No. 9 vein of the Lawson, the vein averaging 7 in. wide of 2000-oz. ore for 45 ft. At the Princess the main stope is 225 ft. long and full of ore from the second level to the surface. In a raise from the second level on No. 6 vein, 2 in. of 2000-oz. ore has been discovered, and a find of high-grade ore has been made in a winze below the same level. At the Provincial, now under the management of John Riddington, a vein, 1½-in wide, of rich ore with the wall-rock carrying silver for 2 ft. on each side, has been found in the conglomerate 60 ft. from the shaft on the 300-ft. level. The Beaver has put shaft No. 1 down to 550 ft. and is going deeper. A station is being cut and a level run at the 530-ft. level. The Buffalo mill treated 4088 tons of ore during December, recovering 144,440 oz. of silver, or 87.70% of the silver disclosed by assays before milling. The annual report of the Wettlaufer for 1911 showed a profit of $313,390. The ore reserves were estimated at 1,003,000 oz. The Wettlaufer has taken an option on the Keeley mine, a hitherto unfortunate enterprise in South Lorrain which was one of the assets of the insolvent Farmer's Bank, and agreed to spend $15,000 per month for a year in development work. The Mond Nickel Co. has acquired 2400 acres of land at Coniston in the Sudbury district as a site for a large smelter, construction of which will be started in the spring.

ST. PETERSBURG, RUSSIA

RUSSIA'S COPPER PRODUCTION SHOWS INCREASE.—MAY USE ELECTRICITY IN PRODUCTION OF FERRO-MANGANESE.

The copper production of Russia in the first nine months of last year is reported to have amounted to 1,121,257 poods, against 1,034,456 poods in the corresponding period of 1910—increase 8.4%. By districts the yield in copper was: Urals, 587,000 poods; Caucasus, 328,000 poods; Siberia, 165,000 poods. The waste smelted in various chemical works amounted to 41,000 poods. The Urals with its leading position includes the Kyshtim works, which produced 162,000 poods of copper this year, against 85,000 poods last year; always for the first nine months.

The congress of manganese producers at Tiflis near the Black Sea has appointed a committee to enquire into the possibility of using electricity for the production of ferro-manganese. The Sharopan manganese industry, near Tiflis, has been in a critical state for a long time now, and it has been urged over and over again that the coal to be found in the neighborhood should be used to produce ferro-

manganese. Probably the coal available has not proved to be of sufficiently good quality, and hence the appeal to electricity.

LONDON

STEEL WORKS FOR VEREENIGING, TRANSVAAL.—MALAY WOLFRAM PROPERTY TO BE DEVELOPED.—SOUTH AFRICAN COMPANIES PROFIT BY EAST RAND PROPRIETARY AFFAIR.

For several years past there has been much discussion as to the possibility of establishing the manufacture of steel in South Africa. In the issue of *The Mining Magazine* for January 1910 a review of the situation was given by one who was in thorough touch with the plan. He, however, withdrew on account of certain restrictions imposed by the Government. Just recently the scheme has been taken up by the firm of Lewis & Marks, who have, with the assistance of Frederick Siemens, and of the people with Sheffield experience, evolved a plan for establishing a steel works at Vereeniging. This town is on the main line of railway from Cape Town, and is situated on the north side of the Vaal river, thirty miles south of Johannesburg. It is in the centre of the coalfield belonging to the Vereeniging Estates, Ltd., controlled by Lewis & Marks, and a great electric power station is being constructed there by the Victoria Falls & Transvaal Power Co., Ltd. The plan is to erect a steel works at a cost of £65,000, with a calculated output of 10,000 tons per year, and at first to use only the scrap metal, which is purchasable in abundance in South Africa. A specialty will be made of drill-steel and tool-steel, mine rails, fencing standards, and such castings and forgings as may be in request. The Government has agreed to foster the industry by purchasing material and giving preferential railway rates. H. H. Wright, of Johannesburg, is one of the directors, and he has transferred to the company his rights in connection with the iron-ore deposits at Magnet Heights, in the Lydenburg district of the Transvaal, and the Government has stipulated that, at the end of three years, the company is to commence experiments in connection with the smelting of native ores. It will be remembered that F. W. Harbord has recently reported on the iron-ore resources of South Africa.

At the present time no metallic tungsten is produced in England, though many firms have tried their hand. A small amount of wolfram is produced in Cornwall, but it goes to Germany for treatment, as does all that is mined elsewhere in the eastern hemisphere. Wolfram is a widely-distributed mineral, but it seldom occurs in large enough quantities to make its exploitation profitable. I have recently referred in this column to new wolfram ventures in Queensland and New South Wales. Another in the East is now being introduced to the notice of London investors. This is in the state of Trengganu, a state in the Malay Peninsula which came under British protection as recently as 1910. The property is situated some distance up the Dungun river and is reached in 38 hours by steamer from Singapore. The ore is found in a quartz lode that traverses slate, and the average content is 8% wolfram. For some years the Chinese have been working the lode, and making a fair profit. More recently, E. H. Sharpe, of the firm of Sharpe, Ross & Co., acquired the mining rights, and, through a company specially formed for the purpose at Singapore, called the Dungun River Concessions Syndicate, has done a good deal of development work. The Syndicate asked Osborne & Chappel, of Ipoh, Perak, a firm well known in the East in connection with tin and wolfram, to make an examination. Their report is generally favorable, and they recommend systematic development on certain lines. They wisely urge that a concentration plant should not be provided just yet. For the purpose of raising the capital for development work, an English company has been formed, called the Dungun River (Trengganu) Wolfram Development Syndicate, with a capital of £40,000, of which £20,000 in shares goes to the old syndicate, and 20,000 £1 shares are being offered for public subscription. Of the latter, 16,000 have been underwritten by Sharpe, Ross & Co. This shows that those who know most about the venture are ready to stake their money. Reginald Pawle and Henry Brelich, two London engineers well acquainted with the East, are acting as consulting engineers to the new company. Sir E. W. Birch is a director; as he is chairman of the Eastern Smelting Co. of Penang, which recently came under British ownership, it looks as if there were some intention of treating the ore locally. There appears to be a fair prospect of wolfram properties becoming profitable, for its use in the manufacture of armor-plate and tool-steel seems likely to expand with the supply of the raw material. Nearly 1000 tons of metallic tungsten is used per year in Sheffield, where tool-steel containing 20% of the metal is produced. The steel-makers there prefer the oxide or the metallic powder, and object to the more recent product, ferro-tungsten, made in the electric furnace on the Continent, as it contains too much carbon. The amount used in the manufacture of filaments of electric lamps cannot be great in the aggregate, and would not be sufficient to keep the mining industry going. Like many other things, the use of tungsten as an alloy for tool-steel was first publicly demonstrated in America, and the exhibit of the Bethlehem Steel Co. at the Paris Exhibition of 1900 served to attract European makers. Creusot in France, and Krupp in Germany followed by using it in armor-plate manufacture. I believe that the latter firm contracts for the supply of wolfram from the United States. Probably the yearly production of wolfram concentrate throughout the world is about 6000 tons, containing 2500 tons metal.

I have referred several times to the case of the East Rand Proprietary, and to the disastrous consequences of keeping secret the difficulty experienced in maintaining the yield of gold at the level prognosticated two years ago by Sir George Farrar and his fellow-directors. Though naturally the incident has done some damage to the prestige of the Rand and to the market for Rand shares, it has not been without its uses as a tonic to the other 'houses.' For instance, it has now been agreed by the other houses that shareholders shall in the future be allowed to see the yearly reports before sending in their proxies, and these reports are to be circulated for quite two months before the meetings are held. This is the nearest approach that is possible, according to the company law of the Union of South Africa, toward a full recognition of shareholders' rights. It is urged that Rand gold mining companies ought to hold their meetings of shareholders in London, and theoretically this would be the right thing. But unfortunately directors have another duty toward shareholders, that is to say, they have to dodge the assessor of taxes. If a Rand gold mining company held its annual meeting in London, it would be reckoned a London company and would be made to pay English income tax as well as the Transvaal tax on profits. A year or two ago the highest courts in England decided that the De Beers Diamond Mining Co. had to pay income tax in England, though it was registered under Cape Colony law and was conducting business in that province and not in England. The French and German shareholders are hit hard by this duplication of taxes, for it is obvious that a Continental investor in South African mines ought not to pay the tax on incomes that is exacted for the purpose of English public revenue.

BUTTE, MONTANA

NORTH BUTTE DISCOVERIES.—B. B. THAYER LIKES COPPER SITUATION.—TUOLUMNE DIVIDENDS.

Between the two veins, one on the 1600-ft. level and the other on the 1800-ft. level, and the vein opened in the Snowball claim, the North Butte mine is in promising condition. On the 2200-ft. level of the Snowball the vein is now about 22 ft. wide, and the ore averages about 10% copper. Much of this ore is now going to the Washoe smelter. The ore on the 1600 and 1800-ft. levels is said to be running close to 12%. While it is denied that the Edith May vein has been cut on the 2800-ft. level, men working in the mine insist that it has been, and that the ore expected was not found.

The Tuolumne company is expected to resume dividends again about next July. They were stopped last year in consequence of the heavy expense incurred in building a railroad spur from the mine to the Butte, Anaconda & Pacific tracks, and on account of the expenditure to be met in the erection of a new surface plant. The railroad spur has been in operation since last fall, and the new surface plant is completed, and all the payments have been promptly met without crippling the treasury. Mr. Hickey, the president, is an ultra-conservative man, and while there is no doubt all this extra expense could have been cared for and the dividends paid at the same time, he insisted that they should be passed for a time, so as not to deplete the treasury. When they are resumed they will be 15 cents, the same as before. The contract with the Anaconda company for the treatment of ore at the Washoe smelter expired on the first of the month, and while it has not yet been renewed, the favorable terms secured leaves no doubt but that it will be in the course of a few weeks. In the meantime, the ore is going to the smelter as usual and under the terms of the contract. The company will start about the first of next month to sink the shaft from the 1800-ft. level to a depth of 2000 feet.

GLOBE, ARIZONA

Work of the Miami. Progress at Old Dominion.—News of the District.

The starting of the sixth unit of the Miami concentrator is still delayed by the non-arrival of the three 8-ft. Hardinge pebble-mills which will follow the rolls in that unit. The mill is now treating over 2500 tons per day with five units working, the recovery being from 72 to 73%. Development on the 750-ft. level is being pushed forward. Where the crosscut from the main shaft intersected the

MIAMI MILL WHILE UNDER CONSTRUCTION.

orebody, the ore is reported to assay 4.76% copper. One churn-drill is at work near the old No. 3 shaft and has not yet passed through the capping. Over 750 men are employed, of whom 440 work underground.

The output of the Old Dominion smelter for January was 2,026,000 lb. of fine copper. The company is planning to put in skips for hoisting the ore, and will include a remodeling of the crushing plant and sampling mill. Some changes will be made in the concentrator which will increase its capacity to 700 tons per day. At the smelter a separate dust-chamber will be constructed for the converters, and a machine installed for cheap handling of converter slag, all of which will be re-smelted. The Gray shaft of the United Globe is shut down for re-timbering, and the work of concreting the Kingdon shaft is progressing satisfactorily. The company now has about 900 men in its employ. At the annual meeting of the shareholders of the Copper Reef Consolidated Mines Co., held in Globe February 5, the board of directors was reëlected with the exception of J. W. Gillingham, who was succeeded by W. A. Griffith of Pittsburg. M. J. Kennedy, of Scottdale, Pennsylvania, was reëlected president at a meeting of the directors, and W. A. Griffith was made secretary. Charles Saxman was elected to the position of manager, succeeding John W. Gillingham, whose contract expires March 1. The property consists of 80 claims about 12 miles south of San Carlos, reported to have favorable surface showings of copper. Excavation is completed for the foundation of the new hoist at No. 2 shaft of the Live Oak mine, and preparations are being made to enlarge the shaft to three compartments. An Ingersoll-Rand compressor, capacity 1300 cu. ft. of free air per minute, has been ordered. The eastern end of the orebody is being developed from No. 1 shaft. Hole No. 2 of the Southwestern Miami Development Co. is down over 600 ft. and is still in the capping. Ore is expected at 900 ft. The churn-drill hole on the Barney group is now over 600 ft. deep. P. S. Tate and Abe Lyle are leasing on the 100-ft. level of the Black Warrior mine. The Warrior Copper Co. has sold its teams and store supplies. The Copper Hill shaft of the Arizona Commercial is being re-timbered preparatory to starting development work after the bonds of the old company have been foreclosed and the new company has taken possession. The South Live Oak company has ben formed to develop the Schultze group of claims lying a mile southwest of the Live Oak.

WASHINGTON, D. C.

New Act for Bureau of Mines.—Special Features Approved by Secretary of Interior.—Facilitation of Work of Federal Bureaus.

The Committee on Mines and Mining of the House of Representatives have submitted their report upon House bill 17260, amending the act establishing a Bureau of Mines in the Interior Department, and the bill in its final amended form is as follows:

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the Act to establish in the Department of the Interior a Bureau of Mines, approved, May sixteenth, nineteen hundred and ten, be, and the same is hereby, amended to read as follows:

"That there is hereby established in the Department of the Interior a bureau of mining, metallurgy, and mineral technology, to be designated the United States Bureau of Mines, and there shall be a director of said bureau, who shall be thoroughly equipped for the duties of said office by technical education and experience and who shall be appointed by the President, by and with the advice and consent of the Senate, and who shall receive a salary of six thousand dollars per annum; and there shall also be in the said bureau such experts and other employees, to be appointed by the Secretary of the Interior, as may be required to carry out the purposes of this Act in accordance with the appropriations made from time to time by Congress for such purposes.

"Sec. 2. That it shall be the province and duty of the Bureau of Mines, subject to the direction of the Secretary of the Interior, to conduct inquiries and scientific and technologic investigations concerning mining, and the preparation, treatment, and utilization of mineral substances, with a view to improving health conditions and increasing safety, efficiency, economic development, and the prevention of waste in the mining, quarrying, metallurgical, and other mineral industries; and to investigate explosives and fuels and unfinished mineral products belonging to, or for the use of, the United States, with a view to their most efficient use; and to disseminate information concerning these subjects in such manner as will best carry out the purposes of this Act.

"Sec. 3. That the director of said bureau shall prepare, publish, and distribute, subject to the direction of the Secretary of the Interior, under the appropriations made from time to time by Congress, reports of inquiries and investigations, with appropriate recommendations of the bureau, concerning the nature, causes, and prevention of accidents, and the improvement of conditions, methods, and equipment, with special reference to health, safety, and prevention of waste in the mining, quarrying, metallurgical, and other mineral industries; the use of explosives and electricity, safety methods and appliances, and rescue and first-aid work in said industries; the causes and prevention of mine fires; and other subjects included under the provisions of this Act.

Sections, 4, 5, and 6 are as published last week, page 247.

The committee submitted a copy of the bill to the Secretary of the Interior, who has expressed his unqualified approval of it, commending especially Sections 4 and 5,

enabling the Bureau to command the temporary services of men of large experience at nominal compensation. The Secretary especially approves of the provision in Sec. 5 for exempting state governments from the payment of the fees required of private persons for special investigations, as the sums involved will usually amount to very little, but would require special legislative provision to meet these charges of $1 to $5 each. The committee in their report call attention to the fact that nothing in the bill authorizes any investigation of private processes for use in the preparation, treatment, or utilization of ores or minerals, nor does it authorize the Bureau to extend its investigations beyond mining operations. Section 5 is existing law, having been enacted as part of the sundry civil act. For some time the Bureau of Mines has been testing explosives at the request of manufacturers, and the provision of the present small charge for this work has operated to materially decrease the number of unnecessary requests. The fees for testing explosives were published as schedule 1 of the Bureau of Mines, June 1, 1911, and range from $5 for a single test to $150 for a complete official test to determine permissibility for use in coal mines. Taken as a whole, the new bill states clearly and specifically what work the Bureau of Mines may do and for what purpose. Without materially extending the scope of the Bureau of Mines, it defines it more clearly and will help in avoiding duplication of the work of other bureaus, while facilitating coöperation with them.

NEW YORK

COPPER SITUATION.—RAY CENTRAL AND RAY CONSOLIDATED.—MONTGOMERY-SHOSHONE BANKRUPT.—GENERAL MARKET NOTES.

Whether the copper situation is such as to justify the hoped-for advances in the metal and, as a reflection of such advance, a livelier and a rising market in copper shares or not, the fact remains that concentration of the principal future factors in production goes on apace, and the heavier, or rather the heaviest, of the banking interests are more and more closely identified with copper.

Recently the consolidation of the Inspiration Copper Co. and the Live Oak Development Co. furnished an opportunity to bring together several of the financial heads in the copper world upon one board of directors. The banking interests most prominently represented were J. P. Morgan & Co. and the Bankers Trust Co. of New York. Following this move comes this week the absorption of Ray Central by the Ray Consolidated. Up to the present time the history of Ray Central has not been marked with any great triumphal progress. The property was at one time, some years ago, under option to the General Development Co., the Lewisohn organization which controls the Miami and the New Keystone. After the work of some months, J. Parke Channing sprung a surprise upon the public and the shareholders in the company by recommending that the option be dropped. It had been rather taken for granted that the Lewisohns would take the Ray Central over, and the result was that a great many people were left rather high and dry, with holdings that they did not want, unless Mr. Channing and his associates were to proceed with development work. The present deal was made by Charles Hayden, of Hayden, Stone & Co., which house has been prominently identified in the financing of all the Guggenheim-Jackling-Penrose-McNeill properties, while the million and a quarter of cash which went into the Ray Central treasury was furnished by the Chase National Bank of New York. The recent underwriting of the Ray Central bond issue of $1,800,000 was a heavy load for the underwriting syndicate, the shareholders taking only some $83,000; as a result, it was proposed to the Ray Consolidated board that the bonds be taken over from the underwriters on condition that the Ray Central shareholders be offered an exchange of one share of Ray Consolidated for each eight shares of Ray Central. The Ray Central bond issue taken over by the Ray Consolidated is convertible into Ray Central shares at $2 per share, as the underwriters were left with some $1,717,000 in bonds, which is equivalent to 858,500 shares of stock. This, with some of the larger inside holdings that have already been pledged for exchange, guarantees to Ray Consolidated a large majority of the outstanding stock of the Ray Central. A special meeting of the stockholders of the Ray Consolidated has been called to approve the issue of some 200,000 shares additional stock to be used in completing the exchange. The present capital of the Ray Consolidated is 1,400,000 shares, to be increased to 1,600,000 shares. From a mining standpoint, it is expected that the consolidation will prove of great advantage and permit the institution of many economies. The ore developed in the Ray Central ground so lies that it can easily be taken out through the No. 1 shaft of the Ray Consolidated. The engineers of the Ray Central estimate the developed ore at 7,348,000 tons, averaging 2.51% copper, a small part of which is of comparatively high grade, running a little better than 5% in copper.

The Montgomery-Shoshone, the property at Bullfrog, Nevada, in which Charles M. Schwab was the principal factor, has notified its shareholders that it is wholly insolvent. Unless the mill which was erected can be dismantled and sold to take care of existing indebtedness, the concern will be forced into bankruptcy. Mr. Schwab is at present devoting his time to doing battle for the steel tariff schedules and resisting the prospective cuts therein, evidently having relegated to oblivion all memories of Nevada mines and the Casino at Monte Carlo, each of which at one time claimed a share of his attention. The great Schwab mansion is forsaken and he lives in Bethlehem, Pennsylvania, where he is devoting his time to his steel plants. The Nevada-Utah snarl has at length landed in the bankruptcy court, where, it is safe to say, it will never be untangled. Nevada-Utah will be a bitter memory for the many followers of Lawson, but its affairs long ago reached the point where the only hope of progress was an entirely new starting point.

The sharp advance in silver is attracting much attention. The price of a little better than 60c. per ounce is the high mark since November 1907, when the market reached a level of 60⅝c. One factor in the present situation is the Chinese revolution, which is creating a demand for many payments in coin. A more important factor is the position of the Indian Government, which is expected to come into market to purchase bars for coinage into rupees. Both London and Bombay are speculating heavily, and it is reported to be quite a question as to whether the present holders can carry the loads they have accumulated until the demand will permit them to get out at a profit. The recent serious disturbances in Mexico nullify in large part, so far as new enterprises are concerned, the good effect of the rise in the price of the white metal. Some days ago it was rumored that the Mines Finance Co. had acquired control of the Kerr Lake property from the Lewisohns, who manage the Kerr Lake and the Wettlaufer through the Canadian Silver Mines Exploration, which is a subsidiary of the General Development Co. The report is authoritatively denied by the Lewisohn people. Robert Livermore, a son of T. L. Livermore, is now general manager of the Kerr Lake mine. Cobalt Townsite is paying an initial dividend of 5% as a quarterly distribution. The concern is a holding company and is one of the Cobalt mining companies that is owned almost wholly in England. Stewart Mining, a Coeur d'Alene mine, control of which is supposed to rest in the treasury of the United Copper Co., has been enjoying one of its spurts of activity in the Eastern market. The mine is supposed to be a valuable property, but, like all Heinze properties, seems to have a great deal of trouble getting to a point of profitable production.

The British Columbia Copper Co. reports net profits for the year ended November 13, 1911, as $134,000, in spite of being obliged to operate for a large part of the time with Pennsylvania coke, which costs $4 per ton more than domestic fuel. The third furnace was blown in on February 11, and the Dominion Copper Co. is expected to furnish one-third of the tonnage smelted.

General Mining News

ALASKA

Copper River

E. A. Patrick, representing Spokane stockholders in the Alaska Copper Co., recently stated at Cordova that the company is planning to carry on development on a larger scale at its property, at Mile 177, west fork of the Kennicott glacier. The property formerly was known as the Greer. The orebody has been stripped sufficiently to show ore deposits of enough value to warrant heavy investment, according to press despatches.

Prince William Sound

Development has been resumed at the Pinochle group of claims near Shoup glacier, under the direction of Ernest King, of Valdez. Some samples from the Bessie group, adjoining the Mayfield property in the Shoup bay district, assayed as high as $1000 per ton, according to a recent report from Valdez. The third clean-up since December 16 at the Cliff mill was made a short time ago, amounting to $10,000, stated B. F. Millard. The mill has averaged about $1000 per day since it was put in operation.

Tony Dahlstrom and Gus Neuman have purchased from Olaf Olson his one-third interest in the Olson, Anderson & Gustafson property of Shoup bay. A sample from recently discovered ore in the Midas Copper Co. mine, in Solomon gulch, five miles from Fort Liscum, assayed 16½% copper, $1.20 to $10.80 in gold, and 50 to 75c. silver per ton, says a despatch from Valdez. The adit in which the ore was found is in 105 ft. Development will be continued until July 1, when actual production will be started. The Midas company, which is not incorporated as yet, includes E. J. Devinney, George Treat, George Baldwin, W. M. Wilson, A. Grigsby, John Fienbloom, and Joseph Plant, all of Valdez.

The Tanana

Gus Raymond is said to have discovered gravel that pans 5 to 15c. on Beaver creek, a tributary to the south fork of the Big Chena river. J. E. Carlson has started on a prospecting trip to Valdez creek, at the head of the Susitna river, in the interests of the Lucky Hill M. Co., of which he was one of the organizers.

ARIZONA

Cochise County

The Commonwealth mine at Pearce is being prepared for the resumption of development. Llewellyn Humphreys is manager of the property.

Gila County

The Inspiration Consolidated bond issue subscription rights were allotted on the *pro rata* basis of the stock outstanding on February 1, when there was found to be issued and outstanding 696,000 shares of stock. The bond issue is for $6,000,000. Holders of 116 shares of stock are entitled to subscribe for one $1000 bond, or holders of 58 shares of stock for one $500 bond.

The construction and development plans of the Inspiration Consolidated are still hanging fire. The greatest obstacle to the final settlement of these plans seems to be the inability of the officials of the Arizona & Eastern Railroad Co. to come to an agreement with property owners along the proposed right-of-way for the extension of the railroad from its present terminus at Miami, near the Miami mine, to the Inspiration and Live Oak mines, a distance of about 1½ miles. In the condemnation proceedings recently instituted in the territorial district court at Globe by the Arizona & Eastern, the court decided that the company must give a bond of $13,500 before it could proceed with construction. This the company declined to do, and, rather than take the chance of an excessive award by a jury when the case shall have come to trial in the new state court, it is now conducting negotiations with the property owners outside of court. W. H. Aldridge, managing director of the Inspiration Copper Co., is now at the mines.

Pinal County

The Ray Con. Copper Co. in January produced about 3,000,000 lb. of copper, as against 2,600,000 lb. in December. The company was handicapped through the fact that the mill work has been ahead of the mine development. On April 1 the company will ship its concentrate to the nearby Hayden smelter, instead of to El Paso. It is believed that this arrangement will reduce the cost of production by 1¾c. per pound.

Yavapai County

Development has been resumed at the Square Deal M. & M. Co. and the Sure Shot properties in the Cherry Creek district, says a Prescott report. L. N. Wombacher is manager of both mines.

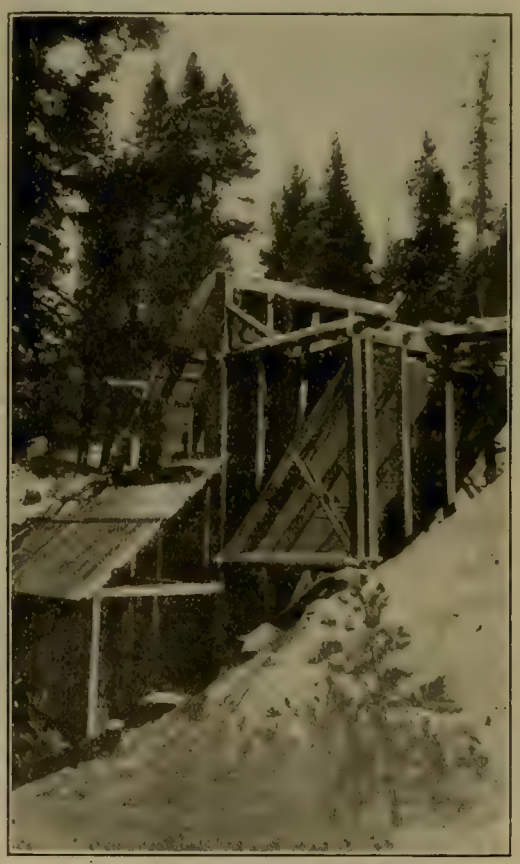
Yuma County

Press reports assert that the Tuscarora M. & M. Co. has discovered a 7-ft. vein of ore assaying about $25 per ton on its property near Parker. John Jarvis is superintendent for the company.

CALIFORNIA

Amador County

The shaft collar of the Bunker Hill mine collapsed in the recent accident which imprisoned 69 miners for about



FORT BIDWELL MILL, MODOC COUNTY.

24 hours. The accident was caused by the breaking of the cable used in hauling a loaded skip up the inclined shaft. The skip jumped the track and the shaft partly collapsed, filling with débris at the 200-ft. level, which was used as a drainage adit. The shift boss rode up on the skip, and only the fact that he stepped off at the collar of the shaft as the skip emerged, saved his life.

Modoc County

Richard Mason, in sinking a winze on the Mountain View claim of the Fort Bidwell Consolidated, at Fort Bidwell, discovered a 2-in. stringer remarkably rich in free gold, according to a recent report. The property is in the High Grade district.

Nevada County

Murray I. Scott, lessee on the A. McGee property near the Eureka, has found a rich ore-shoot 30 ft. from the surface, according to a report from Grass Valley.

The North Star M. Co. has purchased self-dumping skips to replace the old ore cars in the Providence mine, of the Champion group.

Plumas County

The Jameson mill, near Johnsville, has been closed on account of the lack of water. The mild winter has caused fear that other properties may be forced to shut down, unless there comes a heavy fall of snow.

San Bernardino County

The Death Valley Arcalvada Con. M. Co., says a report from San Bernardino, has development under full headway on its property, situated near Cima. Water-power has been developed, and a mill built on the property, as well as other improvements. In the eastern end of the county, in Whipple 'wash,' twenty miles north of Parker, Arizona, recent discoveries on the property of the Golden State M. Co. have brought a number of prospectors into the district. Kit Carson is manager for the Golden State company.

Shasta County

(Special Correspondence.)—The Delta Con. Gold M. Co. is planning to erect a mill soon. The company reports a good reserve of fair-grade ore, but its treatment offers some difficulties. It is planned to augment the mill with a cyanide plant. S. D. Furber is manager of the property, which is in the Dog creek district, northwest of Redding. Reports that the First National Copper Co. was to resume operation at Coram were set at rest a few days ago, when E. B. Braden, manager for the company, stated that no effort was planned, owing to hostility on the part of farmers. The Noble Electric Steel Co. is sending out high-grade pig iron from the Heroult electric smelter. Two furnaces are producing. M. E. Dittmar and associates plan to prospect their holdings at Igo during the coming spring. A diamond-drill will be installed. The Bully Hill Copper Co. has concluded a series of experiments for the electrolytic smelting of copper and zinc ores. It is reported results have been encouraging, but nothing of an official nature has been given out. The Bully Hill ores carry a large percentage of zinc, with some gold and silver.

Redding, February 12.

Sierra County

Valuable ore last Sunday was discovered in the main adit of the Kate Hardy mine, near Forest. Will D. Beggs of San Jose is operating the property.

Trinity County

(Special Correspondence.)—The Alta Bert Gold Dredging Co. has placed in commission its first dredge here. The hull is 98 ft. long, 42 ft. wide, and 9 ft. 4 in. deep, and was built of red fir sawed on the ground. The dredge is electrically operated, has 7½-cu. ft. buckets, and was built to dig 25 ft. below the water-line. It can develop 345 hp. The machinery was taken from the old Scott river dredge.

In 1900 a small dredge was built here by the Urie Machinery Co. of Kansas City. The dredge, which had 2½-cu. ft. buckets, and which was steam-operated, was found too light, and was abandoned after three summers' operation.

Trinity Center, February 8.

The Globe M. Co. has filed suit in San Francisco to secure an accounting by W. D. Pinkston, superintendent for the company from 1907 to 1910, for $60,000 alleged to have been misappropriated.

Tuolumne County

(Special Correspondence.)—The New Providence M. Co. has been incorporated to develop three claims situated just east of the old Providence mine. Its capital stock is $500,000. The officers are M. J. Corbett, president, George W. Mooney, vice-president, and T. L. Bibbins, secretary. The claims are but slightly developed, two short adits having been driven, in both of which 6 ft. of low and medium-grade ore was found. The outcroppings range in width from a few feet to 75 ft. William Floyd, of Soulsbyville, who will be superintendent, states that work will begin within 60 days, and that the plans are to drive a 1000-ft. adit.

Tuolumne, February 10.

COLORADO

Clear Creek County

(Special Correspondence.)—H. C. Reno, who recently purchased the Wisconsin and Corry City mines for a syndicate of Eastern capitalists, has a force of men at work in repairing the 250-ton Pelican mill. Ore treatment will start March 1. Mont Tong, manager of the St. Paul property on Green Lake mountain, expects to resume work March 1. The adit will be driven 600 ft. to intersect the St. Paul vein that is supposed to be an extension of the Colorado Central.

Georgetown, February 10.

Jefferson County

(Special Correspondence.)—Through donations of machinery made by various manufacturers, it will be possible to completely equip the concentration department of the Colorado School of Mines. William G. Haldane will be in charge of the work. Recently $12,500 was turned over to the school for equipping the ore-testing plant. The building for this department was built a year ago, and $50,000 was appropriated by the legislature for securing the necessary machinery. One-fourth of the sum is now available.

Golden, February 10.

San Juan County

I. Mather and John Cloucher have secured a 4-year lease on the Alda group from Robert Hoffman, says a report from Silverton, and have started development.

Teller County (Cripple Creek)

The January production of the Cripple Creek district was 69,726 tons of ore, valued at $1,285,971, an increase over the December output of about 2000 tons, although a shortage of water allowed the Stratton's Independence mill to run only part time. The New Portland mill on Battle mountain treated 13,000 tons of ore, the largest amount since it was put in operation a year and a half ago. The Portland mill at Colorado Springs treated a smaller amount than in December, but the ore had a higher average value than the 1911 figure. A reduction in tonnage there was caused by the change from the chlorination to the cyanide process. The Colburn mill, Battle mountain, of which A. M. Warwick is superintendent, treated 3000 tons. The Golden Cycle mill, Colorado City, had the largest tonnage in its history, treating 33,700 tons of ore. Its capacity is 35,000 tons per month. It is rumored that this mill will be enlarged to handle an increased output from its own mine. The production of the district has been tabulated as follows by the *Cripple Creek Times:*

Mill.	Tonnage.	Av. Value.	Total.
Golden Cycle	33,700	$20.00	$ 674,000
Portland	8,800	23.00	202,400
Smelters	3,800	65.00	237,000
Stratton's Independence	5,226	3.06	15,991
New Portland	13,000	2.97	37,610
Colburn	3,000	3.75	11,250
Wild Horse	1,000	5.00	5,000
Kavanagh	1,200	2.60	2,720
Grand total	69,726		$1,285,971

The January production of the El Paso mine was 130 cars of ore averaging $25 per ton. The production was as large as the ore-houses could handle. According to the figures by T. R. Countryman, the Roosevelt drainage adit was driven 200 ft. in the 31 days of January. The weirs at the portal of the adit have been washed away, making a measurement of the flow difficult. Mr. Countryman estimates the flow at 9500 gal. per minute. The New Portland mill made a new record for itself January 6, when it treated 503 tons of ore in the 24 hours. The United Gold Mines Co. in January produced 29 cars of ore. The

Vindicator Con. Gold M. Co. produced 72 cars, slightly over 2000 tons. The main shaft of the Vindicator, on company account, produced 60 cars of this account. The Cresson Con. M. Co. produced 1700 tons of ore averaging $25 per ton. The Golden Cycle M. Co., February 1, paid a monthly dividend of 2c per share. The Granite Gold M. Co. produced about 2000 tons of ore in January. The ore averaged about $20 per ton.

The old board of directors won the contest for control of the Isabella company, although James F. Burns, of Colorado Springs, was elected to the directorate. The board now comprises E. E. Quentin, A. C. Gardner of Denver, E. M. Kirton, James F. Burns, and Ira Harris of Colorado Springs. The annual stockholders' meeting of the Portland Gold M. Co., held at Cheyenne February 6, resulted in the reelection of the entire board of trustees, headed by Frank G. Peck of Colorado Springs.

The Trilby Mines Co. in January produced about 1000 tons of ore. During the same month the lessees on the Acacia Gold M. Co.'s property produced 400 tons, and Frank Caley, lessee of the Jerry Johnson mines, Ironclad hill, 40 cars. The annual meeting of the Ironclad M. & M. Co. will be held at Denver March 5. It is stated that a plan for paying off the indebtedness of the company will be considered.

IDAHO

Lemhi County

M. M. Johnson's plans for the big adit to connect the Gilmore Mining, Pittsburg-Idaho, and other properties directly with the railroad, have been approved by the capitalists back of the project. As soon as a new company, separate from the mining companies operating in the district, can be organized, actual construction will be started. Those back of the plan are heavily interested in the mines.

Shoshone County

The Stewart M. Co. has started construction work on the tramway from the new adit on Deadwood gulch to the Oregon-Washington Railroad & Navigation Co.'s tracks, west of the Bunker Hill & Sullivan mine. The tram will be operated by gravity to carry the loaded cars to the bins, now under construction.

J. W. Weyer, of Wallace, reports that a good supply of water is now available for power at his property on Cedar creek. The shaft is down nearly 70 ft. below the adit level. Five feet of concentrating ore has been exposed at the bottom of the shaft.

MONTANA

Silverbow County

(Special Correspondence.)—The production of the Anaconda company for the month of January was 26,350,000 lb. of copper, according to the official figures. The December output was 24,400,000 lb., and was the largest monthly production of last year, the next highest being in August, when the production was 22,500,000 lb. In all those figures the production of the North Butte and Tuolumne companies are included, as the ore of both companies is treated at the Washoe smelter. They have been averaging about 2,750,000 lb. per month, of which the North Butte company turned out 2,000,000 lb. Allowing 1,000,000 lb. for the East Butte company, the total production of this district during January was 27,350,000 lb. During the early part of February the amount of ore going to the Washoe smelter has been considerably above the average per day, but according to Mr. Thayer, the president, the production will be kept around the 26,000,000-lb. mark during the year.

Butte, February 11.

The Anaconda made a new record for itself, February 3, when it shipped to the Washoe smelter 271 cars of ore, containing about 13,500 tons. The previous record was 261 cars.

NEVADA

Clark County

It is reported that an orebody assaying about $15 per ton has been discovered on the 380-ft. level of the Princess shaft of the Searchlight Spokane M. M. Co. The mill will be put in operation soon.

A cyanide plant is to be added to the Lucy Gray mill, according to advices from Searchlight. The property, which is equipped with a Lane Chilean mill, is situated in the Sunset district, and is in charge of Carl Anderson. The general office of the company has been moved to Los Angeles. F. J. Gollmer has levied a $5000 attachment on the Treasure Gold M. Co. property.

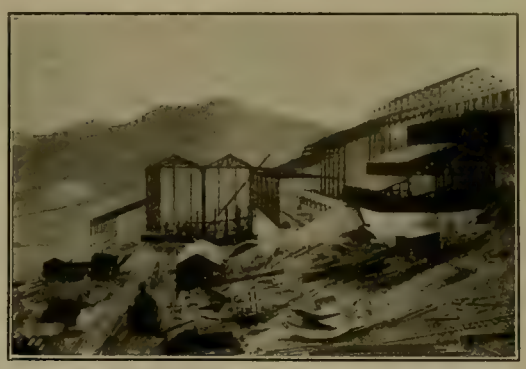
Elko County

It is reported that the Harriman system will build from Rogerson, Idaho, to Contact, in the northern part of the county.

Esmeralda County

The Silver Pick Consolidated has interseeted a new vein, it is reported, on the 120-ft. level, 12 ft. from the shaft. The shaft now is 133 ft. deep.

The Florence Consolidated, which has a lease on the Western Union No. 1 claim, is reported to have discovered rich ore 900 ft. south of the original Antelope district find. The company is a close corporation. The Goldfield



TONOPAH BELMONT MILL, NOW UNDER CONSTRUCTION.

Merger shaft has passed the 600-ft. level, after having been sunk 115 ft. during January. The compressor has been installed. At 530 ft. the shaft passed through quartz, which, however, was not pay-ore.

Humboldt County

The Nevada Superior Mines Co.'s 75-ton concentrator, 15 miles from Humboldt, has been placed in commission. J. W. Geiger is manager for the company.

Lincoln County

The president of the Nevada-Utah M. & S. Co. has filed in the United States District Court company schedules showing total liabilities of $185,033, of which $140,000 is secured, $44,256 unsecured, and $750 due for taxes, says the *Boston News Bureau*. Nominal assets are $309,488, of which $307,743 is for debts due the company. Among the secured creditors is the National Bank of the Republic of Salt Lake City, $21,500. Among debts due to the company are those of Nevada-Utah M. Co., $222,341, and the Imperial Gold & Copper M. Co., $17,434.

Lyon County

According to an announcement by W. C. Orem, the Bluestone mine is to ship 100 tons of ore per day to the smelter.

Nye County

Covering the side of the upper part of the main building of the Tonopah Belmont mill, shown in the cut, will be started in a few days. The ore-bins back of the mortars have been completed, and the general construction has so far advanced that the management is anxiously awaiting the delivery of more machinery.

The Round Mountain M. Co., in the quarter ended November 30, 1911, treated in its mill 15,936 tons of ore at a cost of $65,710. The net operating profit was $80,034. At the close of the period named, the company had on hand $107,566, according to the quarterly report of J.

R. Davis, president and general manager for the company. The Gibraltar M. Syndicate, operating in the Bullfrog district, complying with the Nevada mining law, has reported that on January 1, 1911, the company had on hand $470, and during the year has received $199. Expenses amounted to $401, leaving a balance at the end of the year of $268.

The production of the Tonopah district for the week ended February 10 was as follows: Tonopah M. Co., 3300 tons of ore; Tonopah Belmont Development Co., 2100; Montana-Tonopah M. Co., 1051; Tonopah Extension M. Co., 945; West End Con. M. Co., 775; total, 8171 tons, valued at $204,275.

STOREY COUNTY

The Belcher Silver M. Co. recently held its annual meeting, and the old board of directors was reëlected with George S. Sturges as superintendent. The annual report shows that work for the year closed was confined to the 200 and 300-ft. levels. At the Yellow Jacket mill 2655 tons of ore from these levels was treated, and 310 tons of ore from the 1400-ft. level. The 'recovered value' of the ore was $8388.

The Ophir produced during the week ended February 10 about 359 tons of ore averaging $33.61 per ton. The Mexican mill treated 398 tons of ore with a gross assay-value of $7144. The new classifier has been installed in the mill. The tailing for the week averaged $2.29. The Crown Point produced ore valued at $4300. The shipments for the week included 884 tons to the Yellow Jacket mill. Pumping was carried on as usual.

WHITE PINE COUNTY

The Giroux Con. Mines Co. has a 5-year contract with the Steptoe Valley S. & M. Co.'s smelter for shipments of 900 tons of ore per day as a minimum, and 1200 tons as a maximum. The contract is to become effective May 1. In the Giroux report for the year ended December 31, T. F. Cole, president of the company, stated that there was 4,000,000 tons of ore averaging 2¼% copper in the Bunker Hill group alone. The total developed ore, up to January 1, 1912, was 10,291,000 tons averaging 2% copper. In addition to this, there was 6,600,000 tons of ore averaging 1.65% copper. The company has a balance of $180,000 in cash and bonds. It is believed that a 9½c. cost can be maintained. The Butte & Ely Copper Co., over which the Giroux company has control, has an available cash balance of $250,000. While sinking the Giroux and Alpha shafts, together with the repairs to the Giroux shaft since the fire last August, cost a large sum, it is claimed that there is sufficient high-grade direct-smelting ore in these workings above the 1400-ft. level to more than compensate for the expenditure. It is not believed that the Giroux bonds mentioned will be issued, as arrangements have been made for any temporary financing that may become necessary. Giroux stock was asked in exchange for Butte & Ely Copper Co.'s stock at a meeting of the shareholders in the latter company recently.

The U. S. Geological Survey has announced the publication of a preliminary edition of the geologic map of Ely and vicinity. The final publication, now in preparation, will be a professonal paper describing the geology and ore deposits of the district. The boundaries of the formations indicated in the preliminary map are final, but the subdivisions of the Paleozoic sedimentary rocks, consisting of limestone, shale, and quartzite, are not indicated, nor the system of faults which intersect them. The map is intended to show accurately the boundaries and relative positions of the various areas of Paleozoic sedimentary rocks, the igneous rocks (monzonite and monzonite-porphyry) intrusive into them, and finally the rhyolite tuffs and lavas of Tertiary age which in places cover the older rocks.

NEW MEXICO

GRANT COUNTY

(Special Correspondence.)—Two units of the Chino Copper Co.'s mill are in constant operation. The third unit, owing to unavoidable delay in shipping the machinery, probably will not be in commission before April 1.

Hurley, February 10.

LUNA COUNTY

A report from Deming states that J. A. Kealey, sheriff, and Albert Schultz have discovered copper ore valued at about $15 per ton on their holdings in the Tres Hermanas district.

SIERRA COUNTY

A pump has been ordered for unwatering the Dude Good Luck mine, near Lake Valley. After the unwatering has been accomplished the shaft will be sunk from the 300 to the 500-ft. level. The Black Range M. & M. Co. has been organized to develop 11 claims in the Tierra Blanca district, says a report from Hillsboro. John McFarland, of Omaha, leads the incorporators of the company, which is capitalized at $1,125,000, and which acquired the property from S. A. Hoisinger.

SOCORRO COUNTY

(Special Correspondence.)—The Ernestine M. Co.'s clean-up for the last ten days of January yielded 9450 oz. gold and silver bullion, with a concentrate product of 9250 lb. The past week 694 tons of ore was milled. The ore-shoot discovered several weeks ago, remarkable for its size and richness, is producing a large amount of unusually high-grade milling ore. The new oil equipment recently installed is proving satisfactory and is saving at least $100 per day in power cost. The Alberta M. Co.'s drift on the vein is now in ore of an average milling grade. The Oaks Co. is erecting a gasoline hoist at the South shaft on the Pacific mine which will be in readiness for operation within a week or ten days. The adit on this mine had reached a point 232 ft. from the portal on February 1. Some good ore has been taken from the adit, and the South shaft is yielding several tons per day which is sent to the Deadwood mill for treatment. The drift from the North shaft, 47 ft. deep, has been extended south 25 ft. Two shifts are employed. One unit of the De La Vergne engine equipment at the Socorro Mines is being tried out, and the rest will be turned over soon.

Mogollon, February 9.

UTAH

JUAB COUNTY (TINTIC DISTRICT)

Development will be resumed on the Tintic M. &. Dev. Co. property, through the Sioux-Ajax adit, says a Eureka despatch. J. W. Moodie is manager for the company, a close corporation which has its principal holdings in the Bingham district.

Two raises from the 600-ft. level of the Iron Blossom have intersected ore. The present production of the Iron Blossom is said to be about 300 tons of ore per day, the ore ranging from $12 to $50 per ton. It is reported that the Iron Blossom company is earning about $120,000 per month. A rumor that the Swansea is to shut down has been denied. It is rumored that development may be resumed at the Plutus property.

PIUTE COUNTY

J. W. Young, manager of the Bully Boy & Webster property at Marysvale, recently stated that the mill being constructed there will be in operation before the end of March. Some of the machinery is new, while some was taken from the Bullion Canyon property, four miles away. There is said to be more activity in the Marysvale district than there has been for some years.

SUMMIT COUNTY

H. G. McMillan, general manager for the Daly West company, has issued a statement that the shut-down of the mill is only temporary, having been caused by a lack of water.

WASHINGTON COUNTY

B. Carpenter, of Bloomington, Joseph Riding, and Frank Bently recently reported the discovery of rich copper ore on their property, about 12 miles southwest of St. George.

WASHINGTON

SPOKANE COUNTY

Robert J. Maclean, secretary of the Spokane Chamber of Commerce, has advised J. F. Callbreath, secretary of

the American Mining Congress, that a guaranteed fund of $5000 has been subscribed to bring the 1912 convention to that city the latter part of November. A formal invitation also has been forwarded. An additional $5000 will be raised by public subscription, in the event Spokane is chosen, to entertain the delegates on a trip to the principal mines in the Coeur d'Alene, in Republic, and in the Slocan district of British Columbia.

CANADA

Ontario

January shipments from the Cobalt district amounted to 1237 tons of ore, a figure slightly lower than that for December and for the monthly average of 1911. The Cobalt Townsite company paid a dividend of 5% on February 12, the dividend requiring the disbursement of about $50,000. The company in 1911 shipped 720 tons of ore. A. C. Bailey is manager of the property. The Coniagas established a new record for itself with the shipping of 172 tons of ore during January. The Winyah Gold M. Co. has been formed in the Porcupine district to take over four claims in the Mountjoy part of the district owned by R. A. Cartwright. A. W. Grierson is manager for the company. Owing to the lack of water, the Apex mine, Porcupine district, has stopped operation. The Nipissing mill, which had been closed two weeks for repairs, has resumed shipping, and in the week ended February 3 shipped 43 bars of bullion.

MEXICO

Chihuahua

An aerial tramway has been ordered for connecting the Presena mine of the Alvarado M. & M. Co. with the Palmilla mill. Thirty-two towers will be used for supporting the rope, which will run 12,500 ft. between terminals. The discharge terminal will be of steel, and the towers of lumber. The capacity is to be 350 tons of ore per 10-hour shift. The Alvarado company is considering the resumption of development at the San Juanico mine, west of the Palmilla mill, now operated only in a small way by lessees. The mine has a 1250-hp. hoist. The shaft is 280 ft. deep. The first of the two tube-mills for the Alvarado mill is awaiting the installation of the motor, and the new Dorr thickener will be in commission in a few days.

The El Cristo property, Santa Eulalia district, has resumed operation. Norval J. Welsh is manager.

The production of the Parral district for the week ended January 20 amounted to 13,233 tons of ore, of which 3233 tons was shipped to the smelters and 10,000 tons was treated in the district plants. The production for December was 61,249 tons of ore.

The La Fe M. & M. Co. will resume operation on its properties in the Guadalupe y Calvo district. M. W. La Fayette, of Chicago, Oklahoma, is in charge for the company.

Sonora

(Special Correspondence.)—It is reported that the reorganization of the various Cieniguita companies is about completed on a very satisfactory basis, that the Mexican company will be clear and free of all indebtedness of every kind and character, and that the debts and obligations of the various holding companies will be taken care of. It is said also that the stockholders of the different holding companies will be completely protected in their interests. It has been authoritatively denied that John B. Farish, whose name has been mentioned in connection with the Cieniguita companies, is in any way interested in the corporations or the reorganization of them.

Sahuaripa, February 9.

The Empire M. Co. is planning to build a 3-unit Pittman mill on its Gold Cross property, adjoining the Pasquana mine, southwest of Cananea. The Muchado Grande M. Co., backed by New York investors, will build a concentrator on its property, near Alamos, and also will construct a railroad from the mine to Victoria, a station on the Southern Pacific of Mexico, according to recent advices from Cananea. At Tesla, five miles north of Navajoa, the Sisson interests will build the first of several concentrating plants to be erected on the west coast.

Among the Copper Mines

The Greene Cananea Copper Co.'s January production was about 5,500,000 lb. of copper.

It is rumored that the second unit of the Mason Valley smelter will be blown in by March 1.

Copper exports so far this month amount to 7248 tons, according to New York mail advices of February 8.

It is reported that the Cape Copper Co., the largest copper producer in South Africa, made a net profit last year of about $300,000.

The Calumet & Hecla M. Co., has ordered from the Allis-Chalmers Co. a 10,000-kw. turbine engine for its stamp-mills at Lake Linden. This will be the largest mixed-pressure turbine engine in the United States and will cost about $250,000.

The A. S. & R. Co. declared dividends at the regular quarterly rates for the last two months of 1911, of $1\frac{1}{6}$% on preferred and $\frac{2}{3}$ of 1% on common stock. The preferred dividend is payable March 1 and the common dividend March 15. The dividends were declared on two months instead of three to conform with the calendar year, and the next will be for the first quarter of 1912.

The Cananea Con. Copper Co. has acquired control of the Superior-Bonanza M. Co. and is considering the construction of a railroad from that property to the railroad station at Imuris. One of the shafts will be sunk from the 450 to the 650-ft. level, and development will be started as soon as practicable on the 450-ft. level, where some ore has been blocked. The Superior-Bonanza company is sometimes known by its former name, the Sonora Bonanza Mining Company.

January Copper Review

By Misha E. Appelbaum

During January copper had a slight reaction, but the first hands, being sold out, did not care to reduce their quotations, with the result that the dealers and speculators took all the orders in sight from $14\frac{1}{2}$c. down to 14c. As expected, however, when the January statement was published showing a reduction in the visible supply of 23,000,000 lb., copper immediately jumped to $14\frac{1}{2}$c., at which figure, at this writing, there is a very active demand, and with every indication that the metal is going higher.

Were it not for the fact that the general business situation has not yet shown any improvement, it would be a difficult matter to keep copper at the present level. A visible supply in the United States of 66,000,000 lb. means about one month's consumption. The visible supply abroad is larger, but even if that could be shipped to the United States, it would take several months until the refined copper would be ready for delivery. Statistically, therefore, copper is in a stronger position than at any time since 1907; in fact, it is in a stronger position than in 1907, for in that year we were at the end of a boom which lasted several years, while at present we are on almost the fourth year of a business depression, and even if the improvement does not set in for quite a few months, when it does come we will have a situation without any surplus of copper. Of course, as soon as copper crosses 15c., undoubtedly production will be increased, and this, together with the production from the new mines, would probably keep the market from advancing more than a cent or two; but I cannot help believing that the copper business has seen its worst, and that even without any marked improvement in business, the average price of copper for this year will show a very marked improvement over the last few years, and will even be above the average for the past fifteen years.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

HOWLAND BANCROFT is at Denver.

JOHN G. BARRY was at Parral recently.

FREDERICK LYON was at Kennett recently.

G. W. METCALFE was in San Francisco last week.

T. G. JANNEY was in San Francisco during the week.

C. E. BOYDSTON has returned to Berkeley from Arizpe, Sonora, Mexico.

J. P. HUTCHINS is examining platinum deposits in the Ural mountains, Siberia.

G. W. SCHNEIDER recently examined mining properties near Washington, D. C.

H. C. PARKER has been examining the Muney Creek mines, northeast of Ely.

M. OTAGAWA has returned to Ashio as manager for the Furukawa Mining Company.

GEORGE A. GUESS has accepted the professorship of metallurgy at Toronto University.

ALVIN B. CARPENTER has moved his office to the California building, Second street and Broadway, Los Angeles.

HOWARD POILLON has resigned the position of manager of the Vanadium Mines Co.'s mines and plant at Cutter, New Mexico.

HENRY D. BODDINGTON has gone to London on professional business, and expects to be absent from El Paso, Texas, about three months.

T. H. JENKS is making examinations in the Arizpe district of Sonora, and will then go to New Mexico, expecting to return to Denver early in March.

GEORGE GILMORE and V. M. WEIL, president and general manager, respectively, of the Standard Amalgamated Exploration Corporation, have been visiting Angels Camp.

NORVAL J. WELSH is manager for the Mexican Mines Development Co. and has an office at 229 Avenida Independencia, City of Chihuahua, for general examination work.

Obituary

JEROME A. SNEDEKER, a well known mining engineer and mine owner of Denver, died in that city on February 10. He came to Colorado in 1881 and settled at Aspen, afterward coming to Denver, where, in association with A. E. Reynolds, he practised as a mining engineer with material success. Recently, while on a visit to Duluth to attend a meeting of the Giroux Consolidated Copper Mining Co. he contracted ptomaine poisoning and passed away after a brief illness.

JOHN WILLIAM QUICK, a well known citizen of San Francisco, who died January 7, was born in Ireland in 1839. He came to California in 1854 and engaged in the iron rail manufacturing business. Seeing that there was a demand for screens for mining machinery, he started in the business of manufacturing them, inventing special machinery and improving methods of punching steel, sheet iron, and copper. Success marked his efforts, and the superiority of his products made his name well known wherever mining was carried on. His thorough business methods and integrity made for him many friends. He belonged to the Chamber of Commerce and the Merchants Exchange and was always a worker for the uplift and progress of the city of his adoption. Mild and gentle in his manner, never aggressive and always forgiving, he passed his days loved by his fellowmen. His judgment was remarkably clear and was often sought after. He was a self-made man in every sense of the word and was proud to belong to that little band of Argonauts that are passing so rapidly away.

Market Reports

LOCAL METAL PRICES

San Francisco February 15.

Antimony	11—11½c	Quicksilver (flask)	47.00
Electrolytic Copper	15—16¼c	Tin	47—48¼c
Pig Lead	4.25—5.20c	Spelter	7¼—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

Average daily prices in cents per pound, based on wholesale transactions, standard brands.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Feb. 8	13.85	4.00	6.47	59⅝
" 9	13.93	4.00	6.47	60⅛
" 10	14.05	4.00	6.47	60⅛
" 11	Sunday.		No market.	
" 12	Holiday.		No market.	
" 13	14.08	4.00	6.50	60⅛
" 14	14.08	4.00	6.50	60

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, Feb. 15.		Closing Prices Feb. 15.
Adventure	6¼	Mohawk	$ 53½
Allouez	40½	North Butte	26⅛
Calumet & Arizona	60¼	Old Dominion	46
Calumet & Hecla	420	Osceola	111
Centennial	18⅜	Parrot	——
Copper Range	52	Shannon	9¼
Daly West	5	Superior & Boston	3¼
Franklin	12⅜	Tamarack	28½
Granby	35	Trinity	5⅛
Greene Cananea, ctf.	7⅛	Utah Con	15
Isle-Royale	24⅛	Victoria	4⅜
La Salle	4½	Winona	7
Mass Copper	7⅛	Wolverine	99

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, February 15.

Atlanta	$ .17	Mayflower	$ .02
Belcher	.78	Mexican	3.85
Belmont	9.05	Midway	.25
B. & B.	.16	Montana-Tonopah	1.00
Booth	.06	Nevada Hills	2.35
Chollar	.20	Ophir	1.52
Combination Fraction	.15	Pittsburg Silver Peak	1.22
Con. Virgina	.84	Round Mountain	.47
Florence	.58	Savage	.34
Goldfield Con.	4.45	Tonopah Extension	1.47
Gould & Curry	.08	Tonopah of Nevada	7.00
Jim Butler	.36	Union	1.32
Jumbo Extension	.21	Vernal	.17
MacNamara	.25	West End	.80

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, February 15.

Associated Oil	$44.00	Peerless	$ 4.50
Brookshire	.54	Pinal	3.62
Caribou (New Stock)	1.25	Premier	.48
Claremont	.75	P. S. Petroleum	.18
Coalinga National	.13	Republic	.35
Con. Midway	.02	Silver Tip	.75
Empire	1.05	Sterling	1.47
Enos	.04	S. W. & B.	.20
Maricopa 36	.85	Turner	1.00
Midway Premier	.27	Union	98.12
Monte Cristo	1.30	United Oil	.40
Palmer	.71	W. K. Oil	2.25

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. Feb. 15.		Closing Prices. Feb. 15.
Amalgamated Copper	$ 64¼	La Rose	$ 3½
A. S. & R. Co.	71½	Mason Valley	12
Braden Copper	5½	Miami Copper	23⅛
B. C. Copper Co.	4	Mines Co. of America	3½
Butte Coalition	22½	Nevada Con	18⅛
Chino	25⅜	Nevada Utah	1/16
Davis Daly	⅝	Nipissing	7½
Dobie	⅛	Ohio Copper	1
Dolores	3½	Ray Central	2
First National	2½	Ray Con	16½
Foley O'Brien	⅛	South Utah	⅛
Giroux	4⅜	Superior & Pittsburg	17
Goldfield Con.	4⅜	Tenn. Copper	35⅛
Greene-Cananea	8	Trinity	5⅛
Guanajuato Con.	⅛	Tuolumne Copper	3½
Hollinger	12	United Copper	1½
Inspiration	18½	Utah Copper	56⅞
Kerr Lake	2⅞	Yukon Gold	3⅜

The Portland Gold Mining Company

The annual report of the president of this company, F. G. Peck, notes numerous changes in the mine and mills at Victor and Colorado Springs in the year ended December 31, 1911. The process of treatment at Colorado Springs has been changed from chlorination to cyanidation, with material reduction in the cost of treatment. At the Victor mill, an increase in capacity, due to the readjustments made and others now about completed, will also reduce the cost of treatment. The tailing from this mill has heretofore been stacked on the surface, but it is now used to fill old stopes. This reduces the cost of taking care of the old stopes and keeps the surface entirely free for mining operations. The Portland mine is now free from water, due to the success in cutting several water courses by the Cripple Creek deep drainage tunnel, and preparations are being made for mining on the lowest level, where four ore-bodies are exposed.

The Victor mill was erected for the express purpose of treating the low-grade telluride ores, without roasting, using cyanide of potassium in connection with the 'Portland process.' During the past year changes were made which have brought about a marked increase in capacity. In January 1911 the mill was able to treat only 8052 tons, but in December it handled 12,285 tons, of a gross value of $35,432.15, or an average value of $2.80 per ton. Of this amount, $28,533.73, or 80.5%, was recovered the cost of treatment at the mill being $1.1317 per ton. During the entire year there was treated at this mill 120,961 dry tons of reject, or waste rock, of a gross value of $424,489.15, averaging $3.51 per ton. Of this amount, $345,567.98 was recovered, this being an extraction of 81.4%. The net profits at the mill for the year were $128,738.72, this profit being derived solely from what hitherto has been worthless rock. The profits of this mill will be a very important item in the future, as a sufficient tonnage of this ore is available to keep the mill running for a number of years to come.

At Colorado Springs the mill management for some time past has recognized that the cyanide process is the most up-to-date method for the chemical treatment of gold ores that require roasting, and it has recommended the use of cyanide of potassium in place of chlorine gas as a solvent for gold. This substitution has long been under consideration, and the change is now being made and will be completed about the middle of March. The plan adopted is to treat the ore as heretofore until it reaches the hoppers over the chlorination barrels; here the ore will be diverted to tube-mills and slimed in cyanide solution, the pulp passing to two 200-ton Merrill filter-presses for filtering. These presses are similar to those used at the Homestake mill in South Dakota, where a world's record for efficiency and low cost of operation has been made. The rich gold solution from these presses will be precipitated on zinc-dust, which has proved so economical at the Victor plant.

Mine operations for the past year have been conducted as during the previous year. Twenty new stopes have been opened and more ore placed in sight than was taken out during the year. In mining the shipping grade of ore for the Colorado Springs mill, the stopes were at the same time stripped of the low-grade ore for the Victor mill. The low-grade ore from the mine, together with the reject from the ore-houses, was practically sufficient to supply the Victor mill, but when necessary the dump was drawn upon to keep the mill running at its full capacity. During December work was started preparatory to developing the ore that has been under water since the pumps were pulled on July 1, 1909. This is of better average grade than that mined and shipped during the past year. The cost of mining operations during the past year was increased by the expenditures made to secure economy in future operations and covering plans for filling stopes, and some necessary rebuilding. On account of the troubles arising from fires and bad gases at various mines, life-saving and fire apparatus has been bought. The United States Bureau of Mines officers spent sufficient time at the mine to drill 20 men to handle this apparatus, and each of the men received certificates as to their competency.

Up to January 1 the known permanent drainage from the Portland mine by reason of the deep drainage tunnel, was about 80 ft. The total contributions of the Portland company toward defraying the expense of driving the tunnel have been about $60,000. If the property is drained to the tunnel level, which is about 730 ft. below the present workings of the mine, the cost for drainage will be less than $100 per vertical foot. When general mining operations were last conducted below the water-level, the cost for permanent drainage secured by pumping was $6500 per vertical foot. The heading of the deep drainage tunnel is now in open seamy ground, and another large water-course should be cut within 500 ft. The flow from the tunnel is now about 10,000 gallons per minute.

The net profit for the year was $380,579.35. The total cost of the Victor mill was $338,580.96, and the profit of $128,738.72 for the year 1911 shows a return of 38%. On January 1, 1912, after all bills and costs of operation for the year had been paid, the available assets were of the cash value of $346,066.01, consisting of ore in the bins and paid for, $133,338.15; storehouse supplies bought and paid for, $115,704.31; and cash in the bank, $97,023.55. Development during the year amounted to 9520 ft. and the total to date is nearly 45 miles. Total production has been 1,318,262 tons, with a gross value of $32,827,058, from which dividends to the amount of $8,917,080 have been paid.

Operation for 1911

Gross value of ore mined and shipped		$1,140,051.05
Gross value recovered by new mill		345,567.98
Net cost of mining and milling	$1,114,708.24	
Gross profit on operation	370,913.79	
	$1,485,622.03	$1,485,622.03
Gross profit, as above		$ 370,913.79
Interest, discount, and exchange		9,275.73
Revenue from other sources		389.83
Net profit on operation of mine and mills	$ 380,579.35	
	$ 380,579.35	$ 380,579.35

Surplus or Profit and Loss Statement for 1911

Balance January 1, 1911		$2,402,100.31
Net profit as above		380,579.35
Sundry losses on railroad claims	$ 539.21	
Dividends paid	240,000.00	
Depreciation:		
Value, in place, of ore mined	$196,967.27	
Mine property	86,757.03	
Mill property	92,307.06	
New mill property	32,319.20	
Permanent equipment	36,534.98	
Office furniture and fixtures	585.77	
R.R. rolling stock	1,321.80	
Drainage tunnel	11,733.36	
	458,526.97	
Balance to 1912 acct.	2,083,613.98	
	$2,782,679.66	$2,782,679.66

Cash Receipts and Disbursements for 1911

Balance January 1, 1911	$ 134,848.98	
From operation of mine and mills	2,384,613.20	
Bills receivable	24,128.02	
Sale of junk and revenue from all other sources	13,925.21	
Vouchers and pay checks		$2,220,191.86
Dividends paid		240,000.00
Balance January 1, 1912		97,023.55
	$2,557,515.41	$2,557,515.41

The iron ore mines near St. Olga, in Siberia, produced 2000 tons of magnetic iron ore in 1910, as against 1000 tons in 1909.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

LIABILITY FOR INJURY TO SURFACE

Where a vendor sells and conveys coal in place with the right to enter, excavate, and remove all coal purchased, the grantee is not liable where the removal of all the coal necessarily causes the surface to break or subside.

Armstrong *v.* Maryland Coal Co., (West Virginia) 69 Southeastern, 195. October 1910.

FAILURE TO PERFORM ASSESSMENT WORK

A failure to perform the annual assessment work on a mining claim does not of itself work a forfeiture of the claim. It only permits a re-location and cannot aid an adverse location which was made prior to the year in which the failure occurred.

Bingham Amalgamated Copper Co. *v.* Ute Copper Co., 181 Federal, 748.

INJURY TO MINER—KNOWLEDGE OF INCREASED DANGER

Whether or not the owner and operator of a mine owed a miner of only two months' experience in an iron mine, and with the knowledge he had gained of the character of the work in which he was working, the duty of warning him of the increased danger of the falling of a large body of ore from the roof of a raise, because the timbering had been delayed for six hours longer than usual, is a question of fact which the jury must determine from all the circumstances in the case. But if the miner knew of the increased danger because the timbering was delayed six hours longer than usual, or if in the exercise of ordinary prudence, he should have known of such danger, he cannot recover.

Hosking *v.* Iron Mine Co., (Michigan) 128 Northwestern, 777. December 1910.

MINING LEASE OF INDIAN LANDS

The United States statute authorizes the leasing of Indian allotments within the limits of the Quapaw agency, subject to the condition that such lease should not extend for more than ten years for mining purposes. Under this statute an Indian allottee has power to lease his land in any manner and for any consideration, except that the term cannot extend beyond the prescribed time. And where an Indian leased his allotment for mining purposes for ten years, but before the expiration of such lease he granted another lease to the same person for a similar term to run concurrently without accumulation of periods, the second lease operated as a surrender of the first, and was therefore not a violation of the statute.

United States *v.* Abrams, 181 Federal, 847.

DUTY OF MINE OWNER TO FURNISH SAFE PLACE FOR MINER TO WORK

The doctrine as to the duty of a mine owner or operator to furnish a safe place for miners to work has no application where the miners themselves are engaged in construction of a new shaft by excavation and timbering, and where the use of a platform is only an incident in the preparation of the shaft in which ordinary mining operations are to be carried on while the shaft is in process of construction. But the mine owner in furnishing planks for use as staging while such new mining shaft is being constructed, owes to the employees using the staging the duty of furnishing material reasonably fit for the particular purpose; and if he furnishes material which in its nature is unfit for the work for which it is used, an inexperienced servant or miner who has no knowledge of such unfitness, and is injured by the falling of the platform, may recover. But in such case the mine owner is not liable for mistakes or negligence in the selection of materials by workmen engaged in the work in the shaft with the person who was injured, where they are all working under the same direction.

Riskn *v.* Iron Cliffs Co., (Michigan) 128 Northwestern, 747. December 1910.

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

STAMP-MILLING, A TREATISE ON PRACTICAL STAMP-MILLING AND STAMP-MILL CONSTRUCTION. By Algernon Del Mar. Pp. 134, Ill., index. McGraw-Hill Book Co., New York, 1912. For sale by the *Mining and Scientific Press*. Price $2.

This is a condensed general treatise covering both construction and operation of stamp-mills. The history, principles, and practical workings of stamp-mills are discussed in separate chapters, as also the limitations of single and five-stamp unit batteries, and the process of amalgamation. A long and interesting chapter discusses stamp-mill construction, and in it full place is given to the modern use of concrete in connection with stamp-mills. The illustrations are abundant, and many are excellent, though such as that given on page 73 could be left out to great advantage, as it shows obsolete types of construction, incorrect cam curves, and the ore-bin planking at a different angle from the timbers upon which it is supposed to rest.

The book contains a great deal of information of value to stamp-mill operators, but faulty editing and proof-reading detract greatly from its value. Typographical errors are plentiful. For example: Page 12, third line, "motor" should have been mortar; same page, "Damerest" should have been Demarest. This latter typographical error is repeated on page 5. Page 54, "Columbia" should have been Colombia; page 85, "barral" instead of barrel; page 120, "convas" should have been canvas; page 116, Fig. 85, "bootless" should have been boltless. Page 113 states that Fig 78 on page 112 shows a two-key tappet. The illustration referred to, however, shows a three-key tappet. The punctuation through the book is so faulty that it is at times difficult even for a man thoroughly familiar with the subject to get Mr. Del Mar's meaning. Many of the sentences and statements are so involved as to be practically meaningless. Page 12, for instance, states that "the amount of ore going through a screen, varies inversely as the square of the size of the openings and so far as I can frame a mathematical law by actually varying the discharge with the other factors constant nearly inversely as the square root of the height of discharge, although the latter factor is influenced by the interior and shape of the mortar."

Differences of opinion make discussion interesting, but few engineers will agree with Mr. Del Mar when he states (page 73) that "the only point in its favor [front-knee battery frame] is that the tight side of the driving belt is uppermost." This is a direct contradiction of one of the elementary principles in the design of horizontal belt or rope drives. We are quite sure that if he will reflect a little he will remember that the lower side of the belt should always be the drive or tight side so that the slack would come at once at the upper side to take advantage of the increased arc of contact and diminish the power losses due to slippage. It is true that the designers of earlier types of front-knee battery frames using the horizontal drive were compelled either to have the tight or drive side of the belt at the top in order to keep the cam-shaft in the boxes, when the boxes were placed at the front of the posts, or else put the cam-shaft at the back of the posts and revolve the cams in the other direction in order to have the lower side of the belt the tight or drive side. Either method has many disadvantages, and the front-knee frame in general is merely interesting from an historical point of view, as it is an obsolete type.

We must frankly confess our disappointment in this book, since Mr. Del Mar's ability as a mill operator is well known, and readers would naturally expect from him a much larger amount of material helpful in daily practice than he has given. This only goes to prove that conspicuous ability in one line does not necessarily mean the same ability in another. Technical writing is an art in itself and the ability to express one's self clearly and fluently in writing is a faculty that requires careful cultivation and training.

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EDITORIAL

CALIFORNIA gold dredges in 1910 produced gold to the value of $7,550,254, nearly two-fifths of the total for the state. Progress in this great and profitable industry has been due in large measure to the skill and ingenuity of the designers and constructors of dredges, and it gives us pleasure to present in this issue the first of a series of articles, originally contributed by Mr. Robert E. Cranston to the *Journal* of the American Society of Mechanical Engineers, upon the mechanical features and design of the California gold dredge.

DISTRIBUTION of mineral products over the earth's surface exhibits many peculiarities and is a phase of scientific inquiry well worthy of more extended and extensive study than it has yet received. Russia has a natural monopoly of platinum production, for much prospecting has so far failed to discover elsewhere any deposits containing more than small quantities of that metal. Diamonds seem mainly confined to the southern hemisphere of the globe, and tin, while more generally distributed, is curiously limited in its occurrence. Germany possesses the only large deposits of potash salts, while Chile has a natural monopoly of nitrates. Some general features of the causes of so peculiar a distribution are recognized, but much might be learned by a more thorough study of mineral associations.

GOLD and soot both descend on London in large quantities; perhaps the urban dwellers, having the gold, feel they can put up with the soot. Elsewhere in this issue Mr. T. A. Rickard contrasts entertainingly these two striking features of London life, and many of our readers will marvel that Englishmen, usually so jealous of their rights, are content to tolerate the ever-present nuisance of a pall of soft-coal smoke, with its concomitant blinding, choking fog. In New York City the burning of bituminous coal is not even permitted, while in other American cities its use is hedged about with restrictions which provide for practically smokeless combustion. And in California the citizens of a small town have for some years sought to secure the closing of a smelter which is emitting small quantities of SO_2 at a point five miles distant from them. To grope and choke in a London 'dreadful' is an experience, for the first time. But London smoke and fog is all so unnecessary, and its persistence is surely an evidence of the moment of inertia of the mass action of humanity.

SYSTEM is the aid by which large quantities of work can be done with the minimum of individual attention, and in these modern days of demand for large output at small cost it is almost universally invoked. System, however, presupposes attention to detail, and we therefore beg to call a minor matter to the attention of our correspondents, whose letters to the editor form one of the most interesting and helpful features of each issue. Such letters are often made by our correspondents a portion of a longer letter, not intended for publication, so that part must needs go to the letter file and part to the composing-room; an

awkward subdivision. If our friends would devote a separate sheet to matter intended for publication, expedition, the co-ordinate of accuracy, would be aided and the editorial staff would be correspondingly grateful.

DISAPPEARANCE of the lines of demarcation which have heretofore separated the various groups dominant in copper mining is an interesting and important feature of present-day finance. Widespread comment has been made upon the various interests represented in the Inspiration Consolidated Copper Company, and other later developments are evidencing a fixed policy in this regard. The flotation of a large copper corporation is impossible, owing to the attitude of the Federal authorities, but control—actual physical and financial control—is not impossible, and apparently this end is to be sought through a degree of co-operation similar to that prevailing in the steel industry. Directorates of the chief companies include one or two representatives of the leading competitors. Recent moves in this direction are seen in the participation of Lake Superior interests in Arizona properties and the placing of a Utah Copper representative on the board of one of the more important developing mines of Butte. A Boston firm which has always been identified with the copper interests centring in and around Duluth has now become interested in the Southwestern Miami Development Company, and Messrs. R. T. McKeever, vice-president of the Copper Range, and Thomas S. Dee, of Paine, Webber & Company, have been elected to the board of the Development company. The second instance is the election of Mr. D. C. Jackling, vice-president and general manager of the Utah Copper Company, to a place on the board of the Butte & Superior Copper Company. Neither move would be particularly significant if taken alone, but as indications of a general drift they may well be considered so.

TOPOGRAPHIC mapping of the United States is not exclusively the province of the United States Geological Survey, as some may suppose, for the survey and mapping of the coasts of the United States and the territories under its jurisdiction is the duty of the Coast and Geodetic Survey, which is under the direction of the Secretary of the Treasury, while the Geological Survey is under the control of the Secretary of the Interior. Though perhaps less well known, the Coast Survey is the older, having begun its work in 1807. In addition to the publication of sailing charts, tide tables, and other aids to navigation it is, with the co-operation of a Boundary Commission, charged with the duty of fixing the boundaries of the United States, and some phases of this part of its work are interestingly described elsewhere in this issue by Mr. O. H. Tittmann, superintendent of the Survey. In the discussion following Mr. Tittmann's address an interesting point was brought out, hinging on the fact that a large part of the boundary between the United States and Canada is designated by international agreement as the forty-ninth parallel of latitude. This seems precise, but as a matter of geophysical fact the axis of rotation of the earth is not fixed, but varies, with a period of about fourteen months, leading to a corresponding variation of latitude, so that if a point upon the boundary is precisely fixed on a given date, and a new point determined with equal precision seven months later the two may be as much as 50 or 60 feet apart on the ground. But if Nature is capricious, man is no less ingenious, and it is worth noting that for the computation of tide tables, prepared in advance for each year, an undertaking formerly requiring an enormous amount of labor by a corps of expert computers, a machine is now being devised which carries out the complicated computations with the infallible precision of a mechanical operation.

TELEGRAPHIC reports from New York indicate that the meeting of the American Institute of Mining Engineers held in that city this week was well attended and harmonious. While proxies had been collected by two different committees, there were no great differences of opinion, everybody showing an earnest disposition to coöperate in any movement for the good of the Institute. The candidates for office as proposed by the nominating committee were all elected, though not by equal votes. The principal difference of opinion was with regard to new members of the Board of Directors, the body which manages the business affairs of the Institute. Messrs. E. B. Kirby, George C. Stone, and Charles F. Rand, nominated by Mr. F. L. Garrison, and seconded by Mr. F. F. Sharpless, were elected. A committee consisting of the new president of the Institute, Mr. J. F. Kemp, and Messrs. C. R. Corning, Albert Ledoux, W. N. Nichols, Jr., and George C. Stone, was appointed to study the affairs of the Institute to determine whether or not economies may be effected in its administration that will remove the necessity for raising the dues. Pending the report of this committee, which is to be made to the Board of Directors not later than June 3, action on the proposed amendments was postponed. This action will commend itself to the judgment of all members of the Institute. If after a full investigation by an independent committee it appears that more income is necessary, we feel sure that the members will gladly vote for the proposed higher dues. If possible, however, rates should be kept low and every effort made to enable the Institute to serve the largest number of men engaged in mining and metallurgy. To the new officers we extend congratulations and good wishes and we feel sure that we voice the sentiments of the entire profession in extending equally hearty good wishes to Mr. Charles Kirchhoff, the retiring president, and the others who have labored with him to make the past year one notable in the history of the Institute. That the year may prove equally significant is the general wish.

Quicksilver

Revision of the chemical tariff is proposed in the bill introduced into the House of Representatives by Mr. O. W. Underwood, representative from Alabama. This tariff affects minerals, ores, and metals, and in previous issues some provisions of the act, which has been passed by the House during the week, and is now before the Senate for consideration, have been commented upon. The bill provides for a general decrease in duties upon mineral substances, and a feature of it which is of much interest to producers in California and Nevada is a provision for a reduction of the duty upon quicksilver from 7 cents per pound to an *ad valorem* duty of 10 per cent. Except as part of a general revision downward there seems to be no good reason for such a reduction of duty, while, on the other hand, there are good reasons against, arising out of the peculiar situation in the quicksilver industry. Most of our readers are aware that in the production of quicksilver the United States does not hold the important position that it does in the production of some other metals. The main supply of this metal comes from Almaden, in Spain; Idria, in Austria; and Monte Amiata, in Italy, the United States production, drawn chiefly from California, serving to meet the demands of the domestic market and supply a small and fluctuating amount for export. The quicksilver mines abroad are under the control of the Rothschilds, while those of the United States are in the hands of independent producers, so that outside the United States a virtual monopoly is enjoyed. Taking the average of producers, quicksilver production is not a very profitable business, the margin between operating cost and selling price being, on the whole,

not a large one. As a result, many producers in America only operate in times of high prices, closing down with a falling market. This operates to steady prices. The protective duty serves in this instance to counteract the lower labor costs of the foreign producer and to protect the American operator against a manipulated market. Decrease of this protection would operate to close down all but the most profitable of the American mines and give the monopoly a free hand. The sum involved is not a great one; the value of the total yearly production of quicksilver in the United States approximates a million dollars, but the principle involved is important. While engaged in 'busting trusts' at home, it is obviously inconsistent to clear the way for a foreign monopoly.

Political Straws

Miners are constitutionally peripatetic, and often spend the larger part of their lives in regions distant from their native land. Separation in space does not involve separation in interest, however, and the most patriotic American is frequently the expatriated one. To all such, the political happenings of the day at home are a topic of intense interest. Their interest often finds too little satisfaction, for, though foreign journals now pay more attention to American affairs, they have not yet completely outgrown the attitude of the days when, as a friend relates, an American, hungering for news of home, at last perceived an item in an European journal and, seizing it, learned that—Josh Billings had had a fit! For such expatriates we will endeavor to sketch some salient features of the preliminaries to the approaching presidential campaign. Our friends at home will pardon us, we hope; the more freely because they know we are tied by no strings and are committed to no policy except to tell the truth, fearlessly, so far as it is vouchsafed us to know the truth.

Among the Democratic forces the search for a leader to conduct them from the minority wilderness is engrossing attention. Mr. Bryan, the doyen of the party, has maintained a non-committal attitude, refusing to make any statement as to whom he would endorse. Among those prominently mentioned are Mr. Judson Harmon, of Ohio, and Mr. O. W. Underwood, of Alabama, while prostituted journalism, as exhibited in the Hearst papers, is lending all its aid to the support of Mr. Champ Clark. Mr. Woodrow Wilson has loomed largest as a possible candidate, and at first showed much strength, but more recently what seems to have been a skillfully engineered attempt to 'do him in the eye' has not been without its effect. Items derogatory to Mr. Wilson managed to gain an astonishing amount of publicity, and finally a letter written by Mr. Wilson in 1907, expressing a not unnatural desire to see Mr. Bryan 'knocked into a cocked hat,' was made public. This seems to have failed of its intended effect of alienating Mr. Bryan's friendship, but injected a certain amount of humor into the situation, and amusement was heightened by the disclosure that Mr. Wilson had begged *Harper's Weekly* to be so good as to cease supporting him, as it was weakening his chances of nomination. Here again friendship does not seem to have suffered materially, but in America it is fatal for a leader to get the public laughing at him, rather than with him, and the indirect effect of all these episodes has undoubtedly served to weaken Mr. Wilson's chances of nomination, and, if nominated, of election. There is no pre-ëminent Democratic figure at present, and opportunity bids fair to escape ungrasped, for there can be but little doubt that if the Democratic forces were able to select some strong man and put him early in the field their chances of success in the coming election would be better than at any time in the past fifteen years.

On the Republican side many names have been mentioned. Messrs. Albert J. Beveridge, Hiram Johnson, and A. B. Cummins are suggested by the forces of their respective states, and it is said that Mr. H. S. Hadley, of Missouri, will be urged by his partisans to become a candidate for the nomination. Mr. Robert La Follette was regarded as a strong candidate until, following an intemperate and indiscreet speech before the Periodical Publishers Association on February 2, he was withdrawn, protesting, by his supporters. The impression is general that as a candidate he has destroyed himself, and the choice has now been reduced to Mr. Theodore Roosevelt or Mr. W. H. Taft. Mr. Taft is frankly desirous of reëlection, and, like every other president, is in a strong position to dictate his renomination, just as Mr. Roosevelt dictated his nomination in 1908. There can be little doubt that, aside from this advantage, Mr. Taft would have but little chance of renomination, for it is unquestionable that, for one reason or another, his administration has failed from the beginning to command the general confidence of the people in either its sagacity or firmness. In spite of Mr. Roosevelt's declaration that he could not be a candidate for a third term, a strong element in the party seems bent upon shanghaing him, and the governors of a number of important states have declared themselves advocates of his nomination. And why not? Speaking editorially in our issue of March 6, 1909, we said:

"Mr. Roosevelt in his seven or eight years of power has accomplished what otherwise might have required the time of a generation. And this is what the mass of the American people like, having made up their minds that something had to be done to check the corruption that was sapping the foundations of industrial civilization from New York to San Francisco, and from Chicago to New Orleans. He made blunders, but they are deemed well meant; he proved himself a deft politician, but the wires on which he played were occasionally too evident; he was boisterous in his praise of friends as in his condemnation of enemies, but that was considered his breezy way. The public at large took him at his word and liked to see human frailties that brought him closer to themselves. 'He made good'."

Since that time Mr. Roosevelt has traveled widely in European countries and has doubtless benefited by a first-hand acquaintance with other methods of government. Returning to America, he has shown an unexpected degree of self-control in not interfering in governmental affairs, a temptation which Mr. Taft's bungling methods must often have made almost irresistible. His public utterances have been marked by a greater degree of moderation, and his views and methods of action now appear less extreme. If the American people should refuse to allow a convention, created in the early days of escape from monarchical tyranny, to restrict their choice of president, who shall say that they have acted unwisely? At every change of chauffeurs the steering wheel of the automobile is bound to wobble. Unquestionably the change of administration every four years leads to a wobbling throughout the whole industrial machine and, despite the views of the fathers of the republic, it may well be open to question whether we should not do better to get the best chauffeur available and then keep him at the wheel as steadily as possible. In 1797 it may have seemed possible that a great leader might achieve sufficient dominance to make himself dictator or king, but in the year of grace 1911, when even China has become a republic, such a thing is not within the wildest dreams of any crack-brained enthusiast. Beneath an oftentimes almost facetious outlook upon life the American people have a steadiness of purpose and clarity of vision that usually succeeds in obtaining whatever they think they want, at the time. In choosing a president for the next four years this trait will exhibit itself, without a doubt.

Gold and Soot

By T. A. Rickard

These two products not inaptly typify the energies of the city of London. Taking the more valuable first, I note that the quotation for bar gold remained at its minimum of 77s. 9d. throughout 1911. A price for gold, except in terms of staple commodities, seems strange. As used by bullion-brokers and bankers, it refers to the demand for gold to equalize bank reserves; in effect, the slight difference in the quotation represents the variation in the rate of foreign exchange. Next let us turn to the exports and imports of bar gold. With the figures expressing the latter, my readers are conversant, for they reflect the gold production of the various parts of the British dominions, but the exports give us unfamiliar information concerning the destination of the miner's produce. The figures are given by Samuel Montagu & Co., as follows:

IMPORTS		EXPORTS		PRODUCTION.	
Transvaal	£33,505,000	British India	£7,755,000	Transvaal	£34,991,620
Rhodesia	2,305,000	Germany	5,305,000	Rhodesia	2,647,895
British India	2,250,000	France	4,520,000	British India	2,150,050
South and Central American States	1,200,050	Holland	940,000	South and Central American States	3,250,000
Australia	1,050,000	Turkey	800,000	Australia	11,882,365
West Africa	940,000	Russia	480,000	West Africa	1,069,442
Natal	670,000	Switzerland	465,000	Natal	*Nil*
France	575,000	Austria	175,000	France	255,000
Java, etc.	460,000			Java, etc.	480,000
New Zealand	320,000			New Zealand	1,808,049

I have supplied the third column, giving the output in 1911, as this shows how much of it came to London. Obviously London receives practically all of the gold produced in the Transvaal, Rhodesia, West Africa, and British India. No mint exists in any of these regions. Most of the Australian gold is coined at the Sydney and Perth mints; likewise a large part of the New Zealand gold goes to Sydney to be turned into sovereigns and half-sovereigns. The gold credited to Natal must be Transvaal gold that is shipped from the port of Durban, in Natal, for the province of Natal produces no gold. France yields about one-half of the gold imported to London from that country, so that the total represents banking exchange. This is also expressed by exports. In 1911 the international balance was enormously in favor of Great Britain, therefore exports of gold predominated. This was accentuated by the political crisis at Berlin and Paris. In July the Moroccan incident caused Germany to take gold from London, and France to receive gold from New York. British India is a sink for both gold and silver, the natives hoarding them persistently. The Bank of England increased its stock of gold coin and bullion from £30,548,895 at the end of 1910 to £31,732,115 at the end of 1911. The ultimate destination of this metal is indicated by the export of sovereigns.

The world has a great fondness for sovereigns, despite the spread of democratic ideas. The British sovereign passes current without discount, and usually at a premium, in every quarter of the globe. It contains 916.6 gold per 1000 and the rest by law is 'alloy'. In practice this is mostly copper. The silver in old sovereigns is 10 or 15 parts per 1000, but in new coins made from refined gold it is only 1 or 2 parts per thousand. Sovereigns lose in weight, by attrition. On 100,000 sovereigns in circulation the loss is about £20 per annum. This goes to form an ore deposit for posterity. In 1910 the Mint report estimated that in 10 years the circulation of sovereigns increased by £13,000,000. India and Egypt, as well as foreign countries, prefer this form of gold in settling their balance of trade. The Indian Government reported a net importation of 8,162,000 sovereigns and £7,609,000 in bar gold during the fiscal year 1910-11. Last year the Nile flood was lower, so that, despite the help of the Assouan dam, the cotton crop proved poor; hence £4,000,000 less of gold was required. India, however, benefited from late rains and made a great demand for sovereigns. Indian currency is one of our latter-day problems. According to Samuel Montagu & Co. the import and export of sovereigns in 1911 was as shown in the table below. This last is wholly unlike that previously quoted for bar gold. The exports especially indicate how the less civilized countries require the standard gold coin to 'sweeten' their monetary systems.

From gold we pass to soot. The connection may not be obvious; but it ought to be, for does not carbon precipitate gold from solution, and is not the world's stream of gold largely precipitated under the black pall of London's sooty fog? It was recently shown by a writer in *The Lancet* that 76,050 tons of soot falls annually over the 117 square miles comprised within the administrative

IMPORTS AND EXPORTS OF SOVEREIGNS, 1911.

IMPORTS		EXPORTS	
France	£1,165,000	South and Central Am. States	£6,430,000
Brazil	1,005,000	Egypt	4,105,000
Egypt	705,000	Turkey	3,480,000
Australia	555,000	France	1,990,000
Switzerland	110,000	British India	1,420,000
		Java and other Dutch colonies	340,000
		Cape of Good Hope	230,000

area of London. That soot contained many valuable by-products: 8000 tons of sulphates, 6000 tons of ammonia, and 3000 tons of chlorine in chlorides, not to mention the carbon and tar. The rainfall, aided by the sulphuric acid formed from the sulphurous ingredients of the coal burned lavishly and carelessly, has a decidedly corrosive action, as is suggested by the traces of tin and lead found in the soot. However, the chief fact disclosed by these observations is the defective burning of coal within the London area. Faulty combustion and persistent wastage of fuel are indicated. The domestic hearth and the culinary stove are responsible for a part of it; so are the factories; but within the City itself, which is the blackest part of London, the diffusion of soot is due to the obsolete methods retained and repeated in the heating of buildings. I shall not go far afield for an illustration. My desk is in one of the 850 rooms of Salisbury House. This office-building is only a little over ten years old. As the years go in this land of gently shelving precedent, a decade is nothing; to the hustler at San Francisco it is a geological period. Salisbury House is one of the newest of the big buildings

erected for office use in the heart of the financial district, commonly known as 'the City'. It is true the building has only seven stories, a mansard roof, and a basement, but its moderate height of less than one hundred feet marks the maximum permissible under existing regulations. These are embodied in the Building Act of 1894, by which the limit of height for a new building (except by the consent of the London County Council) is 80 feet above the pavement, with two stories in the roof above that height. In the case of a building erected in a street laid out since 1862, the height of a building must not (except with the consent of the County Council) exceed the width of the street. Salisbury House on its main front is 80 ft. high in its central portion, with the two stories in the roof, as allowed by law. The accompanying illustration was lent

SALISBURY HOUSE, OFFICE OF *The Mining Magazine*, AND LONDON OFFICE OF THE *Mining and Scientific Press*.

to me by Davis & Emanuel, the architects of the building, to whom its general appearance and excellent structure, and not its heating arrangements, are to be credited. The structure cost £300,000. The ground rent is £17,000 per annum. This building, which is representative of other supposedly modern structures in London, has no heating apparatus. Incidentally, I may mention that no law exists forbidding the use of such apparatus. The rooms are small, most of them are 12 by 18 ft., and there are 850 of them. Each of these 'dinky' chambers is heated by a small grate, in which inferior coal is incompletely consumed. None of the halls are warmed. Hence the lighting of a fire establishes a draft of cold air from the hall, if the window be shut as carefully as faulty joinery will permit. Long before the room is heated the worker at his desk has been subjected to damp chill. If he does not light his fire early in the morning he receives the smoke from his neighbors, and if he starts this childish heating arrangement late in the day, he finds a reverse draught that fills his room with smoke, and continues to do so until the chimney has been heated. So much for discomfort. Now for rudimentary expense. The tenants pay 8d. or 16c. per diem for the coal they burn. The average amount consumed in 8 hours is that held by a scuttle, namely, 50½ lb. Thus the price is £1 7s. 4d., or nearly $7 per ton. The proprietors state that 800 tons of coal, costing them 19s., or $4.75, is burnt annually. This would indicate that some of the 2500 persons within the building prefer shivering to such measure of discomfort as is obtained from a smoking fire. At a guess, I would say that one third of the 800 tons escapes up the chimneys and constitutes part of the 75,050 tons of soot that blankets the administrative area of London. A modern heating apparatus, with a furnace in the basement, would save 50%, of the fuel, 98% of the soot, and 92% of the coughs and sneezes that harass the denizens of Salisbury House, London Wall, E.C. Joking apart, the method of heating is an excavated anachronism; it involves a waste of coal inversely as the square of comfort produced; it illustrates an economic horror: right material in the wrong place. My books and mineral specimens testify eloquently to a persistent deposit of black coal-dust. As I look out of my window I see countless chimneys belching forth unconsumed particles of carbon. I cease to wonder at the spurious antiquity given to stone-work by the blackening hand of time, nor at the swift aging of metal-work by the corroding touch of a sulphurous fog. Nor do I marvel at the sun's eclipse that plunges London into a murky gloom, because the moisture overhanging the Thames valley is given every facility for condensation by the dispersal of myriad particles of foreign matter. Picturesque or not, as a fog may seem to persons of diverse temperament, it spells waste of time and economic loss to the busy people whose traffic and transport are impeded thereby. Not long ago, Sir William Ramsay, a distinguished chemist, but a futile economist, prophesied the exhaustion of England's coal resources within 175 years. His data were incorrect. But the ventilation of the subject should awaken my countrymen to the hideous waste and discomfort incidental to archaic methods of using a great national resource.

Fixing United States Boundaries

By O. H. Tittmann

*The superintendent of the Coast and Geodetic Survey is commissioner for the demarcation of the Alaskan boundary, and for that portion of the northern boundary of the United States extending from the Pacific Ocean to the Bay of Fundy, with the exception of the boundary running through the Great Lakes. The beginning of the settlement of the boundary, through Passamaquoddy bay, goes back to the Treaty of Peace of 1728; the settlement of disputed questions was again provided for in the Treaty of Ghent, in 1814, but certain portions of the line were not settled until last year. Some portions of the line have never been laid down on any map, but, generally speaking, the duty of the present commission is merely to fix upon the ground, by surveys and monuments, the line where it has not been heretofore fixed with that precision with which boundaries should be marked. The distance from the Pacific Ocean to Passamaquoddy bay, along the boundary, is about 3800 miles, 1200 miles of which are water boundary, running through the Great Lakes. When the boundary to the west of the Lake of the Woods was marked it was supposed that no one would ever feel any particular interest in this unsettled region, and that provisional marks or monuments at long intervals would suffice for all time. Needless to say, the settlement of this country brought with it irritating questions as to the precise location of the boundary line. For the settlement of these questions a joint treaty covering the boundary from end to end was exchanged and ratified, in 1906, although prior to that time an international commission had been at work in a less formal way in restoring old monuments and tracing the boundary where international questions had made it necessary. The triangulation has been extended from the Pacific Ocean to the summit of the Rocky Mountains, and this part of the line has been monumented with aluminum-bronze monuments.

To the east of the Rocky Mountains this same thing has been done, at the present time, to within one hundred miles of the Lake of the Woods, and the whole boundary has been carefully mapped, for a short distance, on each side of the line. Progress has also been made in surveying the thickly wooded region extending from Lake Superior to the Lake of the Woods, and farther to the east the monumenting and surveying is in progress along the northern boundary of Maine. All this work is done by international coöperation, under two commissioners, one representing Great Britain and the other the United States.

Probably more has been said of the demarcation of the Alaskan boundary than of this northern boundary. The determination of the Alaskan boundary has been going on ever since the tribunal, in London, in 1903, settled the vexed question of the location of the southeastern boundary of Alaska. The greater portion of this line runs from mountain peak to mountain peak over inaccessible fields of snow and ice. Starting on the one hundred and forty-first meridian, west of Mount St. Elias, the line follows the summits to the head of Portland Canal, and down that canal to the vicinity of the historic parallel "Fifty-four, forty, or fight," and thence to the Pacific. Wherever it was possible to place monuments it was done, especially at all river crossings in the passes; all of the mountain peaks were trigonometrically located and the region was mapped photo-topographically. From photographs taken at determined trigonometric points maps were made by geometric construction. It is hardly necessary to say that the reports of the surveyors, who conducted this difficult and hazardous enterprise, are full of thrilling adventure, but only two lives have so far been sacrificed. Many of the men had the unpleasant experience of dropping into glacial chasms, from which they were rescued, but the two men who lost their lives fell into an abyss and their bodies were never recovered. The field work of the southeastern Alaskan boundary has been nearly completed. The other part of the Alaskan boundary extends from the vicinity of Mount St. Elias, northward along the one hundred and forty-first meridian to the Arctic Ocean, a distance of about 600 miles. There never has been any international dispute as to that part of the boundary, which was defined by the treaty of 1826 between Great Britain and Russia. But for reasons not necessary to give here a new treaty was made in 1906 by which the commissioners were instructed to determine, by means of the telegraph, a point on the one hundred and forty-first meridian and to trace a north and south line through it, extending from the Arctic Ocean to the southernmost point of this boundary. The physical difficulties of this work are very great, owing to the hardship of transportation and the shortness of the season. The difficulties of transportation are illustrated by the experience of two years ago, when the parties had to march 300 miles to get to the working ground. The plan of the work which is being carried out contemplates a north and south transit line along this meridian, cutting a line through the timber, planting aluminum bronze monuments in rock or cement bases at intervisible intervals, triangulating along the boundary and the topographic mapping of a strip about two miles wide on each side of it. Aside from the immediate purpose of delimitation, this work will serve as an admirable basis for coördinating the land and economic surveys which will follow in another generation or two.

*Excerpt from an address delivered before the Philadelphia Engineers Club, November 4, 1911.

Annual Meeting of the A. I. M. E.

The annual meeting of the American Institute of Mining Engineers was held in the Engineering Societies building, 29 West 39th street, New York, on Monday, Tuesday, and Wednesday of this week. A local committee was in charge of the arrangements for the meeting, which was well attended. The program, as announced was: Monday, February 19—8:15 p.m., informal social meeting at Institute headquarters. Tuesday, February 20—10 a.m., annual business meeting; 12:30 p.m., luncheon at the Engineering Societies building; 2 p.m., technical session; 7 p.m., banquet at Hotel Plaza, 59th street and Fifth avenue. Committee: James Gayley, A. R. Ledoux, D. M. Riordan, Theodore Dwight, and Thomas Robins. Wednesday, February 21—10 a.m., technical session; 12:30 p.m., luncheon at Engineering Societies building; 2 p.m., technical session.

At the business session on Tuesday the following officers were elected:

For President of the Council—James F. Kemp, New York, N. Y. (term expires February 1913), 1262 votes.

For Vice-Presidents of the Council—Benjamin B. Thayer, New York, N. Y.; Karl Eilers, New York, N. Y.; Waldemar Lindgren, Washington, D. C. (term expires February 1914), 1263 votes each.

For Secretary of the Council—Joseph Struthers, New York, N. Y. (term expires February 1913), 377 votes.

For Members of the Council—Joseph W. Richards, South Bethlehem, Pa.; John H. Janeway, Jr., New York, N. Y.; Sidney J. Jennings, Dobbs Ferry, N. Y. (term expires 1915), 1263 votes each.

For Members of the Board of Directors—Edmund B. Kirby, St. Louis, Mo., 1057 votes; George C. Stone, New York, N. Y., 926 votes; Charles F. Rand, New York, N. Y., 926 votes. Arthur S. Dwight, Joseph Struthers, and Arthur L. Walker were also nominated, but did not receive enough votes for election.

On motion by J. Parke Channing a committee, consisting of J. F. Kemp, C. R. Corning, Albert Ledoux, W. N. Nichols, Jr., and George C. Stone, was appointed to study the affairs of the Institute to determine whether the proposed changes in the Constitution of the Institute cannot be obviated by changes in administration. This committee is to report to the Board of Directors not later than June 3, and earlier, if possible. Action upon the proposed amendments was therefore postponed, awaiting the report of the committee. A fuller report of the meeting will appear in a later issue.

Mechanical Features of the California Gold-Dredge—I

By Robert E. Cranston

*This paper deals only with that branch of gold-dredging which comes directly within the province of mechanical engineering, and the designs described are those commonly used in California. No attempt is made to cover the whole field, and the author has recorded only his personal observations of the more important mechanical features.

In designing a gold-dredge, the first essentials to be determined are the quantity of material to be handled and the depth to which it will be necessary to dig. To a lesser degree, the size and quantity of boulders, quantity of clay, nature and contour of bedrock, contour of the surface, whether the dredge is to be operated in a river or in an inland pond, how high above the water-line it will be necessary to maintain the bank, the nature and consistence of the gravel, distance from a railroad or other cheap transportation, costs of lumber, labor, electric power, supplies, etc., condition of wagon-roads, distance and transportation facilities to a first-class machine-shop, climate, distance to nearest public power-line, and possibilities of developing electric power on or near the property, are important. If electric power is not available, then the costs of the various fuels for generating steam or running gas-engines must be considered, and if the dredge is to be operated inland, how much water is available, and any other data peculiar to the property.

A MODERN 15-FT. DREDGE.

All the above information is requisite for the proper design of a dredge to do the most efficient work. A designer should insist on a full knowledge of all the conditions, otherwise his product is likely to be more or less unsuited to the work it has to do. Beginning with the capacity required, the dimensions of the bucket bases, pins, lips, etc., and the horse-power of the digging motor are determined. The depth of ground determines the length of ladder, which is modified by the height to which it is desired to elevate in order to wash and dispose of the gravel properly. The screen pumps and stacker are designed according to the quantity and quality of coarse material and the height to which it is to be stacked. The other machinery is designed to suit the local conditions, and the hull is planned to support the machinery properly, its dimensions varying greatly from the small capacity shallow diggers, to the 16-ft. dredges excavating 60 or 70 ft. below water-line.

The mechanical equipment of the California gold-dredge as it is today has in it much to be desired in the way of correct dimensions and the relative strengths of its component parts. Many of these parts should be made stronger, likewise there is much waste material which could just as well be done away with. Notwithstanding these admitted faults, the California gold-dredge has during the last few years shown vast improvement over the earlier attempts, and with all its frailties has many good points in its make-up which might be profitably studied by engineers called upon to design similar pieces of machinery.

The first successful gold-dredges in California were patterned after the New Zealand type. A brief description of one of these, built in 1897 and 1898, will not perhaps be out of place. The hull was built of wood of a rectangular cross-section, having an opening or well extending along the centre line part way back from the bow. Near the after end of this well was built an elevated framed structure or main gantry which served to support one end of the digging ladder, the other end being suspended by wire rope blocks from a bow gantry spanning the well. This ladder was a plate girder upon which were mounted rollers to carry the bucket line. The bucket line was composed of alternate links and buckets pinned together to form an endless chain. The buckets passed over a four-sided flanged tumbler keyed to a shaft and driven by a spur gear mounted on the main gantry. At the lower end of the ladder another tumbler served as an idler. In going over the upper tumbler the buckets dumped into a hopper leading into an inclined revolving screen with

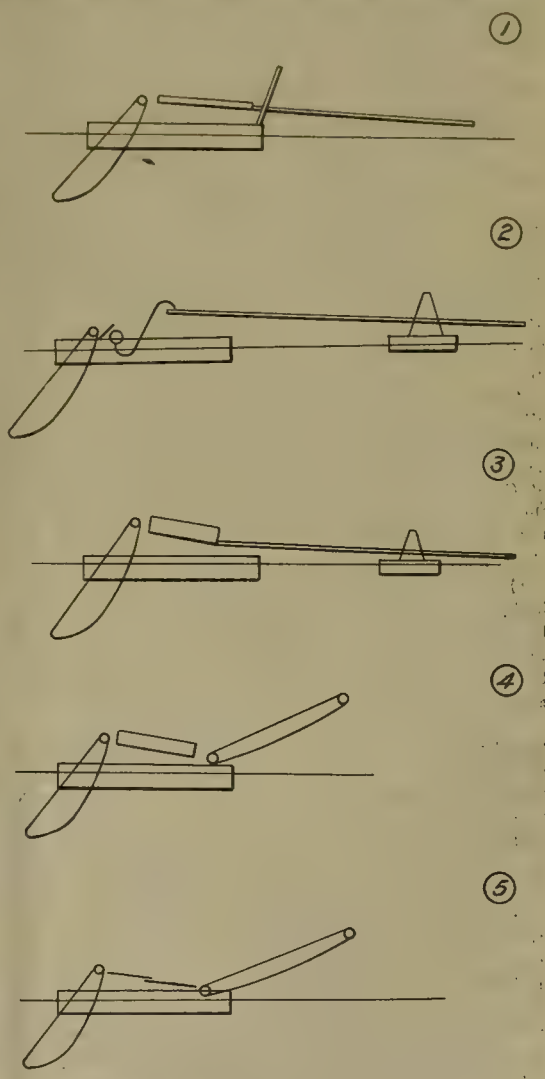


DIAGRAM ILLUSTRATING THE DEVELOPMENT OF THE CALIFORNIA GOLD DREDGE.

*Abstract from the *Journal* of the American Society of Mechanical Engineers.

⅜ to ⅝-in. perforations. A spray pipe ran lengthwise through the screen, throwing jets of water upon the gravel and washing the finer particles and gold through the screen-holes upon gold-saving tables. These tables were covered with cocoanut matting held in place by expanded metal, and were arranged so as first to distribute the fine material over a considerable area and then discharge it at the stern; the oversize went to a bucket-elevator and was stacked some distance aft of the dredge. The dredge was held up to its work by a head line which could be reeled in by means of a drum on the dredge. Side movement was secured by lines, two at the bow and two at the stern, each running to a separate drum. The motive power for these dredges was steam; later replaced by electricity.

Three years before this type of dredge was introduced into California, one of the type known as the double-lift was built near Bannock, Montana. The main gantry was much lower than in the New Zealand type. A revolving screen was used, but the holes were much larger, so that rocks 4 to 6 in. diameter would pass through. The oversize was dumped at the side of the dredge, and the undersize allowed to collect in a sump, whence it was elevated by means of a centrifugal pump into a sluice running aft from near the throat of the well. At the stern was a pivot connection with another sluice mounted on an auxiliary scow. This scow could be moved from side to side, one end of its sluice being pivoted at the stern of the dredge and the other moving in the arc of a circle, thus distributing the gravel over a considerable area. Instead of a head line, spuds were used to hold the dredge up to its work, the end of the digging-ladder moving in the arc of a circle with the spud as its centre.

About this time several dipper dredges were built, but although some were more or less successful, they did not prove to be as efficient as the endless-chain type, and were soon abandoned. In 1899 a double-lift dredge was built at Oroville, and soon after a similar dredge was built on the American river, the latter, however, being of the single-lift type, using close-connected buckets (every link in the chain being a bucket instead of links and buckets alternating) with spuds, no stacker, but having its main gantry high, the buckets dumping into a revolving screen with large holes. This screen was raised high enough so that the finer material fell directly into a fore-and-aft sluice; the oversize dumped into stone-chutes discharging on both sides of the dredge.

A judicious combination of the best features of the New Zealand and the double and single-lift types described above, together with several new ideas not used in any of the earlier dredges, resulted in a dredge being built sometime in 1901, near Oroville, California, equipped with a shaking instead of a revolving screen, the holes in which were small, the fine material going to gold-saving tables as in the New Zealand type, but with Hungarian riffles replacing the cocoanut matting and expanded metal. The oversize was stacked at the stern by means of a belt-conveyor instead of a bucket-elevator. Spuds and close-connected buckets were used as in the single-lift type. This general arrangement became known as the California type, and with its later modifications is the one to receive the most attention in this paper, and, unless otherwise stated, the descriptions are for this type of dredge.

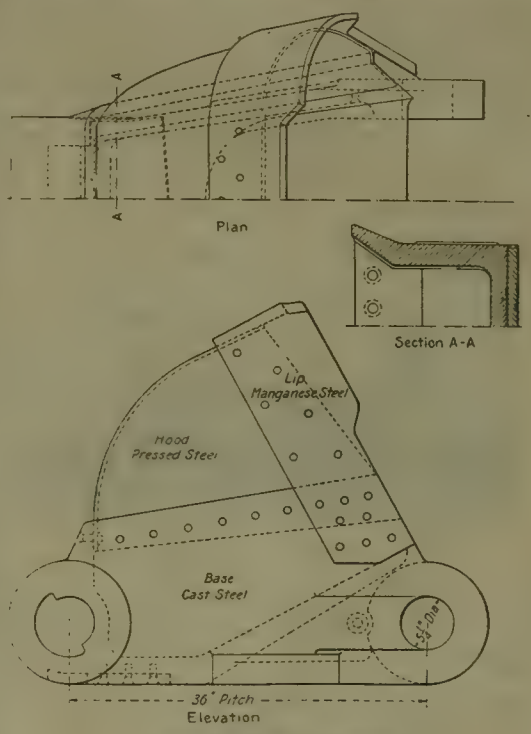
The original New Zealand type, slightly modified, is still sometimes used for the smaller, shallower, and richer areas, where it is said to do very good work. It is cheaper to build and under certain conditions may prove a better investment than the more expensive California type.

The earlier dredges used buckets holding 3 cu. ft., then the 5-ft. size became numerous, and later the 7, 8, and 9-ft. sizes were much used. Many went back to the revolving screen, noticeably in localities where much clay existed. In 1905 a 13½-ft. dredge was built near Folsom, California, and since that time several with 13½ to 16-ft. buckets have been put in operation. Having gained a general idea of the development of this type of gold-dredge, its different component parts will be taken up in detail.

BUCKET.—The bucket is made up of base, hood, and lip. The base is made of cast steel, many grades being used. It should be hard so as to stand wear, tough so as to stand the strain of digging, and should not be too expensive, since it has constantly to be replaced when worn or broken. All dredge costs are figured on a basis of cents per cubic yard of gravel handled, so that the first cost is not vital so long as it will handle the requisite number of cubic yards before giving out.

The most common form of base has one hub or back eye fitting between the two front eyes of the bucket behind it. Some use two back and three front eyes. The advantage of the three-eye bucket is that a smaller diameter pin may be used, there being four planes of shear instead of two; the disadvantage is that the cost of machining is greater and there seems to be a tendency to crack these buckets between the two back eyes, owing probably to a prying action under hard digging conditions, particularly after the pins are partly worn.

Besides the ordinary high-carbon open-hearth steel, chrome



NINE-CUBIC FOOT BUCKET.

nickel and manganese steels are used. One essential is that the bucket casting should be thoroughly annealed before it is machined. It is my opinion that many breaks in bucket bases have been caused solely by improper annealing. A template having long guiding bushed holes is useful in drilling for the hood so that the rivet holes will be accurately spaced both inside and out. This is essential in order that there may be no lost time in making replacements. In machining the base the holes in the eyes should be very carefully bored so as to be exactly parallel with the hole in the hub. In order to do this the bucket may be fitted with its bushing, a shaft put through the hub, the bucket brought tightly against it, and then the eyes bored parallel to this shaft.

Hood.—The bucket hood is made either of pressed steel or cast steel. There are also buckets used which have the hood cast as an integral part of the base. The pressed steel hoods are made in either one or three pieces. The thickness depends on the size of bucket and the nature of the digging, and varies from ¼ to ½ in. It is sometimes reinforced at the back where the greatest wear occurs. The cast-steel hoods are usually made about ¾ in. thick, have a stiffening rib running up the middle, and sometimes shoulders for the lip to rest on and a shoulder for the base

to fit into. The advantages of pressed over cast steel hoods are their cheapness, lightness, and ease of repair if bent or broken. A disadvantage is that the strength cannot always be put where wanted except at extra cost. A standard drilled base may be used as a template for drilling the hood. I consider the one piece preferable to the three piece hood because (*a*) it will stay water tight; and (*b*) there are fewer rivets to work loose and replace. The disadvantage is the difficulty of pressing a single piece into the proper shape, making the cost greater than if three pieces were used.

Lip.—Bucket lips are now nearly all made of cast manganese steel. At one time I used a very hard high-carbon nickel steel forging, its only advantage being that it could be shaped on the ground to fit several different hoods and bases which it was desired to use up. A record was kept of about 100 of these lips, and it was found that for cost and life they were very close to the manganese steel. For use in out of the way places and in emergencies they do very well. Their greatest disadvantage is that they cannot be readily forged into the more intricate shapes now commonly used. The lips in use vary considerably in design according to the nature of the ground and the fancy or judgment of the designer. In the first place, a lip must be made strong enough to perform its work without bending or breaking, even up to the time it is ready to be replaced. If it is bent or broken before this time, damage is done the hood, with the resultant extra cost of repairing the hood as well as replacing the lip. The thickness of the lip is determined by the above conditions, but its width is a matter of judgment, since if made too wide the capacity of the bucket is materially reduced by the time it is worn out; if too narrow, it must be replaced often and a large loss results, both in time and unused metal.

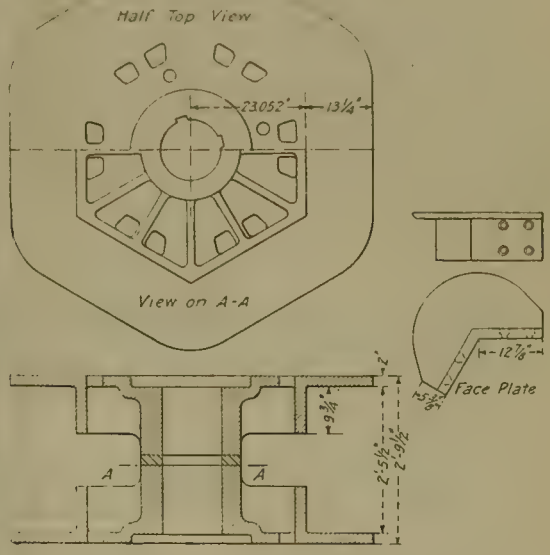
Some engineers prefer a highly arched digging face, others a rather flat face with sharply rounded corners. Those favoring the arched face contend with good reason that it is a stronger shape, and those favoring the flat face and rounded corners think that this shape is a better digger. The shape of the digging edge is another matter in which designers differ; some make it perfectly straight, others prefer corner extensions at the points where the wear indicates most of the digging is done. I am in favor of the corner extensions, since I believe they dig better and the lip is more completely worn out when it is ready to be replaced. The fewer rivets used the smaller will be the cost of re-assembling, but care must be taken to have enough rivets to do the work without shearing or pulling out. On many of the lip designs a shoulder is cast so that the hood edge fits against it, thus taking some strain off the rivets.

Pin.—There have been many attempts to improve the design of bucket-pins, those ordinarily used being rather expensive to make. It is a round shaft with a flat or 'L' at one end. The L fits into a slot machined in the bucket base and prevents the pin turning in the eyes. Dowel-pins, keys, squared and slotted ends, tee shapes, and many other devices have been tried, but so far as I am aware none of them has proved as satisfactory as the old L design. The pins are made of various kinds of steel, the object being to use a very hard material which is also tough and not too expensive. A high-carbon steel, low in sulphur and phosphorus, forged, machined, and then oil-tempered, is most common. Various forms of nickel, chrome, and manganese steel are also used, but so far have not become general practice.

Bushing.—The bushings are made in pairs, half round, and fit a recess in the bucket hub, placed at such an angle that the wear will be evenly distributed. They should be a snug fit, but ¼ to ½ in. short on the ends to allow for the flow of the metal. In using manganese steel this tendency to flow must always be taken into consideration and suitable provision made for it in the dimensions.

Insert Plates.—During the last few years manganese steel insert plates have come into general use in order to protect the bottom of the bucket base near the hub, at which point excessive wear occurs on account of the slip on the upper tumbler. Often buckets are found to be worn out at this point, but perfectly good everywhere else. The manganese plates are of such a shape that after they are put in place and the softer steel of the base peened over the edges they retain their position without other means of fastening.

LOWER TUMBLER.—At the lower end of the digging ladder the buckets pass over a six-sided flanged tumbler which revolves between forks attached to the digging ladder. It is cast of open-hearth steel. Wearing plates are used to protect the faces and the flanges. The detail of design varies on different dredges. Some use a tumbler having curved extensions at the corners of the flanges, others have the corners rounded but not extended, and still others use a circular flange. The extended corners require less metal, but are likely to be broken off, and the circular flange may interfere with the digging. The design in which a side view will show a hexagonal shape with rounded corners is strong and cannot well interfere with the digging. The height of flange is another point of difference, and varies



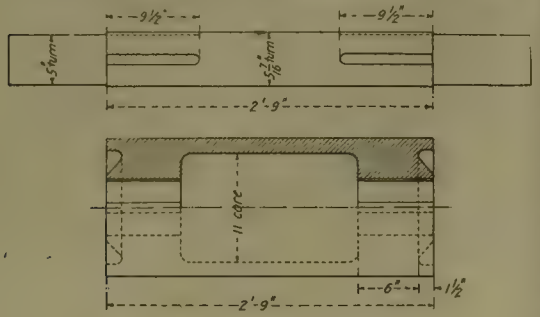
LOWER TUMBLER FOR 9-CU. FT. DREDGE, SHOWING WEARING PLATE.

from 6 to 13 in. at the corners. It must be made high enough to keep the buckets from running off, but if too high may interfere with the digging. It is also expensive. The slope or flare of the flange varies from 0 to 1 in 10. It is claimed by some that if the sides are made too straight the buckets are likely to run off, and if the flare is too great the eyes of the bucket will wear thin at the bottom. I do not know that any standard of flare has been adopted, but I am inclined to the belief that a straight or nearly straight flange is best, all things considered.

Wearing Plates.—The flanges and tumbler faces are protected by wearing plates made of some hard steel; nickel, chrome, and manganese all being used. So far as wearing qualities are concerned the manganese steel gives the best result, but this material is so hard that it cannot be machined, and it is difficult to make the plates fit the tumbler accurately; also, since the rivet holes have to be cored they are likely to be a bad fit. Besides these disadvantages the manganese steel plates are very destructive to the bucket line, and it is better to wear out tumbler plates than buckets. Several tumblers have recently been made with a manganese steel disc set into a recess at each corner and held in place by peening over the edges in a manner similar to the bucket insert plates described above. This method is said to have given good results. Some use separate plates for protecting faces and flanges, while others have the wearing plates made so as to protect both faces and flanges. The advantage of the last method is that the plates are very strong and not likely to break or wear loose.

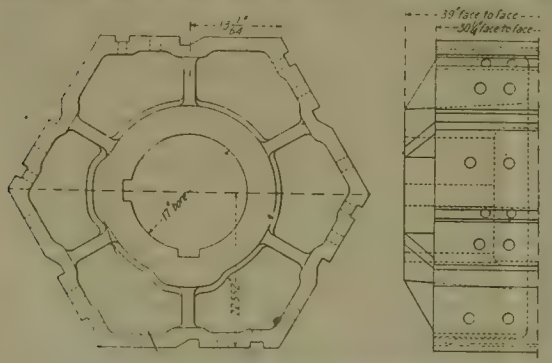
Shaft.—The lower tumbler shaft is usually made of nickel

steel, either oil-tempered, annealed, or both, and may be hollow bored or solid. It should be securely keyed to the tumbler, and I have found that four taper keys, two at each side, 90 or 120° apart, have given the best results. Provision should be made for driving the keys out from the inside, and the tumbler should be either shrunk or pressed on.



LADDER ROLLER FOR 9-CU. FT. DREDGE.

LADDER ROLLER.—The ladder rollers serve to support the buckets on their way from the lower to the upper tumbler. Cast iron was formerly used, but now cast steel, either high-carbon, chrome, or manganese, is most in favor. Very hard chilled white iron cast around a soft core has given good results; also manganese steel made in the same way has proved even more efficient so far as wear is concerned. My objection to the manganese roller is that after considerable use of a soft core, if made thin, is likely to become loose, and if made thick the difference in expansion of the two metals will cause the outside shell to crack. A high-carbon or chrome-steel casting makes a good roller, and



UPPER TUMBLER, 9-CU. FT. DREDGE.

can be made just soft enough to machine; it will then wear well and need not have a soft iron core. Particularly good results have been secured by me with chrome-steel rollers made in this way.

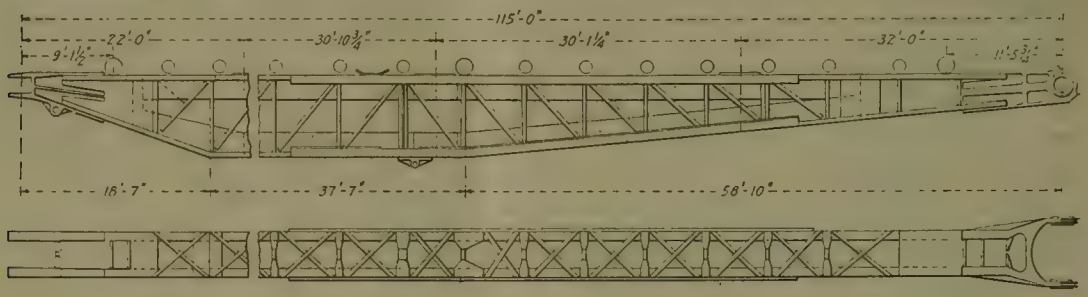
Shaft.—There has always been trouble in keeping shafts tight in rollers. I use two taper keys at each end, 90° apart, the same as for the lower tumbler shaft. This method of fastening has proved perfectly satisfactory.

UPPER TUMBLER.—There have been many forms of upper tumbler tried, but now the common practice is to use a 6-sided plain casting, onto which is bolted a set of heavy cushion plates with guides cast on the sides.

Cushion Plates.—These plates are made to lap over the corners and fit into transverse slots in the tumbler casting. This is done to prevent them from becoming loose, as was the case before this design was perfected. They are made of cast steel, either high-carbon, chrome, nickel, or manganese. The cushion plates are bolted to the main tumbler casting by means of large bolts $1\frac{1}{2}$ or 2 in. diam., with square countersunk heads on the outside.

Wearing Plates.—Wearing plates are used on the cushion plates, both for the faces and the guide flanges on the sides. These plates may be made of any material desired, but the same objection to manganese exists on the upper as the lower tumbler. I use plates forged from worn-out bucket pins and then give them an oil temper. These have given good results, but care should be taken not to temper them too hard, since they then become brittle and will give poor service. The wearing plates are riveted with countersunk rivets to the cushion plates. Riveting is better than bolting for this purpose.

Shaft.—It is imperative that the upper tumbler shaft should be of ample strength and be made of excellent material, since it has to bear the brunt of the digging. A factor of safety of not less than 10 is recommended, and it would do no harm to have it even higher. It is customary to use a material of high tensile strength, since if made of low tensile strength material the shaft will have to be so large that it will interfere with the design of the upper tumbler which it carries. Nickel-steel, hollow-bored, oil-tempered, and annealed shafts are much used, having a tensile strength of 90,000 lb., elastic limit 60,000 lb., elongation 22%, contraction 50%. Excellent results have also been obtained with Krupp crucible-steel shafts, hollow-bored, oil-tempered, and annealed, having a tensile strength of 80,000 lb., elastic limit, 43,000 lb., elongation 22%, contraction 45%. Lately I have used a nickel-steel solid shaft which has been thoroughly annealed but not oil-tempered. This has given excellent results and is inexpensive. The physical properties are as follows: Tensile strength, 80,000 lb.; elastic limit, 50,000 lb.; elongation, 25%; contraction, 45%. A shaft of soft iron or steel, having a low tensile strength but great toughness, such as Lloyds' test steel, would be the ideal shaft for this purpose were it not for the necessity of making them so large that there is no room left to fasten the cushion plates to the upper tumbler. By using a 7 or 8-sided tumbler this could be overcome.



DIGGING LADDER, 9-CU. FT. DREDGE.

DIGGING LADDER.—The design of the digging ladder varies with the depth and nature of the ground to be handled. It is either a plate girder or a lattice girder or truss. The plate girder type is the most common, and in my opinion the best. A little weight may be saved by using the lattice type, and although it may be as strong as a plate girder, there is in the lattice type more danger of rivets working loose, causing ultimate collapse. Ample space should be allowed under the ladder rollers, otherwise the spill from the buckets will collect and prevent the rollers turning. The ladders are made in several sections so that they may be more easily transported. Where the splices occur great

care should be taken to make the joints of ample strength. I have seen several digging ladders fail, and in nearly every case the failure occurred at one of the splices. In figuring the strains in a digging ladder it should be considered not only as a beam supported at two or three points, but also as a column. Where a single line is used for side swinging, the strains must be figured for side as well as vertical stress.

Lower Forks.—At the lower end of the ladder cast-steel forks are riveted to the structural portion of the ladder. These forks are made differently by various designers, but their duty in all cases is to carry the lower tumbler bearings and give a space for the lower tumbler to revolve in. These forks should have great lateral strength, since there is a tendency to spread under the severe digging conditions. I have found it of advantage to make the inside edges of these forks fit very closely to the outside of the tumbler, since if a large space is left rocks lodge and grind out both the tumbler and the forks.

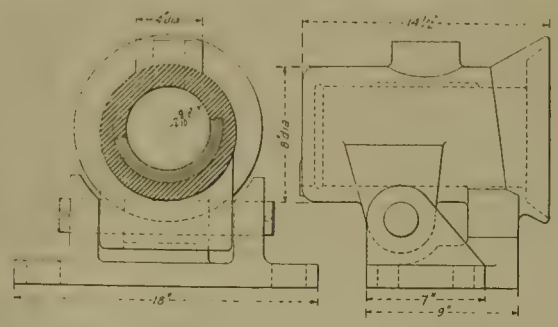
Lower Tumbler Bearings.—There are several designs of lower tumbler bearings used. In the most common the lower portion of the forks are made to form one-half of the bearings and to this the other half is bolted. In this design a replaceable cast-iron bushing is made to fit inside the main casting, often of the self-aligning type. I have used a design similar to that of the locomotive connecting-rod end, which is fastened and adjusted by means of taper keys. The bearing is made of cast iron in two halves and slides between the upper and lower extensions of the forks. Square holes are machined through these extensions to take the keys. The half bearings are interchangeable and can be used for the upper or lower half and for either side. This style of bearing has been found very satisfactory, since it is cheap and easily replaced. Many attempts have been made to use protective devices for keeping grit out of the bearings, rubber, felt, brass, and iron rings having been tried. The rubber and felt have been entirely discarded. Some still use bronze or iron protective rings, but they are all more bother and cause more delays than they are worth. A hole through which grease may be introduced is provided at an easily accessible place on the bearings. The grease is introduced by means of a grease gun with a screw-operated piston. I use a lower tumbler shaft with shallow flanges turned at either end. These flanges fit into recesses on the outside of the tumbler bearings, thus preventing the ladder forks from spreading. Where hollow shafts were used it was common practice at one time to put a rod lengthwise through the shaft, a nut at either end preventing the forks from springing apart. With the modern practice of making the lower forks extremely massive there is little danger of springing, and such precaution need not be taken.

Roller Bearings.—Spaced along the digging ladder at regular intervals are the roller bearings, supported in chairs by pins which allow movement in a plane at right angles to the length of the ladder. The first bearings used were fixed rigidly, and much trouble was experienced by breaking roller shafts, probably caused by movement in the ladder truss. I think it likely, with the heavier ladder construction now in vogue and the larger-sized roller shafts, that the fixed bearing would give little trouble; but even so, the present common design is better, since the bearing may be very quickly and easily removed, and this is a desirable feature in any part of a dredge. The roller bearings are made with half-round bushings similar to those used in the bucket hubs. Cast iron, manganese steel, and bronze are used for this purpose. Cast-iron roller bearings are being replaced by cast steel. Where a self-adjusting bearing is used it should be supported near the middle and be of ample length, otherwise it will tend to tip down and wear out unevenly and rapidly.

Catch-all Pan.—In some of the dredges a pan is provided below the rollers which conveys the slop-over of the buckets to the lower end of the ladder where it will be picked up again. This is a very good idea, but care should be taken to make it at least 12 in. below the rollers and in small, easily replaceable sections. If not deep enough, it is likely to be a source of much annoyance by filling up and stopping the rollers, or if made in long unprotected sections it will wear out and require much work and loss of time in replacing.

Suspension.—The lower end of the ladder is supported at either one or two points, the single suspension being used for the shorter ladders and the two point suspension for the longer ones. Several different designs are in use, the most common being a double set of blocks, one on each side, attached to heavy forged rods or bars connecting with the ladder. Heavy chains, forged or cast links and pin links are also used. Another type has a single set of blocks attached to a cross piece, the connection to the ladder being made from each of its ends. The attachment to the ladder is usually made by means of a cross shaft in bearings fastened to the under side of the ladder.

Upper Forks.—The upper end of the digging ladder is pivoted either on the tumbler-shaft bearing-support or on a separate mounting entirely detached from the bucket drive. By employing the first method the tumbler shaft may be used as a centre, and the relative position of the bucket line and upper tumbler will remain constant for all depths of digging. In the second method the pull on the bucket line will be at different angles, according to the position of the ladder. The first method, therefore, has a decided advantage, but it also possesses the disadvantage of preventing the easy removal of the upper tumbler and shaft, is more expensive, and in case of accident to the ladder the bucket-drive may be involved through the tumbler shaft-bearing support.



LADDER ROLLER BEARING, 9-CU. FT. DREDGE.

Chafing Beams.—Along the sides of the ladder wooden chafing beams are bolted, the outer faces of which are protected by steel plates. I prefer beams put at both top and bottom of the ladder, so that they will steady it when digging hard. The beams on the ladder rub against similar ones on the sides of the well. Those in the well are put either at right angles to the ladder at intervals, or one may be placed on each side of the well parallel to the deck and on the streak above water-line. If this form of chafing beam is used, both the ladder and the well beams should have beveled timbers fitted above them, so that rocks will not lodge and cause trouble when the ladder is raised or lowered. The disadvantage of placing the chafing beams at right angles to the ladder is that in case anything catches on one of them near the bottom and tears off a plate, it is very difficult to repair, while if the beams are entirely above the water-line they are easily accessible. The only disadvantage of placing them in this way is that the distance from the contact point of ladder and beam to the ladder's end is greater by the draft of the hull, and in case of side strain the bending moment is greater. Where a shore sheave is used and the end of the swinging line is attached to the lower end of the ladder, there is very little side strain, and in this case the horizontal wearing plates are best, in my opinion. Where a single swinging line is used, running directly to the shore, considerable side strain is exerted on the ladder, and the chafing beams at right angles to the ladder are preferable. Some designers provide rollers for the sides of the ladder, which serve the same purpose as the chafing beams.

(To be Continued)

The Estimation of Tonnage

By A. W. Allen

The daily estimation of battery tonnage is a necessity, especially where the manager requires details of approximate yield per ton for the purpose of regulating the output. The choice of a suitable method involves the consideration of existing systems, of which the following will be discussed:

1. By the number of cars trammed to the crushers, or crusher-bins, and an estimated weight of ore content.

2. By the actual weight of the cars and ore trammed to the crushers, or crusher-bins, and a deduction for the weight of the cars.

3. By the number of cars trammed to the battery-bin, after crushing, and an estimated weight of ore content.

4. By the use of an automatically weighing belt-conveyor, discharging into the battery-bin.

5. From the 'running time' and an estimated stamp duty.

6. From the yield in the battery and the difference in assay value of the ore, before and after amalgamation or concentration.

In the first instance, where the tonnage is estimated from the number of cars trammed to the crusher-bin, and an estimated weight, the errors arising may be considerable. The accuracy of the system is influenced by the fact that the cars are seldom uniformly filled, and that the condition of the contents, as to size and composition, is liable to vary within wide limits. It is almost impossible to estimate the moisture content with any degree of accuracy, or to obtain a truthful average. An advantage is gained by the direct weighing of the cars and the automatic recording of results. In the latter case the moisture is the only consideration affecting the accuracy of the result.

After the ore has passed the grizzlies and crushers it is in better condition for the purpose of tonnage calculation; but an estimation based on the number of cars trammed is again influenced by the way the cars are filled and the degree of moisture in the contents. The latter determination is now an easier matter, but the result is liable to be affected by systematic under or over-filling of the cars, and any carelessness in recording the number. These latter defects can be remedied by the substitution of an automatic weighing, recording, and distributing belt-conveyor in place of the cars; and the degree of accuracy in the result is then only affected by the accuracy of the machine, and the correctness of the moisture deduction.

The determination of moisture content is an important matter, but receives scant attention in the battery. Even after crushing and automatic weighing, an estimation is no easy matter, since *average* moisture content implies the drying of an *average* sample; and the time taken to obtain such a sample would influence the result, unless impracticable precautions were taken to prevent moisture loss. In the few cases where ore milled is quite uniform, a 'grab' sample might contain an average moisture percentage. Contrary conditions, however, predominate; and sometimes it is necessary to consider the effect of tropical rain on alternate cars of clean quartz and old stope fillings, on their way to the mill. In the latter case even an automatic record of actual weight would be exceedingly difficult to correct for moisture content.

All the methods discussed give approximations of tonnage delivered into the crusher or battery-bin, and not tonnage milled. To make daily correction, involving the estimation of what remains in the battery-bin, or both battery-bin and crusher-bin, reduces the estimate, in the majority of cases, to mere guesswork. A monthly estimate would, doubtless, be more correct, since the error liable to arise on the question of storage, would be minimized; but a daily estimation is under consideration. Tonnage totals cannot be added to or subtracted from as the need for correction becomes apparent. At the end of the month the figures must be either taken or rejected as a basis for the compilation of cost, extraction, and other returns.

The daily estimation of tonnage by means of a calculation based upon the 'running time' and estimated stamp duty is at best a loose method, because 'stamp duty' is known to vary considerably and is affected by a number of circumstances which cannot be taken into account in the calculation. In a 200-ton, 50-stamp mill, recovering 30 oz. of silver per ton, and assuming accurate sampling and assaying, a difference of but one-fifth of a ton per stamp per 24 hours between actual and estimated duty would, at the end of a month, mean a difference of no less than 9000 oz. between actual and calculated returns. The busy millman may also be excused if 'running time' is not always reported in exact figures. This method of calculation has, however, much to recommend it, because no estimation of ore in hand, or moisture content, is needed; but, in the same manner as the results by other methods are affected by variable moisture content, due to lack of uniformity in the product, so is stamp duty liable to fluctuate from the same cause. On the other hand, there are a number of cases where stamp duty remains remarkably uniform, and where this method of calculation is indicated as the best available.

Method No. 6 is, I believe, still in use; and details may serve to prevent further adoption. By this method tonnage is calculated by means of the actual yield in the battery, and the assay of the ore before and after amalgamation or concentration. The figures are bound to tally because the artificial manipulation of results adjusts all possible variations between assay difference and actual returns. The method is only applicable where yield and value are obtainable daily; as, for example, where the concentrate produced is dried, weighed, sampled, and assayed every 24 hours. Given correct sampling and assaying, and the absence of theft or loss in the yield, the result is accurate. On the other hand, with a milled ore yielding high-grade slime and low-grade sand, the extraction figure can be raised at will by the exclusion of a proportion of slime from the tail sample; a drop in stamp duty taking the place of a discrepancy in realization. Theft or mechanical loss would, if undetected, also result in a lower tonnage estimation. In any case, the extraction figures would always agree, and, for this reason and because the method is open to abuse, the system is not to be recommended.

From the above considerations it will be seen that, in the absence of consistent uniformity, the correct statement of battery tonnage is a result more of accident than design; and ordinary estimations, although useful for the determination of daily yield per ton in the battery, are valueless for the purpose required in a detailed return showing actual and theoretical extraction. I therefore suggest the daily use of battery estimations for the purpose outlined, but the compilation of extraction and other returns based on figures obtained where the tonnage of individual lots of ore can be checked and re-checked should occasion arise. This is only possible in the cyanide plant where ore units are, generally, of easily defined volume, of uniform composition, and of uniform moisture content.

In leaching-vats, filled by means of automatic distributors and the adjustment of slats, the tonnage is best calculated by the aid of a box with perforated sides and rope handles, of exactly one cubic foot capacity. The perforations in the sides are important and allow the escape of slime as the box fills with sand, uniformly with the vat. As soon as covered the box is pulled up, the contents leveled off and allowed to drain. The box and contents are then weighed, by means of a steel-yard or spring balance. The sand is then tipped out and a moisture sample sent away for immediate estimation. A deduction for the weight of the box is made and the tonnage in the vat finally calculated from the dry weight of the cubic foot of sand, and the cubic contents of the vat. The result can be verified by alternate weighings.

The tonnage in an agitation vat is generally deduced by methods involving estimations of the specific gravity of both ore and pulp. Published formulae, complicated by the addition of constants and factors dear to the mathematician but abhorrent to the operator, are generally without explanations; and entire reliance on such formulae too often results in mental lassitude and lack of initiative. The correct estimation of ore tonnage in pulp is a much easier matter than is generally supposed; and, if a simple line of reasoning be adopted, the matter of a lost or forgotten formula is of no consequence. The following details may be of use to the working operator who wishes to take an intelligent interest in the method.

The specific gravity of a substance is an amount equal to its weight divided by its volume. Conversely, the volume of a substance is an amount equal to its weight divided by its specific gravity; or is the volume of water it displaces when submerged. Advantage is taken of the latter fact in the preliminary estimation of the specific gravity of the slimed ore, the following method usually being adopted. A suitable flask is taken to which is transferred a portion of slimed ore pulp. The flask is then filled to a mark with water, and weighed. The contents are next discharged, any residue remaining washed out, and the whole carefully dried and weighed. Then if

A be the weight of the dry slimed ore,
B be the weight of flask, slimed ore, and water to mark, and
C be the weight of flask and water to mark.

$$\text{the sp. gr. of the ore} = \frac{\text{Wt. of slimed ore}}{\text{Wt. of water it displaces}} = \frac{A}{(C+A)-B}$$

The result should be carefully checked and the fact remembered that an overestimation of the specific gravity of the ore results, by subsequent calculation, is an underestimation of tonnage; and vice versa.

The specific gravity of the ore pulp in agitation is found in the following way. A fairly wide-mouthed flask or bottle, of known capacity, is taken, filled with the pulp, and weighed. The net weight of the pulp, divided by the volume occupied, will give the specific gravity of the pulp. If a special weight is used to counterbalance the weight of the empty flask, and the capacity of the latter is one litre, the specific gravity of the pulp can be found by direct weighing, and with no more calculation than the placing of a decimal point, thus:

Capacity of flask	1000 c.c.
Wt. of 1 litre of pulp	1330 gm.
Sp. gr. of pulp	1.33

The following line of reasoning may be adopted for the calculation of the percentage of slime, in terms of dry ore, in the pulp:

Vol. of pulp = vol. of ore + vol. of water.

If a = wt. of pulp, then $\frac{a}{g_1} = \frac{x}{g_2} + \frac{y}{g_3}$

g_1 = sp. gr. of pulp.

x = wt. of ore, $\frac{100}{g_1} = \frac{x}{g_2} + \frac{100-x}{1}$

g_2 = sp. gr. of ore,

y = wt. of water, $= \frac{x + 100g_2 - xg_2}{g_2}$

g_3 = sp. gr. of water.

$$100g_2 = xg_1 + 100g_1g_2 - xg_1g_2$$
$$xg_1g_2 - xg_1 = 100g_1g_2 - 100g_2$$
$$x(g_1g_2 - g_1) = 100g_2(g_1 - 1)$$
$$x = \frac{100g_2(g_1-1)}{g_1(g_2-1)} = \% \text{ ore in pulp.}$$

Given the weight of a cubic foot of water as 62.5 lb., the specific gravity of the pulp, and the capacity of the vat in cubic feet, the estimation of ore content can readily be found by the aid of the calculated percentage of solids. Unnecessary calculations are avoided by filling the agitation vats to the same level, and by the compilation of a table based on the capacity of the vat to this level; and arranged to show, at a glance, the tonnage contained for any average specific gravity of pulp.

Tonnage estimations should be made with the greatest care where the amounts are to be used in conjunction with assay returns. The net weight of ore taken for specific gravity purposes should not be much less than 500 gm.; and weighings should be made on a balance sensitive to 0.5 gm. or under. In specific gravity estimations of the ore, and moisture determinations generally, repeated dryings should be made to demonstrate the absence of residual moisture, the sample being cooled in a desiccator before being weighed.

Preservative Treatment of Poles

By W. H. Kempfer

As the pressure method of treatment with creosote is comparatively costly, investigations by the Forest Service were directed to simpler and cheaper methods, which could be employed locally. Special attention was given to the seasoning of the timber, and investigations were conducted with the object of (1) testing the efficiency of various wood preservatives and of the application of varying amounts; (2) developing a method for impregnating the butt, as the portion of the pole most subject to decay; (3) designing inexpensive apparatus for local use in application. The timbers used were chestnut, three kinds of cedar, and three kinds of pine; and six different commercial preservatives were tried. The conclusions reached were: The reduction in the weight of poles by seasoning is generally from 16 to 30%, and thorough seasoning is an essential preliminary to preservative treatment. Poles cut during autumn and winter lose weight less rapidly but more regularly than those cut during the spring and summer; the shrinkage during seasoning does not exceed 1% of the circumference; too rapid seasoning may be detrimental to the timber by causing excessive 'checking.' The superficial application of a preservative, by a brush, to the butt of a pole is not as effective as actual impregnation of the wood, but generally adds two or three years to the life of the pole. Impregnation of many pole timbers may be successfully accomplished by simple immersion in open tanks, first in the hot and then in the cold preservative; as this process may be applied to the butts only, a great saving of preservative is effected.

Sulphur Mines in Mexico

By Wilbert L. Bonney

The great bulk of Mexican sulphur is obtained from the mines near Cerritos, in the state of San Luis Potosi, about fifty miles east of the capital. The deposit is one of the largest and richest in the world. The production of the mines is about 800 metric tons (metric ton = 2204.6 lb.) of refined sulphur per month. The sulphur is found at a depth of 20 ft. below the surface, and the lowest present workings are 190 ft. deep. The mines are at an elevation of about 5800 ft. above sea-level. The ore runs 37 to 90% pure and is melted by the steaming process. Of this product about one-third finds a market in Mexico, the present price being around $32 per metric ton. The mines employ some 700 men. The property is owned by the Virginia-Carolina Chemical Co., an American concern, but is under lease to Germans. The excess over home-market demands is shipped to Germany.

There are traces of sulphur in other parts of the state, and compounds are common. At Venado, about fifty miles north of San Luis Potosi, a sulphur deposit has been uncovered, but its output would be small compared with the Cerritos mines. The Venado deposit lies in a blanket some 10 ft. wide practically on the surface, and the product shows about 30% pure sulphur. The operating company had its furnaces installed by an Italian expert after the manner of the Italian smelting practice, but the capacity of the works will not exceed three to four tons per day under favorable circumstances.—*Daily Consular and Trade Reports.*

The Largest Single-Unit Crushing Plant

By Samuel W. Traylor

This crushing plant, which is at Valhalla, in the suburbs of White Plains, New York, is in process of construction for H. S. Kerbaugh, Inc., and is to be used by this company to prepare stone for concrete to be used in the erection of the Kensico dam, contract No. 9, Board of Water Supply, City of New York. The great size of this work calls for and warrants the use of so large a plant. This dam, which is being built across the bed of old Lake Kensico at about 400 ft. north of the old impounding dike, is to be used as a storage reservoir in connection with the new Catskill system, and will retain sufficient water behind it to insure a supply of about 45 days to New York City, in case of an accident to the system between Lake Kensico and Ashokan. The dam itself is to be built of cyclopean masonry, faced on its upstream side with concrete blocks and on its downstream side with cut stone, and will contain over 1,000,000 cu. yd. of masonry, thus making it take rank as the largest masonry dam in the world.

The geological structure of the valley, which at the point of the dam is 1900 ft. wide, is rather peculiar, it being eroded out of a bed of dolomite, about 400 ft. thick, which lies between the gneiss of the easterly hill and the mica schist of the westerly hill, and at the point of contact there is the badly decomposed and disintegrated condition of the rock naturally to be expected. This will make necessary an excavation of about 130 ft. below the present surface of the valley to insure a dependable foundation, and at this point the total height of the dam will be about 300 ft. The general design of this dam follows the lines adopted in the design of the Ashokan dam, incorporating the peculiar features of expansion joints, drainage wells, and galleries adopted there. The section is of peculiar interest at the present time, when the matter of gravity dam sections is uppermost in the public mind, because of its stability, as the extreme width of this dam will be about 250 feet.

Quarry Equipment.—The pneumatic drills used in quarrying are the largest made for this purpose, having a capacity for boring a 5-in. hole to a depth of 20 ft. There will be used four 90-ton, 4-yd. steam-shovels in loading the rock into the quarry cars. The transportation facilities consist of four 40-ton locomotives, each handling a train of 15 to 20 cars, each car having a capacity of 8 yd. As the trains are loaded, they are hauled into the crushing plant, where the cars are quickly dumped by an ingenious device, and the rock discharged into a chute leading directly to the initial crusher. The train is then hauled through the crusher building and returned to the quarry over a separate track.

The initial 5 by 7-ft. crusher reduces the rock to a size of 9 in. and smaller. It then passes over a grizzly with 4½-in. opening, the undersize or through product going directly to the elevator, while the oversize is run through the second crusher, with an opening 3 by 6 ft., reducing it to 4 in. and smaller. This product, with the undersize from the grizzly then goes to the elevator and is raised to a 7 by 30-ft. screen. This screen is so designed that all material ¼ in. and finer is removed for a sand product and stored separately, while the aggregate, or stone between ¼ and 2½ in. is distributed by a 30-in. conveyor into a 10,000-ton storage bin. The oversize from the screen goes to a small bin, which is equipped with a 28-in. steel pan-feeder and is delivered uniformly to a heavy duty 30 by 60-in. crushing roll; the product from this roll being returned to the same elevator and screen.

The storage bins are so constructed with bottom and side discharge gates as to permit of loading standard-gauge cars running under the bins as well as at the sides, preventing any congestion at this point and making available the full storage capacity of the bins by reason of the many points from which the product is discharged.

General Plan.—From this brief description, and reference to the side elevation, the simplicity of design and economy in operation will be noted, as well as the small number of individual machines required for so large a capacity. Brief specifications are as follows: 1 jaw-crusher, with a clear opening of 5 by 7 ft.; 1 jaw-crusher, with an opening of 3 by 6 ft.; 1 continuous bucket elevator, with buckets 42 in. wide by 18 in. deep by 19-in. projection; 1 all steel 7 by 30-ft. revolving screen; and 1 30 by 60-in. heavy-duty crushing roll.[1]

It will be seen that this plant presents interesting features, from the fact that to duplicate its capacity would require not less than nine gyratories, and if a No. 21 gyratory were used as the initial crusher, all rock coming from the quarry would need to be broken to a size of 3 ft. or smaller before it would enter the crusher. The necessity of breaking the quarry product to 3 ft. and smaller would add materially to the cost of operation of a gyratory plant. The initial crusher in the plant as built, however, will take any piece of rock that will ordinarily come from the quarry, and this greatly reduces the cost of quarrying, handling, and crushing. The matter of repairs is of small moment in this plant, as it is estimated that all wearing parts will last for two years or more in continuous operation without renewals.

Some of the novel features of this plant are the trackage arrangements and the facilities for loading and unloading all products during construction, there being provided a standard-gauge track along the upper side of the plant; a crane runs over this track and into the crusher building, facilitating the removal and placing of the heavy machinery directly from the railroad cars. When the plant is completed this same track will be used for returning the empty cars to the quarry. The crane is so placed that it may be used to advantage, if necessary, for removing pieces of rock more than 7 ft. in size which may have gotten into the plant by accident, and any possibility of congestion from this source is avoided.

There are also two main delivery tracks running directly through the building, and heavy chutes extending from both tracks to the initial crusher. Only one of these tracks will be used at a time, the other being purely an auxiliary to be used in case of mishap or obstruction, when it may be put into commission, thereby making it unnecessary to close down the plant. This track equipment is so arranged, also, that the initial crusher can be temporarily closed down and the rock fed directly to the second crusher, this being especially desirable should the rock from the quarry be running in small sizes, such as would enter the second crusher without difficulty, thus not only saving the large crusher, but considerable expense in the matter of power. This arrangement also permits the making of repairs or changing of wearing parts on one machine without the necessity of closing down the whole plant.

Unloading Device.—There is provided a special unloading device which is supported by the crane extending over the large crusher, delivery tracks, and chutes. This device consists of an air-lift, the cylinder being 20 in. diam., designed to work under an air-pressure of 80 lb., and having a lifting capacity of ten tons. As the cars pass in front of the chutes, one man can quickly dump them by hoisting one side of the car; a very economical arrangement.

Large Crusher.—The large or initial crusher in this plant has a jaw opening of 5 by 7 ft., and will easily take a stone weighing 10 tons and reduce it within one minute. This crusher is constructed of cast steel throughout, with the exception of the large fly-wheels, and has a total weight of 450,000 lb. The fly-wheels are 12 ft. diam. and weigh 15 tons each. The swing-jaw shaft is 20 in. diam. and weighs 6 tons, while the pitman shaft is 24 in. diam. in the pitman and 20 in. at the bearings, and weighs 8½ tons. The swing-

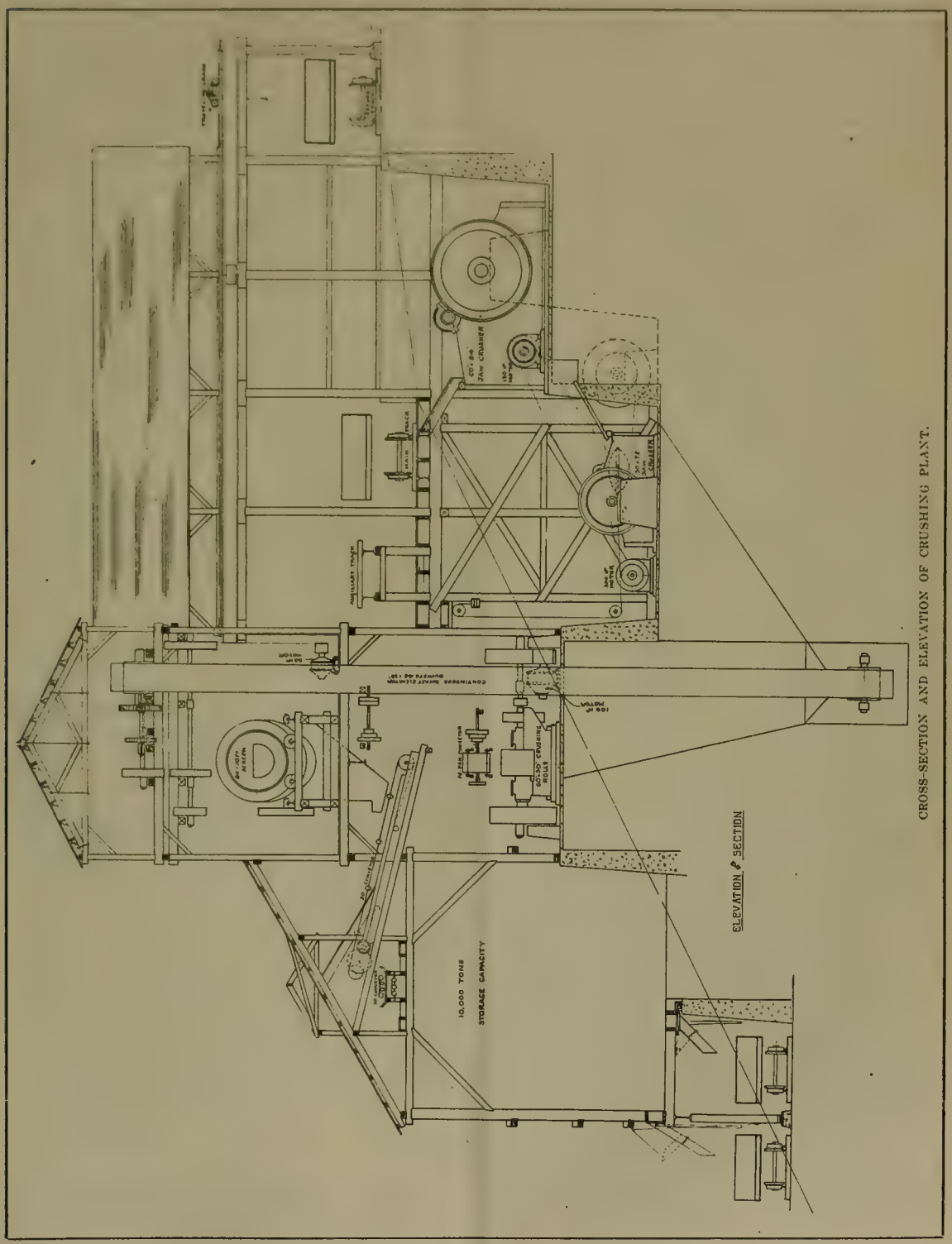
*By courtesy of the author, we are enabled to present this description simultaneously with its publication in *Engineering News.*

[1]The crushing plant was designed by the Traylor Engineering & Manufacturing Co., 30 Church street, New York, with works at Allentown, Pennsylvania, and is being erected by them, including all buildings and the setting of the machinery.

ing jaw of this machine is 13 ft. long by 7 ft. wide, and weighs 74,000 pounds. The wearing plates are made entirely of manganese steel in sections which are interchangeable, so that the different sections may be changed about from time to time, thereby greatly increasing their life. All bearings are water cooled, and compression grease cups 12 in. diam. are provided as an integral part of such bearings for lubrication. The over-all length of the crusher is 24 ft., the width 15 ft., and the height 13 feet.

Second Crusher.—The second crusher has an opening of 3 by 6 ft. and is of the same type as the large one, with an over-all length of 13 ft., width 13 ft., and height 9 ft. The swing jaw shaft is 12 in. diam., and the pitman shaft 14 in. at the pitman and 12 in. at the bearings. The fly wheels are 8 ft. diam. by 12 in. face, and have a peripheral speed of 5000 ft. per minute, being operated at a speed of 200 r.p.m. The total weight of this machine is 210,000 pounds.

Elevator. The situation of the plant is such that it requires the raising of all product, after passing the second crusher, to the screen. The elevator used is of the continuous type, each bucket being 42 in. long, 18 in. deep, and 19 inches in projection. These buckets are fastened to a shaft, the ends of which are equipped with steel-bushed rollers. These rollers travel on a 30-lb. rail made fast to



CROSS-SECTION AND ELEVATION OF CRUSHING PLANT.

runway timbers. Each bucket is provided with a double link-bar on each side, made of ½ by 3 by 18-in. bars. The rollers are lubricated by means of compression grease-cups suitably connected to the end of the roller shaft. The buckets are made of ¼-in. steel pressed from a single sheet and reinforced with a ¾ by 2-in. bar strap fastened on the lip of the bucket, for taking the wear at this point. The speed of the elevator is 95 ft. per minute. The head of the elevator is equipped with compound back gears of large dimensions and operated from the line-shaft that drives the screen.

Rolls.—The 30 by 60-in. heavy-duty roll is one of the largest smooth-faced rolls yet built in this country, considering the width of face and weight of machine. This roll has an over-all dimension of 16 ft. The shafts are 16 in. at the hub and 14 in. at the bearings, each bearing having a length of 46 in. The frame is cast in one piece, and alone weighs 30 tons. The drive pulleys are made of cast steel, the main pulley being 96-in. diam. by 24-in. face, while the smaller pulley on the movable roll is 60-in. diam. by 14-in. face. This roll is operated at a speed of 50 r.p.m. or a peripheral speed of 785 ft. per minute. The rolls are equipped with an ingenious lateral adjusting device to prevent corrugating or channeling of the roll tires. The bearing of this roll is so constructed that it is double the size required for the work being done, is dust proof, and is efficiently lubricated. Its capacity is 300 yd. per hour, crushing from 4 in. down to 2 inches.

Power.—The large crusher is operated by a 300-hp. 3-bearing form 'M' mill-type induction motor, of the slip-ring type, and has about 2½ times full torque load in starting. It operates at a speed of 560 r.p.m. This motor is equipped with a self-starting regulator, 27 by 33-in. pulley, and drives a jack-shaft with a 26-in. triple-leather, endless belt, the pulley on this shaft being 27 by 94 in. This jack-shaft is equipped with an approved individual friction cut-off clutch which permits the starting of the crusher after the motor is in motion. On this jack-shaft is a 60-in. heavy sheave wheel, with 15 grooves for 1½-in. rope, by which the large crusher is operated, the driving sheave on the crusher shaft being 11 ft. diam. A suitable tension carriage and idler sheave is used in connection with this rope drive.

It will be noted that on account of the intermittent load, due to the irregularity in the size of product fed into a crusher of this size, it becomes necessary to have great flexibility in the transmission, although it is apparent that when this crusher is operated at full speed, with the enormous momentum of the two 12-ft. 15-ton fly-wheels revolving at a peripheral speed of 3400 ft. per minute, there can be but little variation, even though the feed is intermittent.

The motor for operating the 3 by 6-ft. crusher is 150 hp., 560 r.p.m., and of the same type as the 300-hp. motor above mentioned. It is equipped with self-starting regulator, and a pulley 21 by 29 in. is belted direct to the crusher, with a 20-in. extra double-leather endless belt. The crushing roll is operated by a 100-hp. 560-r.p.m. motor, of the same type as the others, and is equipped with a pulley 17 by 21 in., which drives a 17 by 108-in. pulley on a jack-shaft, this jack-shaft operating the rolls and also the countershaft that drives the roll feeder. The elevator and screen are driven by a separate 50-hp. type 'K' squirrel-cage induction motor, equipped with self-starting regulator, and operates at a speed of 850 r.p.m. There are two conveyors in the plant—one, the short or cross-conveyor, is operated by an individual 5-hp. type 'K' motor, direct connected through gearing and countershaft; the other, or main conveyor, is driven by a 15-hp. type 'K' motor, direct connected through gearing and operating at a speed of 850 r.p.m., and provided with an individual automatic starter. The current used is alternating, 3-phase, 60-cycle, 440 volts, stepped down from 2200 volts.

THE production of manganese ore in India increased from 642,675 tons, valued at $1,819,540, in 1909, to 800,907 tons, valued at $4,145,275, in 1910. The principal mining of manganese ore during the year was done in the Central Provinces.

California Gas Production

The report of the United States Geological Survey shows an increase in the production of gas in California in 1910, as compared with previous years, and the probability is that this increase will continue on account of the new discoveries recently made. In the Midway district of Kern county four gas wells of high pressure and large capacity had been completed at the close of 1910, and although the gas from these wells was used to some extent for field purposes, preparations were in progress to pipe the gas to towns in the neighborhood of the wells. It is reported that Bakersfield and Fellows are to be supplied, and Taft and Maricopa are now being supplied. Many of the oil wells in California produce sufficient gas to operate the wells, and some have gas to supply neighboring leases both for drilling and operating, as well as to supply a few domestic consumers in the vicinity of the wells. Early in 1910 the exploration for oil to the east of the South Midway fields developed some unusually large gas wells in the Buena Vista hills. Near the close of the year these wells were gotten under control, and active steps were taken for piping the gas to Bakersville. There is every indication that gas will be eventually piped down the San Joaquin to Fresno, and thence to San Francisco in one direction and to Los Angeles in the other. The total production of gas in California was estimated at 2,764,507,000 cu. ft. in 1910, valued at $476,697, of which 245,738,000 cu. ft., valued at $194,631, was supplied to domestic consumers, and 2,518,769,000 cu. ft., valued at $282,066, was supplied to industrial consumers. The gas supplied for industrial purposes was chiefly the product of the oil wells and was utilized for drilling and pumping in the field. The number of gas wells in California at the close of 1910 was 55, three gas wells having been drilled during the year. The number of gas wells abandoned in 1910 was twelve.

MANY attempts have been made to introduce paper as a substitute for the costly prepared skins used by goldbeaters, but only with partial success. Paper was employed before goldbeaters' skin for making leaf metals, and the Chinese and Japanese still use paper, made from the fibres of the mulberry tree, for goldbeating. For the first stages of goldbeating, animal parchment has been used since the seventeenth century; also vegetable parchment in the later stages. Comparative experiments have shown that animal parchment permits only a relatively very slight reduction of the metal sheet; parchment paper allows the metal to be beaten somewhat thinner, but when the limit is passed the metal adheres so firmly to the paper that it cannot be separated without damage. According to a process devised by J. Heinrich (Ger. Pat. 123,197), thin, tough paper of substance of 25 to 30 gm. per square metre is steeped in a hot solution of borax or alum. The paper is stretched over frames, and a coating, first of albumin and then of isinglass solution, is applied, first to one side and then to the other. Papers of various kinds are now used in many goldbeaters' shops, but only for the first stages; the leaf metal is always finished between ordinary goldbeaters' skin. Leaf made from baser metals, however, is beaten throughout between paper. A paper which will serve all the purposes of skin for the manufacture of gold-leaf has yet to be discovered.—W. Theobald in *Papier Fabrikant.*

BY FAR the most important of the six gold mines in the Dutch East Indies is the Redjang Lebong, Sumatra; during 1910 the value of the output was £403,000 and the dividend was at the rate of 100%. The next largest is the Ketahoen, also in Sumatra; the output was worth €114,000, and the dividend was 20%. There are two producers in Celebes, the Totok and Paleleh, yielding £63,500 and £58,500 during 1910, respectively; the latter paid 7½% dividend. The Sintoeroe in West Borneo produced €17,500 and made a small profit.

Russian Gold Production in 1911

ST. PETERSBURG CORRESPONDENCE

Reports are beginning to come in, though not of a sufficiently complete character, respecting the gold production in Russia and Siberia during the past year. One is to the effect that in the Urals, while the production in 1910 amounted to about 480 poods* of gold and of platinum to about 331 poods, something like the same totals are to be expected as the results of working last year, 1911, although it is remarkable that, the price of platinum having soared away to a hitherto unattained level, namely, 36,000 to 37,000 rubles per pood, the quantity of platinum produced will be seen to have remained at about the level of the preceding year. That does not, of course, prevent the platinum producers from having made a fine year's business out of the metal last year. The future of the Ural gold industry, it is now seen clearly, must be based on vein gold, because the gold sands that yielded such handsome returns to the gold washers of the past appear to have all that is of real value washed out of them, and it is only the remains of the gold sands that now respond to the efforts of the gold producer. The individual gold washer, in view of the metamorphosis in the industry, will now rapidly disappear, and mining and stamping plants, and all the appliances accompanying the working of gold quartz, will take his place and he will only be an auxiliary.

In the neighboring area—Western Siberia—the gold sands are also weakening, and here, too, the question of vein gold is the one that is occupying the mind of the gold producer, who appears usually in the form of joint-stock companies largely financed, as is known, from outside the country. There is a company, known as the Russian Gold Co., the principal function of which appears to be the financing of various enterprises that yield sufficiently good prospects to justify their being so supported. The production of gold in Western Siberia amounted to about 280 poods in 1910, and in 1911, as in the case of the Urals, is expected to be about equal to this.

Going farther to the famous Olekmin and Vitim river basins where the Lena Gold Co. has operated with such wonderful success—at all events, as a producer—the yield this last year is expected to come out inferior to that of 1910, which was about 845 poods, because the want of water made it difficult in many cases and impossible in others to wash the gold. Other areas now well known as gold-producing ones within the limits of the Russian Empire are the Priamur and the Primorsk. In these two provinces the difficulties attending the production of gold are well known, consisting chiefly in the absence of labor, power, and of the means of communication, not to speak of the faulty state of knowledge there. The production of gold in 1910, which was something like 800 poods in these provinces, has received a serious setback in 1911 and is expected to have made no better than 700 poods when the figures are available. This preliminary statement for 1911 indicates that while the nearer goldfields, those of the Urals and Western Siberia, will soon have done with dredges, the more distant ones, namely, those of Eastern Siberia and as far northeast as the Tchukot peninsula, where, as has been repeatedly pointed out, about 95% of the gold comes from sands, will afford a market for dredges.

The gold sands of Eastern Siberia, of course, vary in richness, and independent workers as well as the strong companies will attack the richer sands first. But as Russian gold reserves are now attracting more attention than ever before, always putting aside the temporary gold fevers such as attended the speculative world a year or two ago, the determination to get the best out of the ground cannot fail to cause those engaged in the work to bring the best appliances, plant, and apparatus into operation that the means at their disposal may make possible. Every year the number of dredges at work in Russia shows an increase, and as the suitability of these for work becomes known to local men they will, of course, come into greater demand. The chief difficulty for the moment is the obstinacy of the Russian Government, which will not assist the gold industry by allowing foreign dredges free entry or even at a reduced duty so as to bring the lower grade sands within the reach of profitable operation. At the same time it is notorious that the Russian-made dredge is an exceedingly inferior article and is hardly worth buying except to handle sands of a fair gold content. Its cost is enormous, owing to the protective duty, and the interest chargeable on this prime cost is sufficient to wipe out a considerable margin of the gold content of the sands, as far as the profit and loss account of the respective concerns goes.

But the Russian goldfields, even in the Far East, are not exclusively alluvial. They have been demonstrated in many districts to be largely of gold-bearing veins, and when, as indicated above, the intensive exploitation of the sands has reached its maximum, which must take place at a much more rapid rate now than previously, there will be an appeal to the lower-lying vein gold and a call for the mining plant and machinery required for its exploitation.

*One pood of pure gold is worth $10,886.72.

Production and Dividends, Portland Mine

The record of production and dividends of the Portland gold mine, Victor, Colorado, covering the period from April 1, 1894, to December 31, 1911, was given in the recently issued annual report.

	Net Tons.	Gross Value.
April 1 to Dec. 31, 1894	7,826.286	$ 553,975.75
Jan. 1 to Dec. 31, 1895	31,516.346	1,700,094.89
" " 1896	23,598.172	1,116,128.29
" " 1897	18,852.221	1,177,642.65
" " 1898	27,798.850	1,879,681.96
" " 1899	38,548.090	1,951,219.34
" " 1900	60,786.755	2,351,396.26
" " 1901	76,905.550	2,408,413.23
" " 1902	89,664.279	2,334,023.76
" " 1903	90,244.582	2,608,993.59
" " 1904	96,521.385	2,598,724.84
" " 1905	109,233.496	2,422,033.42
" " 1906	103,614.253	1,932,083.22
" " 1907	79,960.049	1,600,950.52
" " 1908	94,311.432	1,834,080.79
" " 1909	83,908.459	1,438,650.35
" " 1910	67,515.200	1,241,168.30
" " 1911	50,258.435	1,140,054.05
Total	1,151,063.843	$32,289,315.21
VICTOR MILL		
July 1 to Dec. 31, 1910	46,237.000	113,253.44
Jan. 1 to Dec. 31, 1911	120,961.000	424,489.15
Grand total	1,318,261.843	$32,827,057.80
Total dividends paid to Jan. 1, 1912		$8,917,080.00

PERSONAL INJURIES occurring to workers on the Los Angeles aqueduct form the subject of a paragraph in the recently issued report of William Mulholland, chief engineer, for the year ended June 30, 1911. The statistics cover the entire period during which construction has been in progress, approximately five years. From the beginning of construction work on the aqueduct to the date of the report, 653 cases of injury to employees have been reported to the department for investigation. This total, however, includes all cases, no matter how slight the injury and regardless of whether or not the employee lost any time by reason thereof. In pursuance of the policy adopted by the Board of Public Works, half pay has been allowed during the period of disability due to such injuries, to 325 of the injured employees, the total amount paid out on such half-pay allowances being $12,454.58. In eight cases the employees have made claims for damages, six of these cases resulting in suits for damages. An aggregate sum of $7750 has been paid in settlement of such damage claims, and there are three suits for damages still pending against the city growing out of personal injuries received by employees on the aqueduct while engaged in the performance of their duties.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

The Estimation of Tonnage

The Editor:

Sir—Mr. Stadler's article in your issue of January 27 will have been welcomed by mill and cyanide men who have to obtain tonnage figures from specific gravity measurements of their pulp. If the author could give some hints on how to obtain the value of 'd' (density of solid) in the case of clayey, graphitic, or otherwise nonhomogeneous ores, his article would be of yet greater value. A short time ago I attempted to obtain the weight of ore passing through a tube-mill by taking the weight and specific gravity of the discharge from the feed cone, but could obtain no reasonably consistent figures. The ore contained quartz with a large amount of clay and oxide of iron; on drying it at steam heat and then determining its density in the usual way, quite discordant results were obtained, probably due to varying oxidation of the iron and dehydration of the alumina. Further attempts were made by taking a litre of pulp in a flask and weighing it, then allowing the solids to settle, and determining the specific gravity of the clear supernatant liquid. As much as possible of this liquid was then siphoned off and the flask filled with a liquid of different specific gravity, such as alcohol or concentrated cyanide solution. After thorough mixing, the flask was again weighed, the solid allowed to settle, and the specific gravity of the supernatant liquid determined. From these weights values for the density of the solid were obtained, but these were scarcely better than those obtained by the drying method. Can Mr. Stadler help those in like difficulty who have not a nice clean ore of regular density to work with? T. B. GREENFIELD.

El Oro, Mexico, February 8.

[The article on estimation of tonnage, by A. W. Allen, published elsewhere in this issue, will doubtless serve to meet our correspondent's need.—EDITOR.]

The Chicksan Mines, Korea

The Editor:

Sir—In my description of the Chicksan mines, Korea, published in the *Mining and Scientific Press* of April 1, 1911, the following passage occurs, "enough work has been done, however, to show that the vein [at Homune] is of good size and has an average gold content of $11 per ton." The mine was full of water at the time of my visit to the property, and this statement was based, among other sources of information, upon a report on the Chicksan mines published by the Shibusawa-Asano Mining Partnership, where, following a statement that the assay results are from samples taken from a vein throughout its whole breadth and at several places in the vein, the gold content of the Homune vein is given as 2.21 oz. Edwin W. Mills has since written me that "according to the Koreans, the Homune vein produced a great quantity of gold down to a depth of some 120 to 130 ft. At this point the inflow of water was so great that further work had to be abandoned. Under my direction the main shaft was sunk to a depth of 245 ft., and a vein of quartz was found about 30 ft. from the shaft on the 225-ft. level. But no vein with an *average* gold content of $11 per ton has yet been proved at Homune." The wording of the Japanese report is obscure, and as Mr. Mills was at one time superintendent of the property he should be in a position to speak authoritatively regarding it. Mr. Mills further objects to my designating the terms of this concession as favorable, since other companies now operating in Korea enjoy even more favorable terms. It seems to me, however, more accurate to speak of these latter as unusually favorable, rather than to regard the former as unfavorable. During 1911 the Chicksan Mining Co., an American company, in which the Korean Exploration Co. and the Shibusawa-Asano Mining Partnership hold equal interests, has been finally organized. This company was referred to in my description as though it were already formed, though it was at that time only in process of formation.

THOMAS T. READ.

San Francisco, February 16.

Precipitation of Copper From Mine Waters

The Editor:

Sir—A reference to the precipitation of copper from sulphate solution by the use of metallic iron, which does not appear to have come to the attention of your Rio Tinto correspondent, W. G. Nash, and which has considerable interest for students of the subject, is found in the writings of Aureolus Philippus Theophrastus Bombast, of Hohenheim, called 'Paracelsus the Great', who was born about 1493 and died in 1541. In the 'Book concerning the Tincture of the Philosophers', chapter VI, is found the following statement:

"This work is a wonderful one in the light of Nature, viz., that by the Magistery or the operation of the Spagyrist, a metal which formerly existed should perish and another be produced. This fact has rendered that same Aristotle, with his ill-founded philosophy, fatuous. For truly, when the rusties in Hungary cast iron at the proper season into a certain fountain, commonly called Zifferbrunnen, it is consumed into rust and when this is liquefied with a blast-fire, it soon exists as pure Venus [copper], and nevermore returns to iron. Similarly in the mountain commonly called Kutenberg they obtain a lixivium out of marcasites, in which iron is forthwith turned into Venus of a high grade, and more malleable than the other produced by nature."

This statement affords clear proof of the fact that this method of gaining copper was not merely an experiment, but was actually a process commercially resorted to for the purpose of procuring the metal. It is also one of the clearest and most definite statements of the reason why the alchemists believed in the transmutation of metals. If by merely immersing metallic iron in clear spring-water the iron disappears and copper is found in its place, what better evidence could there be? The paragraph cited above is found in the English translation by Arthur Edward White, Volume 1, page 28, published in London in 1894.

HORACE V. WINCHELL.

Minneapolis, February 8.

Gold Deposited by Magnetic Electric Currents

The Editor:

Sir—The article in a recent issue of the *Mining and Scientific Press*, entitled 'A Mountain of Gold', by T. A. Rickard, and a review of which appeared in the *Literary Digest*, January 13, 1912, impels me to air my views as to the method by which gold is deposited in quartz veins or bodies. I am no geologist or metallurgist, but have spent almost thirty years in the gold-mining field, during which time I have visited and seen many mines and prospects, and have often noted conditions that, to my reasoning, conflict with the universally accepted theory that gold is deposited in quartz by direct precipitation from solution. I cannot reconcile this theory with the fact that orebodies become impoverished in depth. Again, in all artificial precipitation, the gold precipitates as a powder—in little separated granules—and I would judge natural precipitation would do the same. I do not dispute the fact that gold is held in solution in the water of the earth and seas, and possibly some gold is deposited by precipitation directly from the solution, but this must be distributed more uniformly throughout the mass than the rich bunches and nuggets will admit of.

I believe the gold is deposited by magnetic currents, of

which the earth is full. These currents, as they pass back and forth, pick up and carry—in other words, become impregnated with the gold electrons, and are carried by them until they come in contact with quartz, which is a precipitant. The gold once deposited acts as an agent of attraction for more gold, the same as amalgam in a mill; and I hold where rich bunches and nuggets in quartz are found, these currents were strongest and crossed.

There is a belt of country east of the Mother Lode in California that is full of fissures, which are young, geologically speaking, and in many of these rich ore is found at or near the surface, but invariably the amount decreases rapidly with depth, and no great depth at that. The reason is, that these fissures being of recent date and the currents acting slower with depth, there has not been time for enrichment. There is no doubt in my mind but that, in ages to come, all these veins will have been enriched in depth, according to the energy in the currents and the auriferousness of the surrounding country. All the older formations or veins where ore of good value is found near the surface almost invariably are found to contain ore of value to a substantial depth, and if gold is deposited by direct precipitation to a certain depth in old fissures, why not in the younger ones? Further, since gold precipitates in a powdered form artificially, it is reasonable to suppose it would do the same naturally.

I account for the solid nuggets as having been formed by the gold electrons being welded together by the magnetic currents at the time of being deposited. The quartz electrons (I use the word electrons, since an electron is supposed to be the ultimate element of matter, hence all matter must resolve itself into electrons) are disintegrated and disposed of by the same method that the gold is deposited. I quite agree with Mr. Rickard in his statement that it is hardly likely that veins of solid gold will ever be discovered, or any deposits larger and richer found than any heretofore known. I believe that it was intended for gold to be a precious metal, to be used for its present purposes, and that the same is true with the other metals, which have all been deposited in proportion to their various uses. Creating a deposit of gold would destroy its value for the purpose intended. My theory of the slow formation of gold in veins and orebodies by magnetic currents does not admit of such a possibility, since geologically the veins and bodies are not old enough. I believe in the distant future, when gold deposits shall have become exhausted, gold will be collected by electro-magnetism (generated at stations for the purpose) from the earth and sea.

F. J. MARTIN.

Angels, California, January 25.

[Mr. Martin need offer no apology for writing. A man need be expert neither as geologist nor metallurgist in order to make observations of value, and Mr. Martin's notes on the relative ages of veins in the California gold belt, based upon his long acquaintance with the region, are of independent worth, whatever may prove to be the correct explanation. As to the theory he proposes, it has many elements that are attractive and is not necessarily in conflict with that of deposition from solution, since electric currents act through the latter. When the United States Geological Survey was first formed, G. F. Becker undertook field tests as to the strength and possible importance, from the point of view of ore genesis, of the earth currents. The work was expensive, results conflicting, and the matter was given up without definite results. In the decades since these studies were made, much has been learned about magnetism and about methods of measuring currents. The relations of electric currents to solution and deposition of metals are also better understood. Perhaps a re-study of the whole problem now would lead to positive results, either affirmative or negative, and if so, would seem to be well worth while.—EDITOR.]

Heating Cyanide Solutions

The Editor:

Sir—With reference to the benefits derived from slime treatment with heated solution, the one probably least considered is increased filter capacity. I offer the following record of results obtained with two Just laboratory filters run simultaneously, one cold and one at about 100°F., at constant vacuum on identical pulp. The wash solution in each case was cold.

TEST NO. 1

	Time, min.	Solution Displaced. c.c.	Value per ton.	KCN.	P.A.	Cake. Dry Wt., gm.	Moisture, %
Loading A at 70°F.	60	1570	$1.86	1.3	0.5	825	36½
Washing A with cold water	60	785	1.45	1.1	0.4		
Loading B at 100°F.	20	1570	2.08	1.3	0.5	810	34
Washing B with cold water	100	1435	0.92	0.55	0.25		

Difference by fire assay in tailing value in favor of heating pulp over loading cold on same length cycle, $0.28 per ton.

TEST NO. 2

	Time, min.	Solution Displaced. c.c.	Value per ton.	KCN.	Cake. Dry Wt., gm.	Moisture, %
Loading A at 70°F.	45	1635	$1.36	1.05	915	41
Washing A with cold water	50	830	1.20			
Loading B at 100°F.	15	1850	1.36	1.05	885	38
Washing B with cold water	80	2460	0.42			

Difference by fire assay in tailing value in favor of heating pulp over loading cold on same length cycle, $0.28 per ton.

A consideration of the above results will show that in preheating pulp going to the other filters (in this case a very difficult natural slime) the loading period was reduced 60%, the permeability of the cake to wash solutions increased and more undissolved gold put into solution during both loading and washing periods. On the other hand, by preheating, the cycle could have been reduced from 150 minutes to 110 minutes for the same efficiency as when loading cold, increasing the filter capacity 27%. In the mill for which three tests were run the total tonnage could thus have been increased 21%, the capacity of the filter plant being the limiting factor in tonnage treated.

NOEL CUNNINGHAM.

Millers, Nevada, February 3.

Federated Malay States Gold Output

The amount of gold exported during the month of November 1911 was 775 oz. from Raub. The total amount exported during the previous months of the year was: From Seremban, 241.79 oz.; from Raub, 6134 oz.; or a total of 6375.79 oz. The total amount exported to the end of November was: From Seremban, 241.79 oz.; from Raub, 6909.40 oz.; a total of 7150.79 ounces.

SILVER-LEAD, zinc, and copper ores were mined in the Ussuri mining district during 1910 in respective quantities, as follows: 2085 tons, 14,770 tons, and 40 tons.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

COPPER is sometimes added to nickel steel, to the extent of ½%, for facing armor-plate to resist corrosion.

AMERICAN rosin in large quantities is being sold in Japan, an order of 3000 barrels having been sold at one time through Yokohama importers.

ROLLS for grinding lasted nine years in the Colorado Springs plant of the Portland Gold M. Co., and two new sets of 16 by 32-in. rolls have just been substituted for the old ones, at a cost of $4034.13.

FIBROUS talc is a variety of talc or soapstone that occurs at but one locality in the United States, Gouverneur, St. Lawrence county, New York. It is used principally to give weight to paper. In 1910 the production was some 70,000 tons, of an average value of a little over $10 per ton.

LODE locators in California are required by state law to file proof of labor within 30 days after the time limit for performing such labor, but there is no 90-day requirement as to work. The statute merely provides that development work shall be of the character, in the manner, and within the time required by the laws of the United States.

PERMISSIBLE charges for surveys and charges for publication in newspapers have been fixed by the Commissioner of the General Land Office, in accordance with the provisions of the Land Office regulations. In a daily paper the charge may not exceed $7 for each ten lines for the full period required by law. For a weekly paper, $5 is the permissible charge. For the publication of citations in contests or hearings, not more than $8 may be charged for five publications in a weekly paper, or $10 for publication in a daily paper for thirty days. When it appears that excessive charges have been imposed by any surveyor, prompt steps are taken to correct it.

IN assaying ores containing much copper this metal is largely concentrated in the lead button, making it hard, and necessitating repeated scorifications, and in some cases a preliminary removal of the copper by solution of the ore in nitric acid. This leaves the gold in the insoluble residue, which is filtered off, and the silver in the solution is thrown down by hydrochloric acid. The resulting precipitate of silver chloride is filtered, and the residue and the precipitate are scorified together. Ores containing much arsenic or sulphur are generally roasted at a low heat, and the assay is made on the roasted material, but this must be carefully done, otherwise considerable losses will occur.

TELLURIUM can be detected in ores by a method recently described by G. T. Holloway, who suggests a method of isolating the metal from ore for testing purposes by concentrating it with the gold and silver in a lead button obtained by the ordinary fire assay, it being possible to treat as much as 50 to 60 gm. of ore in this way. The lead button is then dissolved in nitric acid, diluted, and the tellurium precipitated by means of lead foil, the deposit thus obtained being then cleared and tested by concentrated sulphuric acid. If tellurium is present a deep violet color is produced that disappears on further heating. Manganese peroxide, when present, sometimes interferes with this test.

IN explosives for use in the open air, such as, for example, quarrying or railroad excavation, strength and efficiency in removing rock are the qualities that are most important, and usually are the only ones that need consideration in the selection of a suitable explosive. Explosives that are to be used in tunneling must not only possess strength and efficiency, but also be of such composition that upon exploding they will not give off large quantities of poisonous or offensive gases. In explosives intended for use in coal mines, a further property is most important. Besides possessing the qualities of strength, efficiency in breaking down coal, and freedom from poisonous explosion products, the explosive should be of such nature as not readily to ignite explosive mixtures of gas or coal dust.

WHEN mining claims are re-located in such a way as to forfeit the rights of previous locators, the question as to whether the improvements made are forfeited depends upon whether they can be considered a part of the realty or not. Thus, in California it has been held that an engine and pump became part of the realty, and an engine-house with 15-hp. engine, boiler, and attachments, fastened to the realty and used for development of the claim, were held to be real property, belonging to the re-locator, while a cabin set on blocks and a portable fence were held to be personal property. The land department has held that the improvements re-located cannot be counted as part of the $500 expenditure required by law.

THE oldest locomotive-manufacturing plant in Sweden, the Trollhättan Mechanical Works, operated by the firm of Nydqvist & Holm, is now constructing its one thousandth locomotive. The plant was established in 1847 principally for making heavy castings and turbines. Locomotive manufacture was begun in 1871. Imports of locomotives into Sweden, mostly from Germany, have been as follows for the last three years for which statistics are available: 1907, 23, worth $55,370; 1908, 27, worth $79,830; 1909, 11, worth $23,350. In 1907 five locomotives were exported from Sweden to Denmark and one to Norway, the total value of the export being $35,900. In 1908 eight locomotives were exported, all to Denmark, the value being $90,460. None was exported in 1909.

TO ascertain the velocity of a stream choose a place where the channel is straight for 100 to 200 ft. and has a nearly constant width and depth; lay off on the bank a line 50 or 100 ft. in length, marking each end; then allow small chips to float down the stream, by one of the methods described below, noting the time required for these to traverse the distance laid off on the bank. The surface velocity in feet per second is obtained by dividing the distance in feet passed over by the float by the time in seconds it takes the float to travel this distance. The average of several such determinations will give the mean surface velocity of the stream. This result multiplied by the coefficient 0.80 gives very nearly the mean velocity of the stream. To obtain the area of the cross-section of the stream, stretch a tape from shore to shore and take the depth of the stream at intervals of 2 to 5 ft. The average of these depths may be assumed as the mean depth of the stream. This average multiplied by the total width will give the area of the cross-section of the stream in square feet. The discharge is found by multiplying this cross-section area by the mean velocity, as obtained by the float measurements, the result giving the discharge in second-feet, or, in other words, the number of cubic feet flowing past the point of measurement each second. In determining the velocity for small streams and when only approximate results are desired, the float is placed in the centre of the stream only. For larger streams and when greater accuracy is desired, a tape is stretched across the stream and the distance between the banks is divided into a number of equal spaces or sections. Floats are then allowed to drift down the stream as near as possible to the centre of each of these spaces, the same number of floats being used for each section. The mean surface velocity is then assumed to be the mean of the surface velocities obtained for the several sections. For each float the distance of its starting point from the right bank is recorded as indicated.

Special Correspondence

BULAWAYO, SOUTHERN RHODESIA

Decline of the Bucks Reef Property.—Selukwe Columbia Profits.—Tanganyika Smelter at Lubumbashi.

That Rhodesia, although it possesses numerous large low-grade properties and not a few mines which are enduring in depth, is a country which contains, in the main, erratic quartz shoots of no great extent, has been generally recognized for years past, although in times of great prosperity, as, for instance, during the boom of 1909-1910, this consideration is often very largely disregarded. However, from time to time, events happen which serve to emphasize the truth of the view that in the majority of Southern Rhodesian mines it is unwise to look much beyond the pick or the face of the last blast. The disastrous decline in the fortunes of the Bucks Reef Gold Mines, Ltd., affords a case in point. In 1910 Bucks Reef shares were quoted at 68s. 9d.; today they stand at about 7d. The profit for the year 1910 amounted to £33,115, being at the rate of 82s. 7d. per ton, whereas during the quarter ended September 30, 1911, a profit of only £2167, or 15s. 9d. per ton, was earned. More recently the property has been operated at a loss. The ore reserves were, at the end of September last, only about one-half of what they

TYPICAL SMALL MINE IN RHODESIA.

stood at twelve months previously, and the value of these reserves was also one-half of what it was on September 30, 1910. During the last month or two the stope between the second and third levels in the Prestwood block has come into poor ore, consequently the grade milled for October and November was lower. A little while ago the consulting engineer visited the mine, and reported that, while recent developments have shown an improvement, the ore opened up will not be available for some months.

A satisfactory improvement is to be noted in the report of the Selukwe Columbia Gold Mine, Ltd., not only in the profit earned, but in the underground development as well. For the year ended June 30, 1910, the operating profit was £8869, while in the twelve months ended June 30, 1911, the profit was £18,222. The improvement is in a large measure due to the satisfactory manner in which the lower levels on the main lode have been opened up. On account of this the tonnage milled has been increased, and furthermore, the grade of ore sent to the mill has been augmented. With a view to increasing development, an important addition has been made to the plant during the year in the form of an electric air-compressor at the auxiliary shaft. This compressor, which has a capacity of five drills, will be used for the development of the eastern section, and will allow the six-drill compressor, at the main power station, to be used entirely for the main and No. 2 lodes. To supply the extra electric power required for the compressor, a second generating set has been installed at the main power station.

After years of promises and unfulfilled anticipations, copper smelting operations are at last proceeding in the areas controlled by the Tanganyika Concessions, Ltd., in the Katanga district of the southern Congo and in those portions of Rhodesia which lie to the north of the Zambesi river. In so far as the Tanganyika company is concerned, the smelting work calling for chief remark is the proceeding at Lubumbashi, close to the Star of the Congo mine and the township of Elizabethville. The method of treatment there adopted has been kept much of a secret, but it is pretty generally known that operations are not resulting too satisfactorily. For one thing, the type of furnace employed is said to be unsuitable, and although this was pointed out before they were installed, the Tanganyika Concessions management insisted on carrying through the original program. Then again, the absence of a good quality of coking coal at a reasonable distance from the Tanganyika Concessions mines has been a serious economic drawback. With the existing railway systems, Beira is the nearest port of the Katanga, and coke imported over this route from England costs £14 to £15 per ton, an almost prohibitive price. With a view to remedying matters in this direction, the Tanganyika Concessions, Ltd., recently has been negotiating with the Wankie Colliery Co., whose property is situated in northern Matabeleland. What the eventual result of these negotiations will be is, however, much of a speculation, for the coking possibilities of the Wankie coalfields are problematical. Recently extensive coal deposits have been found on the Congo-Zambesi watershed by the Rhodesian-Katanga Function Railway Co., and development of these is proceeding, but here again, coke is a very questionable matter. Owing to the peculiar geographical position of the Katanga fields, situated, as they are, almost in the heart of Africa, with the nearest port in Portuguese West Africa and as yet unconnected with the copper belt, the outlook for these areas, which are indisputably of highly mineralized nature, is far from bright.

LONDON

Camborne School Situation Acute.—San Felix Mine Has Good Ore Reserve.—Tin-Dredging in Southern Siam.

About three months ago I referred in this column to the parlous state of the Camborne Mining School, in Cornwall, and to the short-sighted policy of the governors in not making the most of the new principal, W. Fischer Wilkinson. At the time, I mentioned that the finances were several thousand pounds on the wrong side for the year, and that there were serious thoughts of abandoning the King Edward mine, where the practical lessons are given. The news from Cornwall this week indicates that the position is becoming acute. It is stated that Mr. Wilkinson has handed in his resignation, and that this notice and the question of the mine are to be discussed at the next meeting of governors. In the meantime it is of interest to note that William Thomas, who was considered a likely candidate when Mr. Wilkinson was elected, has just been made outside examiner on mining and surveying in connection with the Royal School of Mines in London. Mr. Thomas was for some years lecturer on mining at Camborne and was induced to leave that position to undertake the reopening of Botallack. This work has proved too much for many other engineers besides Mr. Thomas, who has since then been doing good work as a teacher elsewhere. It may be mentioned that the Royal School of Mines has acquired the Tywarnhaile mine at Porthtowan, between St. Agnes and Redruth, for instruction purposes connected with mine surveying. I ought to add, in connection with the King Edward mine, that when it was acquired there was a full expectation that it would yield a substantial income from the sale of tin concentrate. This hope, however, has not been fulfilled.

Encouraging news comes from the Tominil company, which owns the San Felix silver mine in the Tamazula district of Durango, Mexico. The consulting engineers,

Pearse, Kingston & Browne, write most hopefully of the prospects, which is comforting to Englishmen who put money into the venture. The company was formed in London six years ago to acquire from Parry Gosset this old mine, which had yielded to previous owners some handsome profits from the auriferous silver sulphide ore sold to smelters. Mr. Gosset continued to act as mine manager and consulting engineer, but later was succeeded as manager by G. W. Schneider, who soon disagreed with Mr. Gosset as to the value of the mine. It was then found that the ore left by the old owners was not rich enough for direct shipment. In 1908 the late Ernald Richardson, of Swansea, became interested in the scheme, and supplied additional capital, taking preference shares in the company. He appointed W. R. Francis, a relation, as metallurgist in charge of the cyanide plant it was planned to erect. Soon after this, Mr. Richardson died, and subsequently a general clearance of the managers was made, Messrs. Gosset, Schneider, and Francis resigning. The shareholders asked Pearse, Kingston & Browne to undertake the management, and Mr. Browne and Selwyn Goldstein proceeded to Mexico to reëxamine the mine and reorganize the metallurgical plant. They found things in some confusion and were obliged to recommend the expenditure of further capital for development of the mine and for putting the cyanide plant in order. Accordingly, in August 1910, the company was reconstructed. The par value of the shares was reduced by half, and the new ordinary shares were issued with a liability of two shillings, the holders of the old preference shares being given new ordinary shares carrying no liability. The Mexican revolution delayed operations and the reorganized mill ran only intermittently during the year 1911. The reports now at hand show that the mill is paying expenses, and dividends are within sight. The development work has given most encouraging results and a substantial reserve of ore has been developed, estimated to yield £3 per ton. After so many years of disappointment, the shareholders are now in more amiable mood.

The possibilities of the southern part of Siam as a field for tin-dredging have received much attention during the last two or three years, and just recently several engineers have been sent to make further investigations. This part of Siam is really the northern end of the Malay peninsula, and as the rich tin gravels of Perak are almost adjoining, many promoters have argued that there is here a profitable sphere for operations. There are two companies dredging for tin in southern Siam, and they are both obtaining excellent results from gravel which contains about one pound of cassiterite per cubic yard. One is the Tongkah Harbour Tin Dredging Co., which was formed three years ago by people in Tasmania. Curiously enough, violent opposition was subsequently encountered in Australia among the shareholders, who decided to send independent experts to make a further examination of the gravel. Bitter controversy raged for some time between the directors and these experts, the latter alleging that the property was far from being the profitable venture it was supposed to be. With all these eminent people in disagreement, the only thing to do was to await results. It has surprised Englishmen to find that the directors have so far 'made good'. The profit for the past year has been no less than £76,139, derived from the treatment of 2,217,343 cu. yd. of gravel. The production was 1142 tons of tin concentrate, which sold for £117,487, and the total costs of all sorts were £41,348. The detailed figures were: yield, 1.15 lb. per cu. yd., valued at 12½d.; cost, 4½d. per cu. yd. The dredges employed were supplied by Werf-Conrad of Holland.

The other company operating in southern Siam is the Renong Dredging Co.; it was formed in London in 1908, Edward T. McCarthy having examined the property and made strictly conservative recommendations. Here also the Werf-Conrad type of dredge was adopted. So far only one has been used, but acording to present plans additional property is to be acquired and another dredge built. The performance of the dredge has been exceptionally good. During eleven months 698,679 cu. yd. of gravel was treated, yielding 241 tons of cassiterite concentrate averaging 73% metal. This works out at about ¾ lb. per cu. yd., valued at 10¼d. The revenue from the sale was £30,155, and the total expenses were £15,517. The cost per cubic yard was 5d. and the profit 5¼d. Of the profit, £10,187 has been distributed among shareholders and the remainder carried forward as a cash reserve to provide part of the capital required for the second dredge above mentioned. The remainder of the necessary capital is to be raised by debentures or loans.

BOSTON

Hub Brokers Resent New York's Pretensions as Copper Trading Centre.—Lake Porphyries Active.—Commissions, Not Dividends, Criterion in Judging Consolidations.

Notwithstanding that New York has a metal exchange and lays the flattering unction to itself that it is becoming more and more of a copper centre, even at Boston's expense, the time is never likely to come within this generation when Boston will yield its prestige as copper headquarters. Now and then concern is expressed by poorly informed writers lest Boston's glory should depart as a red-metal clearing house, but there never appears to be, upon serious analysis, so much as an appreciable drift in that direction. New York holds the market on Amalgamated, known as 'Big Copper', and the leading mining and smelting interests of the Guggenheims. But even this fact, influential as it is, is not conclusive as to the controlling and representative character of the copper-share market. In New York the Lake stocks, which two or three generations of Bostonians and New Englanders have dealt in prosperously, are little more than names. They convey about as much meaning to the votaries of the New York Stock Exchange as the Comstocks or Kaffirs. While Mr. Finlay's conservative views as to the longevity of the Lake district are entitled to serious consideration, the statement may be made without thought of its being challenged, that the copper-share market without the Lake list would look small. While Boston is hospitable to the porphyries, it is still loyal to its first love, the Lake issues, and will be trading in them, whether depleted mines or unscratched prospects, until the end of the chapter. Amalgamated, Utah Copper, and American Smelters may lead the copper market at times, when Boston will be glad to follow at the other end of an arbitrage wire, but nothing short of a revolution in copper valuations and markets will take from Boston its distinctive character as the exponent of the world's second basic metal.

Copper consolidations are all the talk now in Boston. Ray Consolidated has done that which must have seemed inevitable for a long time, in having absorbed Ray Central. As Ray Consolidated and Ray Central are both New York issues, in which Boston specializes only at second hand, the prospect of the estates and companies being coalesced does not affect Boston more than languidly. But the plan to combine Mayflower and Old Colony, both of them Lake stocks and ever near and dear to Boston's heart of hearts, is quite another matter. The estates adjoin and are still in the prospect stage. The proposal to consolidate them has much to commend it in a physical way. The recent important drill discoveries were made on the Mayflower property, but a short distance from the Old Colony boundary line, and the idea is advanced that the two properties can be worked better as a unit. The same conditions apparently apply to both. But both Mayflower and Old Colony, since the first of the year, have been imparting a great deal of new and long-needed life to the local market, each issue being active day after day and producing a good deal of money for Stock Exchange houses in the way of commissions. Boston Stock Exchange memberships are worth from $25,000 to $30,000 apiece, ranking in value only next to seats in Wall Street's principal mart, and these investments must yield fitting return. Therefore,

members of the Exchange do not willingly submit to changing conditions, however wholesome and laudable they may otherwise appear, which threaten a deprivation of brokerage fees. Consolidation of offices, conservation of resources, and unity and utility of management are in themselves attractive ends enough, as a matter of course, but commissions, be it remembered, are the breath of the brokers' nostrils. A year ago, when the Calumet & Hecla officials engaged J. Parke Channing at a large reported fee to appraise a number of Lake properties for proposed inclusion in a $10,000,000 Calumet & Hecla merger, there seemed in truth much to recommend the plan to favorable consideration. It was stated that the merger would effect an economy of at least a million dollars annually in the management of the properties involved. The plan was reasonable enough and seemed as equitable to all the interests concerned as human ability, with its proneness to error, could make it. But the success of the merger meant the removal by absorption from the Boston Stock Exchange and Curb of a number of active stocks, some of them of long standing and of cherished association of ideas, and the Stock Exchange members were at once in open revolt. Recruited as they were by minority recalcitrants from the Michigan mining end, they made successful opposition to the Calumet & Hecla interests and forced them to abandon a merger scheme which was apparently so fair and disinterested as to look to some people positively philanthropic and altruistic. But the merger plan, with all that it had to commend it, clashed with the selfish interests of brokers and against these it did not prevail.

NEW YORK

No Increased Demand for Copper Shares.—Butte & Superior New Mill.—Canadian Notes.—State Department May Interfere in Mexico.

There is nothing more illogical or curiously contrary and whimsical than the attitude of the market public. For months the accumulated copper surplus has been pointed to as the one thing bound to hold the metal market and, by deduction, the copper-share market, down. The metal market has advanced to 14½c. on the strength of the reduction in surplus as shown by the January report of the Producers' Association. The surplus is shown to be about 66,000,000 lb., but there has been no resultant activity in copper shares. Whether the public is convinced that the demand for copper metal is due primarily to Government purchases abroad, or to purchases by some big pools who expect to sell to the governments a little later, is not clear, but in spite of the fact that the metal is up and stocks have decreased, there has been no marked inquiry by the public for copper shares. From U. S. Custom House reports it is shown that February exports for the first half of the month ran something over 3,000,000 lb. per day, and if this rate is maintained the month will be a record-breaker in the way of copper exports.

D. C. Jackling says of the Butte & Superior property that it is the largest zinc mine in the world, the ore averaging better than 20% zinc, and concentrate showing 15 oz. silver per ton. The new mill, which will increase the capacity of the plant to 1000 tons of ore per day, will go into commission about June 1. The plant is to be equipped with all of the latest devices. At present the property is shipping 400 or 500 tons per day to the old Heinze plant at Basin. The plans for the equipment of the Inspiration Consolidated are being held up somewhat, waiting for more definite plans concerning transportation. The Arizona & Eastern railroad has its present terminus at Miami, and it will be necessary to build 1½ miles of additional track, in order to reach the Live Oak and Inspiration ground. Negotiations are in hand to provide the necessary right-of-way, and until these are at an end, definite arrangements for the Inspiration mill will be delayed.

While Cobalt has ceased to interest the public, from an investment point of view, the district goes on its way making some new high records from time to time. Shipments last week totaled about $123,000—a new high record for the output of a single week in the history of the district. The Temiskaming North Dome controversy is still on, and appeals for proxies are being made to the shareholders by both contending factions. Porcupine district is looking forward to a definite date for the beginning of regular production. The Dome mill is to go into commission on March 23, and the occasion is to be made a gala day in Porcupine. A number of Ontario officials have been invited to attend, and the event is to be given some provincial importance.

The French Government has a watchful eye, evidently, upon the efforts of foreign promoters to reach the savings of the thrifty people of France, all securities which are offered for listing on the Paris Bourse are having more and more of a gauntlet to run. The French market is the principal one for Rio Tintos, which in turn is one of the chief speculative issues in that market, and several American issues are traded in on the Coulisse, which is an unofficial outside market under the control of the Bourse. Ray Consolidated and Chino Copper have both been prepared for listing on the Coulisse, but owing to some further restrictions recently imposed by the French Government and the appointment of a governmental commission to scrutinize the securities traded in, the applications for these issues will have to be made afresh. Comparisons are never in good taste, but it is hard to refrain from saying that if the American public were protected in like manner, it would never assume its present attitude toward mining investments.

The impression seems to be gaining ground that the rise in the silver market has been overdone by speculators in anticipation of the coming of the Indian Government into the market to buy silver for the coinage of rupees. Both silver and copper have been the mediums of heavy speculation in European financial centres in anticipation of governmental needs. In the case of silver, the demands of India and China furnish the ground for heavy buying, while the copper needs of European armaments have provided the speculative basis in the case of the red metal.

The acute situation in Mexico is pressing into public notice more prominently during the past week, and it would be no great matter for surprise if the State Department should find itself compelled to take some immediate action.

August Heckscher, of the New Jersey Zinc Co. and the Oil Fields of Mexico, has been elected a director of the British Columbia Copper Co. to succeed the late Edwin Hawley. During the past year the British Columbia Copper Co. has lost three directors through death, Mr. Hawley, J. C. Reiff, and F. L. Sommer. The annual report, just issued, contains a strong tribute to them. The operations of the company were not particularly satisfactory during the year; the output was, in round numbers, 10,000,000 lb. of copper, as against 7,000,000 lb. last year. But costs were high, about 40,000 tons of coke being imported from Pennsylvania at a cost of $150,000 above the cost of the same tonnage from the local ovens.

BLACK HILLS, SOUTH DAKOTA

Golden Reward Roaster to Be Erected Soon.—Wasp No. 2 Resumes.—Homestake Power Plant Nearing Completion.—General Notes.

All of the machinery for the Golden Reward company's Wedge 75-ton roaster has been delivered, and it will be erected as soon as possible. Excavation was commenced last fall, but work was suspended on account of heavy snows and cold weather. This plant is to be at the Astoria mine, where a large body of sulphide ore has been opened. This material carries a high sulphur content, and will roast easily to a good cyaniding material. Oil will be secured from the Lander, Wyoming, field, about 300 miles distant. At the present time the company's 250-ton cyanide mill at Deadwood is operating only part capacity, and this will not be increased until weather conditions are more favorable.

Mill construction is going forward slowly at the Bis-

marck Consolidated, adjoining the Wasp No. 2, where the severe weather and snow caused a partial suspension. The Wasp No. 2 resumed operations on February 12, after a six weeks' shut-down due to inclement weather. During the time the mill was closed, it was given a general overhauling. The annual report of the company, just issued, shows that during the year 1911 the mine produced 160,860 tons of ore which yielded in the mill $286,160, or an average of $1.78 per ton. During the year $60,000 was paid in dividends, while additional money was spent for improvements. The most important improvements during the year were a steam-shovel for stripping in the open-cut, a No. 6 Gates crusher at the mill, and a commodious boarding and bunk house for employees. The steam-shovel is working satisfactorily, and a similar machine will be placed in the open-cut, for handling ore, early in the spring.

The completion of the Homestake's hydro-electric plant, on Spearfish river, of 6000-hp. capacity, is in sight. The intake dam and tunnel are complete; the generating station has been finished, the generators placed in position, and the work of wiring is well under way; the pole line to Lead, 11 miles, is completed, and the wires strung; the generating station at Lead is finished, and the transformers and switchboard are being placed. Motors of 25 hp. will be used for driving the stamps, each motor of this size operating ten stamps, so that it will require an even hundred of these motors to run the mills. The crushers, which are situated at the shafts where ore is hoisted, will be run by 35-hp. motors, twenty of these being used. Other equipment which will be provided will be for the two cyanide plants, the slime plant, machine-shop, carpenter shop, timber framing, and other surface works, not including hoists or compressors. C. C. Forester, of Denver, has been appointed general manager of the Evans Consolidated property, and will assume his duties at once. This property almost adjoins the Deadwood townsite on the east. A large showing of milling-grade ore has been made, and the first work of the new manager will be to equip the property with a cyanide plant. The money necessary to equip the mill has been raised, the issue of treasury stock which was allotted for this purpose has been oversubscribed, and the money returned to the subscribers who were too late. Work is to be resumed at once on the property of the St. Louis Placer Mines Co., on Judson creek, in southern Lawrence county. This property was purchased late last fall, and before much more than preliminary work had been done, winter interfered. The Boston investors, represented by F. H. Cutting, who purchased the Gladiator mine from Burt Rogers and associates, of Deadwood, have bought two adjoining claims from J. P. Hymer, of Denver, and are now preparing to start development.

SALT LAKE CITY, UTAH

Utah Metal M. Co. Tunnel Progressing.—Other Similar Projects in Utah Districts.

Within the current year the long tunnel of the Utah Metal M. Co. will be completed. This is one of the most important operations now in progress in the Bingham district. The tunnel, which, when completed, will be about 11,000 ft. long, will traverse the entire Oquirrh range of mountains, from Lark on the eastern side to a point near the Tooele smelter of the International S. & R. Co. on the west. It will not only afford facilities for deep development of known orebodies for several mines, and cheap transportation to the smelter, but it is believed that several new orebodies will be cut. On February 1, 4000 ft. of work remained to be done. From the Tooele side an average progress of 10 ft. per day is being made. On the Bingham side the progress has not been so rapid on account of the soft ground, but the face is now in a harder formation, and it is expected that in the future equally rapidly progress can be made on this side. If the rate of 20 ft. per day can be maintained, this will complete the tunnel in 200 days from February 1, or not far from the first of September. The work from the Tooele side is being pushed with hydro-electric power from water sources owned by the company, thus reducing the cost. E. P. Jennings, consulting engineer for the company, states that the Bingham workings are approaching the places where mineral is expected. The face is within 700 ft. of the Mountain Maid ground, which has been opened to a point 230 ft. above the Utah Metal adit level. Porphyry containing pyrite and copper stains is already being penetrated. This face is in over 600 ft. The Tooele side is in close to 7000 ft., and Mr. Jennings expects that within another 1000 ft. it will cut the Jordan and Commercial lime, from which formation a large portion of the silver-lead ores of Bingham have come. The present management of the company has expended about $250,000 since November 1909 on the work and is financed to carry it to completion. The most interesting part of the work, from the standpoint of mineral development, is ahead, and the progress is being closely watched at Bingham.

Arrangements have been made to finance another Bingham adit project—the Montana-Bingham. A company has been organized to provide funds to extend this adit 4000 ft., tapping veins of the Bingham Amalgamated, Congor, Fortuna, and Starless, with all of which companies agreements have been made for the development of the ground and the transportation of ore. A similar project is now being agaitated in the Cottonwood district, but as yet it has not reached the tangible stage with money behind it. One of the latest plans under discussion is to start a tunnel on the old Colonial property in Big Cottonwood, and carrying it 15,000 ft. to the divide. Another 1500 ft. would bring it under some of the leading properties on the Alta side. A plan less ambitious but more feasible is that of the new Michigan-Utah Consolidated company. This corporation is merging the Utah Mines Coalition, City Rocks, Grizzly, and other properties which already have been good producers and will operate them in unison.

LAUNCESTON, TASMANIA

Present Condition of the Tasmania Gold Mining Company.

The gold mine in Tasmania controlled by John Taylor & Sons is giving disappointing results. The company, called the Tasmania Gold M. Co., was formed in 1903 to acquire properties at Beaconsfield, Tasmania, that previously had been operated by a local company. These mines had been successful gold producers, but owing to the increase of the flow of water in depth, the continued working of the property involved a far greater expenditure on pumping plant than local owners could afford. This capital was provided on the flotation of the London company, and the plant laid down in one of Henry Davey's best examples of the modern Cornish pump. The water trouble has not, however, been the only drawback, for the lode has proved of irregular content in depth. In 1909 the grade fell seriously, and in October 1910 it was found necessary to reconstruct the company in order to provide new capital. The nominal capital was then reduced from £500,000 to £250,000 by altering the denomination of the shares from £1 to 10s., and the new shares were issued credited with 7s. 6d. paid, thus carrying a liability of 2s. 6d., sufficient to provide £62,500 in cash. The reconstruction of the company was successfully carried through, and one shilling per share has been called up. During the period under review, 52,968 tons of ore was raised, from which 23,143 oz. gold was recovered, realizing £97,820. The expenditure at the mine and in England amounted to $101,913, leaving a loss of £4020. The development work has been actively conducted on the deeper levels, especially on the 1370-ft. level east. The results have not been altogether satisfactory, owing to the presence of a horse of country rock. The shaft tapping the lower levels has been sunk to 1530 ft., and a drift is being started at 1500 ft. The results here obtained will determine the future of the company. The ore reserve above the 1370-ft. level is estimated at 43,084 tons, in addition to which 27,288 tons is 'partly developed,' and 30,000 tons is 'probable.' The company has never paid any dividends.

General Mining News

ALASKA

PRINCE WILLIAM SOUND

A new orebody, assaying 4% copper, recently was discovered on the property of the Fidalgo Bay Alaska Copper Co., says the *Valdez Prospector*. Thomas Donahue is president of the company. The second vein on the Cliff property has been intersected on the 400-ft. level, it is reported. The lower adit driven by Todd Date and Patsy Hogan of the Mayfield company on the Mayfield group, Columbia glacier, has intersected an orebody assaying about $65 per ton. The adit is in 180 ft., and is 200 ft. below the upper adit.

ARIZONA

COCHISE COUNTY

The 15 claims and two mill-sites of the Copper King group will be sold at sheriff's sale, March 4, to satisfy a judgment secured by W. A. Cummings against T. F. Gilbane, says a report from Tombstone. The property, which is near the South pass, has been an object of litigation for several years.

GILA COUNTY

(Special Correspondence.—The enlargement of No. 2 shaft at the Live Oak from 2 to 3 compartments has

MAP OF ARIZONA.

been started. Jack McIvor has the contract for the work and has hired some of the best miners of the district. The shaft is 928 ft. deep and will be enlarged by raising from four or five different points. It is expected that the work will require about two and a half months. In the meantime a double-drum hoist and two 150-hp. boilers will be erected, and development of the orebody from this shaft will be resumed as soon as the shaft work is finished. Development is now in progress from No. 1 shaft, near the eastern end of the property. M. E. McCarthy is superintendent. The churn-drill hole that is being drilled in the bottom of the 400-ft. shaft of the Barney group, under option to the Lewisohns, has passed out of the schist into dacite and is now over 800 ft. below the collar of the shaft. E. B. Tinker is superintendent of the property. Work is progressing on the water-supply dam for the Inspiration Consolidated concentrator, and tests are still being conducted by J. M. Callow in the experimental mill. A trestle is being built from the mouth of the main adit to the site of the new steel warehouse. The Miami mine is producing at the rate of over 2500 tons per day from the 420-ft. level, and development on the 570-ft. level continues. Five units of the concentrator are in operation. In place of the rigid rolls, a Hardinge ball mill is being tried out in one unit and a set of spring rolls in another. Nearly 800 men are employed.

Globe, February 16.

At the annual meeting of the stockholders of the Southwestern Miami Development Co. held at Globe on February 12, it was voted to increase the capitalization from 50,000 shares to 100,000 shares, par value $5. The increase of 50,000 shares was taken by William A. Paine, of the firm of Paine, Webber & Co. of Boston, and associates, at $4 per share for $2 paid in stock, which, with the money received from the recent call of $1 per share on 35,000 shares, will give over $200,000 for payments on the property and for its development. There are now issued and outstanding 15,000 shares of fully paid stock, and 85,000 shares of $2 paid stock upon which $3 per share can still be called, giving an additional $255,000, should it become necessary. It is proposed to purchase two additional churn-drills, making three in all, and continue the exploration of the property. It is estimated that the money now on hand will be sufficient to meet the payments on the property, purchase the additional equipment, and operate the three churn-drills for nearly two years, or until January 1, 1914. The officers of the company are: President, George F. Ruez, Ishpeming, Michigan; vice-president, R. T. McKeever, vice-president of the Copper Range Consolidated company; secretary and treasurer, Robert H. Gross, president of the East Butte Copper M. Co. The above with the following make up the board of directors: T. S. Dee, of Paine, Webber & Co., Boston, Mass.; D. T. Kennedy, Boston, Mass.; George J. Maas, Negaunee, Mich.; and H. B. Hovland, Duluth, Minn., formerly president of the Live Oak Development Co. and now a director of the Inspiration Consolidated Copper Company.

MARICOPA COUNTY

H. William Stevens, W. J. Martin, and associates, have acquired the Bonanza and Golden Eagle groups of claims. The property has a 40-stamp mill, compressor, and other equipment. A company will be organized for developing the property, says a Phoenix despatch.

SANTA CRUZ COUNTY

The Virginia Con. M. & M. Co., capitalized at $1,000,000 and with headquarters at Nogales, has been incorporated by C. L. Beatty, E. L. Ish, and R. H. Colvin.

YAVAPAI COUNTY

The American Gold company has acquired the Farley group of claims, near Columbia, and has started development there. The Allen mill, taken over with the property, is being remodeled by R. C. Henson, and a cyanide equipment will be added. George Dillard is general manager for the company.

CALIFORNIA

BUTTE COUNTY

Yuba Consolidated dredge No. 13, at Oroville, has broken the record for low cost in placer mining. The dredge, which cost $327,000, last month handled 320,000 cu. yd. of gravel, at a cost of 1.85c. per cu. yd., says a report in the *Boston News Bureau*. The property is now yielding an annual profit of $1,200,000 to Mrs. R. D. Evans, of Boston, it is said. R. D. Evans paid $600,000 for a controlling interest in the company, which is claimed to be the only California gold-mining company to return to Boston investors the original investment.

INYO COUNTY

It is reported that a lens of ore averaging over $100 per ton has been discovered on the Whipsaw claim of the Keane Wonder M. Co., near the Nevada line. The first two years of operation of the Keane Wonder mill showed an average yield of $12 per ton, but lately richer ore has been mined.

MODOC COUNTY

(Special Correspondence.)—While promotion of com-

panies in the High Grade district seems to have attracted more attention than actual mine development, it is true that operations have been handicapped by the inclement weather. It is expected that development will be in full swing in June, or perhaps earlier. While Eastern, as well as Colorado, Spokane, and Los Angeles capitalists have shown some interest in the district, it is said on good authority that no strictly cash deals have been made for any properties since the reported rich discoveries on the Sunshine, Modoc, Mountain View, and other claims. So far all transactions have been in the form of options or bonds. Many reports from the district have been grossly exaggerated, but conditions are favorable for developing mines.

Alturas, February 17.

NEVADA COUNTY

While excavating for the new Elks' hall at Grass Valley, ribbon quartz and a gravel deposit were found which mining men considered indicative of valuable ore in the vicinity. No attempt at an assay has been made.

PLACER COUNTY

C. G. Ward and Steven Rogers, of the Ward Consolidated company, have discovered an 8-inch vein of gold quartz assaying over $4000 per ton, says a newspaper report from Auburn. At a depth of 50 ft. they intersected a 'kidney' of tungsten ore. The property is in the Ophir district.

SHASTA COUNTY

It is reported that the Victor and Grand Central properties, in the Harrison gulch district, have been consolidated.

The Mount Shasta mine has been sold to A. A. Lindsay and associates, of Portland, Oregon, for $35,000, by Alden Anderson. Mr. Anderson recently bought the assets of the defunct Bank of Shasta County and established a new bank. The mine was among the assets. Mr. Anderson also sold two claims adjoining the Michigan property to the Pioneer Gold & Silver Co., of New York. The company, it is rumored, is about to buy the Bully Cave mine.

SISKIYOU COUNTY

(Special Correspondence.)—The Blue Ledge Copper Co. has obtained patents on 27 claims in the Blue Ledge district, about four miles south of the California-Oregon line. The company has conducted extensive development during the past eight years, expending about $700,000 in the work. A main adit and numerous auxiliary drifts and levels have been driven. It is reported that the company plans the building of a railroad from the district of Medford, Oregon, and the possible construction of a smelting plant. The developed ores carry copper and some gold. Robert A. Towne and associates of New York are chiefly interested. The Spring Gulch Tunnel Co. is developing good ore near Yreka and installing machinery for its treatment. About 45 men are working at the Jilson mine, near Montague, and the mill is running steadily. The Siskiyou Electric Power Co. is extending a power-line to the property, and electricity will be employed as soon as the water-supply falls short. The London syndicate is pushing its adit to intersect the main shoot in the Gum Boot mine.

Yreka, February 17.

TRINITY COUNTY

It is said that the Trinity Dredging Co. by June 1 will be operating one of the largest gold-dredges in the state, about five miles from Lewiston, on the Trinity river. The dredge is now under construction, and will have a hull 109 ft. long and 46 ft. wide. The buckets are to be of manganese steel. The dredge will have a capacity of between 100,000 and 110,000 cu. yd. of gravel per month.

TUOLUMNE COUNTY

The shaft of the Tarantula mine of the United Gold M. & M. Co. has attained a depth of 950 ft. below the outcrop. Sinking is still in progress, while explorations to the north of the shaft are being continued without interruption. This company is also drilling large areas of gravel at Yankee Hill, near Columbia, and it is expected that active mining operations will be commenced during the summer.

YUBA COUNTY

Press rumors are to the effect that a $20,000 mill and hoist will be erected at the Manzanita mine.

It is rumored that the Dewey mine, near Rackberry, is to be reopened, although the name of the operating company has not been announced.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—A streak of ore from 3 to 6 in. wide has been uncovered on the foot-wall of the Silver Stream vein, intersected by the Hamill adit in West Argentine, that shows assay-values of 2000 oz. silver per ton. E. Le Neve Foster, of Denver, is manager. A shipment of two carloads of zinc ore was made this week from the Gambetta mine. Returns of 52% zinc and 36 oz. silver per ton were received. B. J. O'Connell is manager. Parachini & Co., lessees of the Seven-Thirty mine, shipped 22 tons of lead ore this week that milled 59 oz. silver and 40% lead. Stoping is under way on a streak that is 14 in. wide. The Diamond mill will be brought into commission next week. Dump matter will be treated exclusively. H. C. Reno is manager of the plant.

Georgetown, February 17.

TELLER COUNTY (CRIPPLE CREEK)

The report of the Doctor-Jack Pot M. Co. for the last quarter of 1911 shows that the company last year produced 4980 tons of ore, of an average assay-value of $15.26. The treasurer's report shows an increase for the quarter of $463, a smaller increase than for the preceding quarter owing to expenditures for taxes and the subscription to the drainage adit, and to the $1500 charged against depreciation. The Mary McKinney has announced the intersection of the vein at a point 100 ft. below the old water-level. No decision has been handed down by the United States Appellate Court in the Work M. & M. Co. suit. The El Paso Con. G. M. Co. has declared a dividend of 1c. per share, payable February 29 to stockholders of record February 17. The dividend will mean the disbursement of $24,500.

IDAHO

IDAHO COUNTY

Rumors from Golden are to the effect that unusually rich ore has been discovered in the lower cross-cut adit of the Wonder property. The Center Star is to resume operation, under the direction of Charles Tiedeman.

SHOSHONE COUNTY

The earnings of the Federal M. & S. Co. for December, after all charges, totaled $79,800, or about $10,000 in excess of the preferred dividend requirements, says the *Wallace Miner*. The earnings for the four months of the company's 1911-1912 fiscal year which have been reported total $277,600, or only $2076 short of the preferred dividend requirements. At the end of the first quarter the earnings showed $11,957 less than the preferred dividends for the quarter.

MONTANA

LINCOLN COUNTY

(Special Correspondence.)—Showing 11 ft. of rich ore with the hanging wall not yet in sight, the vein at the Snowshoe mine has just been tapped on the 500-ft. level. Sinking the shaft to this level was completed only recently, and it is the deepest by far of those in the Libby district. The Snowshoe was purchased by E. H. Wilson about a year ago, and since last spring has been operated steadily. The ore carries silver, lead, and gold.

Libby, February 17.

SILVERBOW COUNTY

(Special Correspondence.) — The Laurium-Montana M. Co. held its annual meeting here. The main adit of the mine is now in 300 ft. The directors elected officers for the year. The financial condition of the company is suffi-

ciently strong to carry on all development planned. J. Bruce Kremer, who is a director and also counsel for the Butte & Superior company, and J. M. Hyde, who installed the flotation plant for the company at the Basin works, have left for New York, where, it is stated, a movement is on foot to acquire other property in the vicinity of the company's plant. The reports of the president and treasurer show that the company is in good condition. The new concentrator, which was originally intended to have a capacity of 500 tons per day, will have a capacity of 750 tons per day. The Colorado mine of the Davis Daly company is making ore shipments averaging 50 tons per day, divided between the Washoe and East Butte smelters. The shipments are more than sufficient to pay all obligations. The ore is coming from the 1700-ft. level. W. F. Fisher, the new manager for the company, said that it had been decided to sink the shaft another 200 ft. It is expected that at that depth a larger and richer body of ore will be found.

Butte, February 17.

(Special Correspondence.)—Bruce McKelvey, of Hayden, Stone & Co., is expected here in a few days with some of the directors of the Butte & Superior company, to make an inspection of the company's property and to see what progress is being made in the construction of the concentrator. The building will be closed in by the last of the month and some of the machinery in place. A. B. Wolvin, president of the company, says that unless something unforeseen occurs, the concentrator will be ready to go into commission by the middle of May, which will be at least two weeks ahead of the contract time, June 1. As the lease on the Basin works does not expire until June 30, this will give the company six weeks to remove whatever machinery is required from Basin and have the mill in operation by at least the middle of June, or possibly earlier. Mr. Wolvin says that the company has been earning $30,000 per month from the ore treated at the Basin works; but, with improved methods, some new machinery, and the saving in railroad haulage of the ore backward and forward, the company will be in a position to increase its net earnings to $50,000 per month. When asked about a report that there might be a dividend in the near future, he declined to commit himself, but did say that he would not be surprised if the stockholders received something on their investment about the close of the year.

Butte, February 13.

The Barnes-King company expects to be in a position in the course of three weeks to take over a promising property in the hope that some day the stockholders will get some return on the money they have had tied up for several years.

The new surface plant of the Tuolumne company has been completed and steam turned in, but it will be about the first of the month before it is put into commission. As soon as everything is working smoothly, the production will be increased to about 400 tons per day, and the work of sinking the shaft from the 1800-ft. level to a depth of 2000 ft. will be commenced.

NEVADA

Clark County

Ore similar to that of the Florence and Mohawk is said to have been discovered on the property of the South Nevada G. M. Co., seven miles east of Las Vegas. The ore is said to assay as high as $40 per ton. Paul Watelet is general manager for the company.

Humboldt County

The Seven Troughs Coalition company in January produced in bullion and concentrate $40,074, according to late reports, exclusive of the clean-up of the cyanide plant, not yet made, which would amount to about $4000. The run for the past two months has totaled more than $85,000. In January the recovery was 98.79%, according to the official report.

Nye County

(Special Correspondence.)—The 10-stamp mill of the MacNamara is in steady operation and is doing excellent work. The stamps are 1500 lb. each and 5 tons per stamp are now being crushed, though it is expected to increase this to 7½ tons as soon as all the machinery has been in operation long enough to get 'warmed up.' The pulp is ground in a tube-mill and then agitated in an agitator of the Trent type, but devised by Herbert Haas, the metallurgist for the company. Filtering is done in a leaf filter and a novel device is employed to secure economy of water used in discharging the washed cake, as the cost of water is 75c. per 1000 gal. and any excess water used in discharging is a corresponding loss. The filter leaves discharge into a pointed box provided with a screw conveyor at the bottom. Between the blades of the screw are radial arms which thoroughly triturate the cake and produce a fluid pulp with a minimum of water. As the country is rather flat and dumping room at a corresponding premium, this adds greatly to economy of operation.

Tonopah, February 21.

It is announced that the Tonopah M. Co. has secured an option on a seven-tenths interest in the Tecopa Con. M. Co. The financing of the company will depend on the report on the property to be made by J. E. Spurr, second vice-president of and consulting engineer to the Tonopah

BELMONT SHAFT.

company. It is rumored that the capital stock of the Tecopa company may be increased from $3,000,000 to $10,000,000.

The Tonopah Belmont Development Co. in January produced 3729 oz. gold and 366,319 oz. silver. During the month 7698 tons of ore was milled, and 2665 tons shipped to the smelter, making a total production of 10,363 tons of ore. The profit for the month was $151,487. The Tonopah M. Co. of Nevada in January milled 14,943 tons of ore, averaging $18.60 per ton. During the month 269,635 oz. gold and silver bullion, valued at $214,070, and 112 tons concentrate, valued at $39,530, were shipped. The profit for the month was $143,340.

The production of the Tonopah district during the week ended February 17 amounted to 8832 tons of ore, as follows: Tonopah Mining, 3400 tons; Belmont, 2400 tons; Montana-Tonopah, 952 tons; Tonopah Extension, 960 tons; West End, 770 tons; and the MacNamara, 350 tons of ore.

Storey County

Owing to the construction of a bulkhead and some retimbering, the Ophir company last week produced only 236 tons of ore, which had a gross assay-value of about $5660. Much development activity marked the week at the Consolidated Virginia, although only 29 cars of ore, assaying about $19 per ton, was saved. The Crown Point, from the 1400-ft. level and stope No. 3, produced 636 cars of ore, valued at $4723. The Yellow Jacket mill is still running at full capacity. With what is being mined each week and what is stored ready for treatment, the mill will be running for the rest of the month. The Mexican mill was shut down for two days on account of changes made in the classifying and thickening system, but despite the 65% running time, 323 tons of ore was crushed. The changes were completed February 15.

WHITE PINE COUNTY

The Lead King M. & M. Co. has discovered on its property a vein of steel galena ore, assaying about 80% lead and 6% silver per ton, says a report from Ely. The property is known as the Morning Star claim, and is situated east of the McGill smelter.

NEW MEXICO

SOCORRO COUNTY

The Juanita mine, at Kelly, has been reopened by local merchants. Lee Terry is manager of the property, which contains zinc carbonate ore.

(Special Correspondence.)—During January 4800 tons of ore was milled at the Socorro Mines, yielding 7 tons of concentrate and 28,000 oz. of gold and silver bullion. On account of a shortage of wood at the old power-plant, the mill closed on January 30, but will start as soon as the new power-plant is in commission, probably in the present week. Fuel oil will be used.

About 45 ft. of development work was done at the Deadwood Mines property the past week. The mill handled 200 tons of ore. The Ernestine M. Co.'s bullion clean-up for the first ten-day period in February is being smelted. The past week's tonnage was 694, with 64 sacks of concentrate. The ore-shoot recently discovered is one of the largest and richest in the Mogollons. At the Oaks Company's property the head-frame, hoist, and equipment at the South shaft of the Pacific mine will be placed in commission this week. The shaft will then be sunk as rapidly as possible, with two shifts. During January, 162 tons of ore was treated in the Deadwood mill. Work continues in the main drainage and transportation adit. At the Deep Down property the lessees will soon have the old workings in shape for production, when ore will be sent to the Deadwood mill for treatment. A gasoline hoist has been ordered for the mine.

Mogollon, February 16.

OREGON

JACKSON COUNTY

H. L. Herzinger, of Grants Pass, was elected president of the Southern Oregon and North California Mining Congress at the session recently held at Medford. Yreka, California, was chosen for the next meeting, to be held June 18. A resolution was passed condemning what is considered arbitrary interference with miners on the public domain in regard to the use of timber, and delay in granting patents. A resolution of thanks to W. B. Heyburn, United States Senator from Idaho, was passed, thanking him for his attitude toward recent bills affecting the mining industry.

UTAH

JUAB COUNTY (TINTIC DISTRICT)

The Tintic M. & D. Co. has resumed operation at its property, which has been idle for several years. The company, which is a close corporation, owns a group of claims adjoining the Mammoth and Gold Chain properties. Since sinking was resumed, a little over a month ago, at the Eagle & Blue Bell mine, the shaft has been put down about 170 ft. William Owens, superintendent for the company, believes his men can maintain a total of 130 ft. per month. The Tintic Central has resumed development, with Thomas Holdaway as superintendent. The company recently levied an assessment of ½c. per share. The assessment will be delinquent March 9, and the sale day is set for March 27.

SALT LAKE COUNTY

The annual report of the Utah Metal M. Co., operating in the Bingham Canyon district, states that the 11,000-ft. tunnel is to be completed within six months. To date $242,606 has been expended, on machinery, labor, and supplies. On January 27, says the report, the tunnel was in 548 ft. from the Bingham side of the mountain, and it is believed that a rate of about 10 ft. per day can be maintained. The tunnel is in 6796 ft. from the Tooele side, and is being driven at a rate of about 70 ft. per week. All of the work from the Tooele side is by hydro-electric power generated at sites owned by the company. E. P. Jennings, consulting engineer, reported that the Bingham end of the tunnel has penetrated a hard porphyry rock, filled with pyrite and with some copper stains in the seams. It is believed that orebodies may be intersected in the near future.

The Utah Copper Co., according to a recent report, will have all 13 units of the Arthur mill in operation by August 1. This will give the plant a capacity of 9000 tons of ore per day, which, added to the 12,000 tons capacity of the Magna mill, will make a total for the company of 21,000 tons per day, against the 17,000 tons capacity the company has at present. The eighth unit of the Arthur is to be put in operation about March 1, and every month thereafter one new rebuilt unit will be started, if the present plans are carried out. It is said that the Utah Copper Co. has ore reserves of 100,000,000 tons of fairly well assured, in addition to the 200,000,000 tons of proved ore reserves. The development to date has resulted in the extraction of about 16,500,000 tons.

SUMMIT COUNTY

While lack of water is hindering operation at the mill, the Daly-Judge mine is maintaining its usual production of ore. The cement work for the bad stretch in the Snake creek adit, in charge of Oscar Friendly, will be completed about March 1, when work will be resumed in the face of the bore. Shipments from Park City during January amounted to 7346 tons of ore. Lack of water is handicapping also the Daly West mill. The company's affairs are in good condition, recently stated H. G. McMillian, general manager for the company, and operation will be resumed later.

WASHINGTON

STEVENS COUNTY

Fred Dodge, lessee at the Providence mine, near Turk, has shipped a carload of lead-silver ore to the smelter. The Deertrail company has shut down, owing to the deep snow, but will resume early in the spring. The Germania mine will be out of the receiver's hands and will resume operation in the spring, according to a recent rumor. The mine has 400 ft. of development work, and it is reported that a large tungsten orebody has been intersected. A. H. Stiles, manager for the Cedar Canyon S. & R. Co., for several months has been building roads, as well as erecting an ore-house and making other improvements. Sinking on the vein has been resumed. A car of medium-grade ore will be ready for shipment soon.

CANADA

BRITISH COLUMBIA

In the No. 1 or lower adit of the Cascade Falls M. Co.'s property, at a distance 130 ft. from the portal, the orebody which also is being developed in the No. 2 adit, has been intersected. F. B. Hume is superintendent for the company.

The British Columbia Copper Co. in the year ended November 30, 1911, produced 9,944,987 lb. of copper, against 7,143,456 lb. in the preceding year. Owing to the low price of copper and unfavorable operating conditions, the profit for the year was only $133,929, against $256,561 for the year before, and $204,973 for the year ended November 30, 1909. The cost, it is believed, was about 11c. per pound, against 9c. for the preceding year. The earnings fell short of the dividends paid, by $14,000. It is rumored that the company's assets, including copper on hand, are scarcely in excess of its current liabilities, but it is not believed that the obstacles hindering last year's operation will appear again.

YUKON

Gravel running 40 to 50c. for the 7-pan bucket is reported by F. H. Back on No. 5 on the left fork of Nansen creek. Twenty-five men are wintering on Nansen creek. Nansen creek is on the main Dawson-Whitehorse road, and is 40 miles west of the Yukon river. Carmack's is the nearest Yukon river post.

MEXICO

CHIHUAHUA

Banks in Parral are reported to be secreting their funds, and families are leaving the town on every train through fear of the revolutionists. Recent advices state that the principal mines throughout the state are still operating, as a general rule, and it is asserted that they will continue to do so unless the situation becomes more threatening. The Guadalupe mine, of which Vicente Visconti is manager, in the Parral district, has closed down, and will not resume until the political situation is quieter. The principal mines in the Santa Eulalia district are reported to have a full complement of laborers.

COAHUILA

The Coahuila M. & S. Co. is to resume operation at the Medra Luna property, near La Mancha, according to a recent report. The Reyes M. & S. Co. also is planning to resume development of its property west of La Mancha, which is a station on the National Railways system.

HIDALGO

Much activity is expected at the San Rafael y Anexas property as the result of the arrangements for the quotation of the company's shares on the Paris Bourse. Stockholders have been given an opportunity to exchange the old shares for the new issue, at the National Bank, in Mexico City, at the rate of ten new shares for one of the old free shares, five for one of the *ariadas* of San Rafael, nine for one of the *ariadas* of La Sorpresa, and six for one of the *ariadas* of La Soledad.

SINALOA

(Special Correspondence.)—On the west coast of Mexico there have been no signs of the revolution in Chihuahua. Mining development is quiet, but land enterprises seem to command a great deal of attention. There has been much small-pox, of the black variety, around Mazatlan, Guaymas, and Chinipas.

Mazatlan, February 17.

Among the Copper Mines

THE HANCOCK SHAFT, in the Lake district, is expected to intersect the Pewabic lode in the near future. A mill test of ore from the No. 3 vein showed a yield of about 18 lb. per ton.

THE MIAMI COPPER CO. is said to be maintaining costs at between 8 and 8½c. per lb. It is producing about 2,500,000 lb. of copper per month, with five units of the concentrator in commission. With the starting of the sixth unit in the not far distant future, it is said a rate of production will be maintained of 3,000,000 lb. per month, or about 36,000,000 lb. per year.

ON THE EAST DRIFT of the 1800-ft. level of the Tuolumne, an orebody about 25 ft. wide and carrying about 8 ft. of copper glance and bornite, has been opened. Since intersected by the cross-cut, the drift has been in ore running about 6% copper, but the development work of the past few days has brought out ore much richer than any yet found in other portions of the mine.

ACCORDING TO CURRENT GOSSIP, says the latest Hayden, Stone & Co. letter, the second stamp of the Winona mill, the only inland mill in the Michigan district, is to commence doing duty within a brief period. The first stamp was placed in commission last March, and for the seven months following the yield per ton was reported at slightly under 13 lb., which probably spelled an operating deficit. Mill adjustments are credited in part for the subsequent somewhat improved recovery, the figures for recent period being about 14 lb. per ton.

F. AUGUSTUS HEINZE is said to be endeavoring to secure some claims near the Hidden Lake property, just outside of Anaconda. The commencement of work on the extension of the railroad to the Georgetown district is attracting people from all over the country, as there is no doubt the district has some valuable properties which can be worked to advantage when a railway will bring the ore to the smelter for treatment. The Hidden Lake is shipping ore regularly to the Washoe smelter. After a conference between a Heinze representative and some of the owners of the Hidden Lake mine both parties acknowledged that a deal was under consideration, but declined to make any statement.

THE ACTIVE DEMAND for both standard and refined copper during the months of November and December, says the current James Lewis & Son's report, has been followed during January by dull markets, consumers buying sparingly while speculators have sold to secure their profits. The further material improvement in the statistical position has consequently had no effect, being neutralized by the weakness of the New York Stock Exchange and fall in the shares of copper producing companies. Opening at £62 13s. 9d. for cash, Standard copper advanced to £64 on January 3, fell to £62 18s. 9d. next day, and again advanced to £64 5s. on the 8th. From this point it declined to £61 15s. on the 16th, but recovered to £63 5s. on the 17th, falling to £60 17s. 6d. on the 29th. This price induced active buying, and up to £62 7s. 6d. was paid for cash and £63 3s. 9d. for three months on the 31st. February 1 cash fell to £61 10s., but closing prices are £61 16s. 3d. cash and £62 12s. 6d. three months. Sales total about 45,000 tons. American refiners having previously sold large quantities of electrolytic for prompt and forward delivery, raised their price to 14½c. per pound, and maintained it at this until a few days ago, when more desire was shown to make further sales by one large producer who offered at £65 5s. per ton c.i.f., and this price has been accepted for a fair quantity of wire bars for February and March delivery. American shipments for January from the northern ports are advised as 30,967 tons. European stocks have decreased 1988 tons and a very large reduction in American refiners' stocks is expected. Imports are 3004 tons and deliveries 1545 tons less than during the same period last year. The total arrivals in England and France for the month have been 22,139 tons, and the deliveries 23,827 tons. Stocks have decreased 1688 tons, and the visible supply 1713 tons. The arrivals in England from Chile during the month have been 1628 and the deliveries 1359 tons, and from other countries 12,412 and 14,603 tons, respectively. The arrivals in Liverpool and in Swansea from the United States have been 2595 tons bars and 1763 tons plates; in London 732 and in France 7740 tons. The Chile charters for the month are advised as 3600 tons, including 1375 tons for the United States.

THE LEXINGTON MINE, owned by the La France company, in the Butte district, is to be operated again after having been closed for several years, and the ore is to be treated at the Basin Reduction Works, it is reported. A few months ago, when the works was taken from the State Savings Bank by New York interests, it was supposed that the persons furnishing the money were acting for W. A. Clark, as experts had made an inspection of the property for him; but it now transpires that the finances came from the La France people, or rather interests acting for that company. The Lexington was originally a silver property and had to be closed down on account of the low price of that metal. For several years it has been known that the mine has been rich in zinc, but after several tests had been made under different processes, none were found equal to treating the ore at a profit. However, some recent tests have clearly demonstrated that the ore can be handled at a good advantage, and, while no official information has yet reached this city, men who are very close to Heinze say that the Lexington is again to be operated, this time as a zinc proposition, and that tests made under a new process show that the ore can be treated at a profit of at least a dollar per ton. The La France company had this information a few months ago, when it was decided to redeem the Basin Reduction Works, and the mystery which surrounded the redemption is now explained.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

E. W. PARKER is in San Francisco.

ALBERT BURCH is in southern California.

HOWARD D. SMITH is expected from London.

H. W. TURNER is in San Francisco temporarily.

H. FOSTER BAIN has returned to San Francisco.

CHARLES JANIN has returned from Santa Barbara.

JAMES G. BERRYHILL was in San Francisco recently.

A. C. VEATCH was here recently and has gone to the southern oilfields.

WEBB SMITH was in San Francisco recently and has returned to Martell.

WALTER J. RADFORD has returned from South America and will make his headquarters at Denver.

A. D. MILES has opened an office as consulting engineer in the Traders' Bank building, Toronto, Canada.

TAKESHI KAWAMURA was in San Francisco and has gone to Arizona and Colorado to visit mines and mills.

W. M. KNOX sailed on the *Korea* on February 20 for Vladivostock, expecting to reach Nicolaievsk by April 1.

R. C. TROEGER is in charge of extensions of the Dellaphene adit for the Estella Mining Co., Keeler, California.

E. M. MCGARY is general superintendent for the Chosen Mining Co., operating in the Yeng Byen district of northern Korea.

T. C. CRAWFORD, president of the United Gold Mining & Milling Co., sailed from London for New York on February 17.

J. D. HUBBARD is designing a 600-ton cyanide plant for the Chosen Mining Co., of Korea; he is expected in California early in March.

R. VAN A. MILLS, recently professor of mining at the Pei-Yang University, Tientsin, has returned from China, and is now at Washington, D. C.

J. H. BATCHELLER has resigned from the employ of the Britannia Beach Mining & Smelting Co. and is now metallurgist for the Tomboy at Telluride.

JOHN T. REID has returned to Nevada after a short business trip to New York concerning the Nevada United Mining Co. and the Mines Development Co. of Nevada.

CHESTER B. ALLEN, manager for the United Gold Mining & Milling Co., has gone to New York. He expects to return to San Francisco about the middle of March.

WARREN D. SMITH, chief of the Philippine Bureau of Science, will spend several months in the United States, visiting Washington, Pittsburg, and the California oilfields. His address is care of C. F. Smith, 1715 Kendall avenue, Madison, Wisconsin.

SAMUEL S. ARENTZ, superintendent for the Nevada Douglas Copper Co. for the past four years, has been appointed general superintendent for the company and of the Nevada Copper Belt railroad, with headquarters at Ludwig, Nevada. ARCHIE J. OREM becomes superintendent for the Nevada Douglas Copper Company.

W. R. BASSICK, for seven years with the Bucyrus Co., during five of which he was Pacific Coast manager, resigned from that company the latter part of 1911, and since January 1, 1912, has been in charge of the commercial department of the Yuba Construction Co., 311 California street, as manager of sales.

Obituary

BENJAMIN F. PEARSON, of Halifax, N. S., died of kidney disease on January 31. Mr. Pearson, who was 56 years old, had been prominent in Nova Scotian politics, but is better known as a successful financier and promoter of industrial enterprises, including the Dominion Coal Co. and the Dominion Iron & Steel Co., his achievements extending to Mexico and South America as well.

Market Reports

LOCAL METAL PRICES

San Francisco February 21.

Antimony	11—11½c	Quicksilver (flask)	47.00
Electrolytic Copper	15—16½c	Tin	47—48½c
Pig Lead	4.25—5.20c	Spelter	7½—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

Average daily prices in cents per pound, based on wholesale transactions, standard brands.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Feb. 15	14.13	4.00	6.53	59⅜
" 16	14.13	4.00	6.53	58½
" 17	14.13	4.00	6.53	58½
" 18	Sunday.		No market.	
" 19	14.23	4.00	6.53	59⅜
" 20	14.23	4.00	6.53	59⅜
" 21	14.23	4.00	6.53	58½

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, Feb. 21.		Closing Prices Feb. 21.
Adventure	7¼	Mohawk	$ 55
Allouez	39	North Butte	25½
Calumet & Arizona	59½	Old Dominion	45½
Calumet & Hecla	425	Osceola	111
Centennial	18¼	Quincy	76
Copper Range	53¾	Shannon	9½
Daly West	5½	Superior & Boston	3
Franklin	12¾	Tamarack	28
Granby	34½	Trinity	6¼
Greene Cananea, ctf.	7⅜	Utah Con	14½
Isle-Royale	24½	Victoria	4½
La Salle	4½	Winona	7½
Mass Copper	7¾	Wolverine	100

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, February 21.

Atlanta	$ .15	Mayflower	$ .02
Belcher	.55	Mexican	3.55
Belmont	9.62	Midway	.31
B. & B.	.16	Montana-Tonopah	1.15
Booth	.06	Nevada Hills	2.30
Chollar	.15	Ophir	1.60
Combination Fraction	.14	Pittsburg Silver Peak	1.22
Con. Virgina	.82	Round Mountain	.49
Florence	.65	Savage	.28
Goldfield Con.	4.50	Tonopah Extension	1.40
Gould & Curry	.08	Tonopah of Nevada	7.25
Jim Butler	.37	Union	1.22
Jumbo Extension	.25	Vernal	.17
MacNamara	.23	West End	.90

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, February 21.

Associated Oil	$44.12	Peerless	$ 4.50
Brookshire	.50	Pinal	3.75
Caribou (New Stock)	1.25	Premier	.53
Claremont	.70	P. S. Petroleum	.18
Coalinga National	.14	Republic	.30
Con. Midway	.03	Silver Tip	.85
Empire	1.05	Sterling	1.47
Enos	.04	S. W. & B.	.19
Maricopa 36	.85	Turner	1.00
Midway Premier	.24	Union	98.25
Monte Cristo	1.35	United Oil	.36
Palmer	.70	W. K. Oil	2.25

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. Feb. 21.		Closing Prices. Feb. 21.
Amalgamated Copper	$ 65	La Rose	$ 3⅛
A. S. & R. Co.	71¼	Mason Valley	12⅜
Braden Copper	5½	Miami Copper	24
B. C. Copper Co.	4	Mines Co. of America	3⅜
Butte Coalition	22¾	Nevada Con	19
Chino	25⅜	Nevada Utah	⅛
Davis Daly	⅝	Nipissing	7½
Doble	⅛	Ohio Copper	1
Dolores	4	Ray Central	2
First National	2½	Ray Con	16⅛
Foley O'Brien	——	South Utah	⅛
Giroux	4⅜	Superior & Pittsburg	17½
Goldfield Con.	4⅜	Tenn. Copper	86½
Greene-Cananea	7⅛	Trinity	6½
Guanajuato Con.	⅜	Tuolumne Copper	3⅜
Hollinger	10⅞	United Copper	1½
Inspiration	18½	Utah Copper	56½
Kerr Lake	3	Yukon Gold	3⅜

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

ASSESSMENT WORK ON MINING CLAIMS HELD IN COMMON—CONTIGUOUS CLAIMS

The annual assessment work, where several claims are held in common, may be done on one of the claims for all, or it may be done on adjacent patented land or even on public land, if the claims are contiguous and the work is for the benefit of all of them and tends to develop them all and facilitate the extraction of ore from them. But mining claims which touch each other only at a common corner are not contiguous within the rule authorizing the performance of assessment work for several contiguous claims on any one of them.

Annville Hydraulic & Draining Co. *v.* Code, 182 Federal, 205.

PATENT TO MINERAL LAND

When the right to a patent under the soldier's additional homestead law depends upon whether the land is agricultural or mineral, that question must be determined according to the conditions existing at the time when the applicant complies with all the requirements of the statute. If at such time the land is not known to be chiefly valuable for coal, the applicant acquires a right to a patent which will not be disturbed by any subsequent change in the conditions; but if upon such compliance, it is discovered that the land is valuable for coal, nothing that he subsequently may do will give him a right to a patent, because such land known to be of that character is not subject to acquisition under such law, but only under the coal-land law.

Leonard *v.* Lennox, 181 Federal, 760.

AUTHORITY OF PIT-BOSS—NOTICE OF DANGER AND PROMISE TO REPAIR

Where a pit-boss employed the miners and other operatives in a mine and had authority to discharge them, and had immediate charge of the actual underground operations, and where it was his duty either to remedy any defects and dangerous conditions, or to report it to the proper office or department within whose scope such work properly belonged, where any such defect or dangerous condition was called to his attention, notice to him of the dangerous condition of a cage is equivalent to notice to the company, and a miner giving him such notice has the right to rely on the promise of such pit-boss that he would fix it as soon as possible.

Poli *v.* Numa Block Coal Co., (Iowa) 127 Northwestern, 1105. October 1910.

OWNER OF MINERAL RIGHT BOUND TO PROTECT SURFACE

Where surface land is owned by one person, and the mineral below, with the right of extracting the same, is owned by another, the owner of the mineral right is bound to protect the surface, unless the right of destroying the surface has been expressly reserved in terms so plain as to admit of no doubt. This rule was applied where co-owners of a mining claim conveyed the surface by separate conveyances at different times, each deed reserving the mineral and the right of extracting the same, with a covenant not to excavate nearer to the surface than 20 ft. One deed contained a covenant on the part of the grantor to conduct the mining operations so as not to injure the surface rights conveyed, and so as to protect the surface for a depth of 20 ft. thereunder. The other deed contained a covenant that the grantor should leave 20 ft. below the surface of the ground for support, but expressly provided that the grantor did not obligate himself to support or maintain the surface by timber or otherwise. Neither deed absolved the grantors from the obligation, implied in the grant of the surface, so to conduct their mining operations that the surface should at all times be sustained.

Cartoon *v.* South Butte Mining Co., 181 Federal, 941.

Company Reports

NEW YORK & HONDURAS ROSARIO MINING COMPANY

This company, operating mines at San Juancito, Honduras, during the year ended September 30, 1911, made a net production of $1,022,453, and the bullion sold amounted to $972,319. Operating expense for the year was $468,061, leaving a profit for the period covered by the report of $554,389. The mill treated 35,813 tons of ore, producing a total of $887,170. The ore yielded 1,395,136 oz. silver and $103 oz. gold, against a production the previous year of 1,289,174 oz. silver and 10,621 oz. gold. The actual extraction was 84.93%. Despite unavoidable shut-downs, a daily average of 47.2 stamps dropping was maintained at the mill. Total labor and supply cost for the year amounted to ₱9.16 per ton, against ₱9.10 for the previous year. Higher labor cost, which was offset by savings in supplies and chemicals, was caused partly by increased repair work for the old mill. About 38,716 wet tons of ore was transported to the mill by the aerial tramway at a cost of ₱1.09 per ton, against a cost the previous year of ₱1.50 per ton. The maintenance of the surface department for the year cost ₱35,518, or a rate of ₱1.12 per ton of ore produced. The San Juancito power-plant was officially put in commission in January. It cost ₱220,476, of which ₱143,896 was spent during the year covered by the report. The figures include the cost of an additional water-supply known as the Aguacatal flume-line, which amounted to ₱19,896. Excavation for the new Rosario mill was started, and during the year ₱343,590 was spent for labor and supplies, not including machinery. The completion of the mill, about March 1912, will give the company, it is claimed, the distinction of dropping the heaviest batteries on the continent, 1800-lb. stamps. B. D. Davis is superintendent of construction. A topographical map of the property of the company has been made along lines of the United States Geological Survey by J. H. Sinclair. The ore reserves include 121,088 tons of ore blocked out averaging $26.16 per ton, against 107,575 tons averaging $25.30 for the previous year, and 340,000 tons of ore averaging $15.50 per ton, which will be available when the new mill is started. The dividends paid during the year amounted to $90,000, making a total to date of $3,060,000. The capitalization of the company is $1,500,000, and the surplus amounts to $1,639,534, the assets of the company being valued at $3,488,367.

MINERALS SEPARATION, LIMITED

The report of this company for 1910 shows that it has reached the profit-earning stage. The income during the year from royalties and treatment operations was £82,691. For depreciation of plant, and experimental expenses, the directors have written off £54,100, so that the company could proceed, from the beginning of 1911, without encumbrance. Litigation expense, amounting to £17,078, has been charged against the share premium reserve. The company has secured a contract with a large mine in South Africa, according to a statement by John Ballot, chairman of the annual meeting, and the subsidiary corporation in America has in prospect a number of profitable contracts. Mr. Ballot referred at length in his report to the action of James M. Hyde, who since his retirement from the Minerals Separation in February 1911 has used its process independently in Montana. Suit for infringement of patent has been filed against Mr. Hyde. Mr. Ballot also explained in detail the results of the Minerals Separation process as used by the Zinc Corporation at Broken Hill, and asserted that the latter company had substituted it for the Elmore vacuum process because it was cheaper and more effective in the treatment of the low-grade material and slime. A noteworthy feature of the report is the statement that all debentures have been retired. The Minerals Separation, Ltd., owns the Sulman-Picard-Ballot and other patents for concentration by flotation.

Recent Publications

VICINITY OF ELY, NEVADA. Preliminary geologic map. U. S. Geol. Surv. Washington, D. C., 1912.

ANNAES DA ESCOLA DE MINAS DE OURO PRETO. N. 11, 1909, 130 pp. N. 12, 1910, 193 pp., ill. Ouro Preto.

THIRTIETH ANNUAL COAL REPORT OF ILLINOIS. By State Mining Board 1911. 445 pp., ill. Springfield, Illinois, 1912.

MINERAL RESOURCES OF THE UNITED STATES. CALENDAR YEAR 1910. PART I, METALS. 796 pp., index, map. Washington, D. C., 1911.

THE SITKA MINING DISTRICT, ALASKA. By Adolph Knopf. Bull. 504, U. S. Geol. Surv. 32 pp., maps, inserts. Washington, D. C., 1912.

THIRTEENTH ANNUAL REPORT OF THE MINING INDUSTRY OF IDAHO FOR THE YEAR 1911. By Robert M. Bell, State Inspector of Mines. 132 pp., ill. Boise, Idaho, January 1, 1912.

AN INVESTIGATION OF THE AIR-LIFT PUMP. By G. J. Davis and C. R. Weidner. 167 pp., ill. Bulletin of the University of Wisconsin, No. 450. Madison, Wisconsin, October, 1911.

THE RATE OF BURNING OF FUSE AS INFLUENCED BY TEMPERATURE AND PRESSURE. By Walter O. Snelling and Willard C. Cope. Technical Paper 6, Bureau of Mines. 28 pp. Washington, D. C., 1912.

WESTERN PORTION OF TORBROOK IRON ORE DEPOSITS, ANNAPOLIS COUNTY, NOVA SCOTIA. By Howells Fréchette. Bull. No. 7, Canada Department of Mines. 20 pp., ill., map, insert. Ottawa, 1912.

TOLERANCE OF EUCALYPTUS FOR ALKALI, with partial reprint from Bulletin 196. By R. H. Loughridge. Bull. No. 225, College of Agriculture, University of California, Berkeley, California. 70 pp., ill. Sacramento, 1911.

THIRTY-SECOND ANNUAL REPORT of the Director of the United States Geological Survey to the Secretary of the Interior, for the fiscal year ended June 30, 1911. 151 pp., index, maps, inserts. Washington, D. C., 1911.

REPORT ON THE GEOLOGY AND MINERAL RESOURCES OF THE CHIBOUGAMAU REGION, QUEBEC. By E. R. Faribault, J. C. Gwillim, Alfred E. Barlow. 215 pp., ill., index, insert. Province of Quebec, Department of Colonization, Mines, and Fisheries. Quebec, Canada, 1911.

PETROLEUM AND NATURAL GAS. PART II, MINERAL FUELS. By M. J. Munn, C. H. Wegemann, E. G. Woodruff, and Robert Anderson. Bull. 471-A, U. S. Geol. Surv. Advance chapter from 'Contributions to Economic Geology, 1910'. 132 pp., maps, inserts. Washington, D. C., 1912.

INVESTIGATIONS OF EXPLOSIVES USED IN COAL MINES. By Clarence Hall, W. O. Snelling, and S. P. Howell, with a chapter on the natural gas used at Pittsburg, by G. A. Burrell, and an introduction by Charles E. Munroe. Bull. 15, Bureau of Mines. 197 pp., ill., index. Washington, D. C., 1912.

HISTORY AND STATUS OF MINING IN YAVAPAI COUNTY, ARIZONA. 23 pp., ill. Published by the Immigration Commissioner of Yavapai County, under the Supervision of the Committee on Mines and Mining of the Prescott Chamber of Commerce. Prescott, Arizona, December 1911. This pamphlet is the forerunner of other similar publications to be issued by Immigration Commissioners and civic bodies in other counties of the new state.

The Excelsior Airometer

The sale of compressed air for commercial use has attained enormous proportions in the past ten years. Especially is this true in the mining districts of Australia, Africa, and America. Yet there has never existed until now a satisfactory, practical, and reliable means of measuring the air thus sold. The general practice in selling compressed air to mines is to calculate the amount of air consumed from the number and size of the drills, hoists, and other machines operated. This method is inequitable, rarely correct, and productive of much dissatisfaction.

The Excelsior airometer is a simple, reliable, and accurate air meter, that has been developed to meet the growing need for such a device in connection with the increasing use of compressed air for mining and commercial purposes. It measures in cubic feet the amount of free air used in the cylinder consumption of compressed air. Simplicity, durability, and accuracy are the dominant features of the Excelsior airometer, it being guaranteed not to vary more than 3% from its original standard in five years. It is the only meter that automatically compensates for variations in pressure, that shows on its dial the exact amount of air that has passed through it, irrespective of pressures, and that does not require careful attention to keep in condition.

The airometer is built upon the principle that in the cylinder consumption of compressed air, the speed of the air passage is dependent upon the pressure, and that the number of cubic feet of free air used is in direct proportion to the speed the air body assumes when filling the cylinder. It consists of a series of turbines and deflecting discs, arranged alternately within a casing. The shaft upon which the turbines are mounted extends throughout the length of the meter, and is connected by worm gears with a series of decimated gears, which are connected to a series of decimal dials, from which the meter reading is taken.

The deflecting discs are stationary in the casing, and around the outer edge are bored a series of holes, which have their axial line at an angle of 45° across the axial line of the meter. Between the discs are compartments, where the turbines are mounted on the shaft. The vanes of these turbines are set so that they face the axial line of the orifices at right angles. The air is admitted to the meter, and passing through the orifices, impinges in turn on the vanes of all the turbines before passing out. A simple gear shift is attached to the dial of counter to be thrown in and out of engagement with the meter gear. This allows the operator to take an accurate record of the air passing through the meter in a minute, simply by throwing the dial into engagement for one minute and then throwing it out. The dial is kept in mesh with the meter gear by a spring in the front wall of the dial box. It is thrown out of engagement and locked by pushing in and turning the knurled button projecting from the rear of the dial box. The Excelsior airometer will measure the air passing through a supply pipe in exactly the same fashion that water, gas, or electricity is measured. Every cubic foot of air that is delivered to the purchaser must pass through the meter, is measured, and must be paid for, whether it is used to run hoists, operate drills, blow smoke, or is allowed to leak through faulty joints and connections. On the other hand, the purchaser has the assurance that he is getting a fair return for his money, and it behooves him to watch the air consumption in his mine and avoid wastes.

The airometer is attached and attended in the same fashion as a water meter, only requiring an occasional oiling. The meter reading is taken from a series of decimal dials, as on a gas meter. This reading can be taken weekly, monthly, or at any convenient period. When the dials have completed a full register, they automatically reset themselves and start over again. The capacities of the dials range from 10,000,000 cu. ft. on the smallest size to 1,000,000,000 cu. ft. on the largest size. A meter will pay for itself in a very short time, and thereafter will prove to be a safe, faithful, and economical guardian of the interests of both seller and buyer of compressed air.

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TABLE OF CONTENTS

EDITORIAL

TAXATION of ore reserves is proposed in a bill now before the legislature of Idaho. This might well be called, 'A Bill for an Act to Discourage Stability and Economy in Mining.'

WORK on the Panama canal is in steady progress, as is evidenced by the notable records in steam-shovel excavation that are now being made there. During January the excavation amounted to 2,441,441 cubic yards, or an average daily output of 101,594 cubic yards.

IMPORTS of copper into the United States have grown from 1,000,000 pounds in 1900 to 266,000,000 in 1911, while exports have grown from 338,000,000 to 787,000,000 pounds in the same period. The large imports into a country so preëminently an exporter are largely due to our superior facilities for smelting and refining.

A NOT UNCOMMON phenomenon in mines is the finding of no ore where it was confidently expected, to the discomfiture of the management and the decrease of profit. A pleasing example of the contrary is the Camp Bird mine, which, having altogether yielded $22,785,000, of which approximately $11,500,000 was profit, was thought to be near exhaustion in 1910. During that year new ore was discovered which yielded a profit of $110,000 and in 1911 ore worth $300,000 more was found. New finds during the past month have further extended the productive life of the mine, so that in a small way it bids fair to resemble the widow's cruse. We hope it may.

WATER has long been a problem at Cripple Creek and, now that deep-level drainage is effectively secured, seems about to exhibit, to use an expressive phrase, 'reverse English.' Recent metallurgical development has led to the multiplication of mills in the district, and with their increase in number comes an increased demand for water, of which the supply is limited. Many suggestions have been made, among them that mills should be constructed underground. The objections to this are obvious, but the proposal cannot be instantly dismissed, for the plan offers advantages. Cripple Creek operators have handled their metallurgical problems admirably so far, and may be expected to continue to do so.

ELECTION of Mr. James F. Kemp as president and Mr. Waldemar Lindgren vice-president of the American Institute of Mining Engineers, marks not only the selection of eminently qualified men for distinguished posts, but is a deserved compliment to geologists as a class. It is striking that despite the large contributions to the work of the Institute made by the geologists, Mr. Kemp is the first to be elected president. In Canada, the engineers have not been so slow to divide honors with their professional brethren. Mr. Frank D. Adams, now president of the Canadian Mining Institute, is known mainly for his research in pure science. He succeeded Mr. W. G. Miller, the well known pioneer of Cobalt and the distinguished Provincial geologist of Ontario.

LITIGATION regarding filter patents entered another stage this week when the United States District Court decided, in the suit brought by the Moore Filter Company against the Tonopah-Belmont Development Company, that the Butters filter is not an infringement of the Moore, but that the stationary type of filters is distinctive from the movable type. An appeal is, however, to be taken, and since the Moore Filter Company controls the Cassel patents covering stationary types of filters, more litigation is sure to follow. It is one of the gravest defects of American patent law that there is no sure and simple method of quickly determining the relative rights of rival inventors. Metallurgical and other industries are, therefore, saddled with almost endless trouble and expense, and it often costs as much as it is worth to establish a patent right. The system is radically wrong, and a patent should mean more than "the right to go into court."

ECONOMY and efficiency are watch-words of modern practice, and in the use of fuels they are especially applicable. The work of Mr. W. A. Bone on combustion has attracted so much attention through his public lectures in this country that we are glad to present this week a brief summary of his conclusions. His methods and the results are none the less interesting for having been totally anticipated in this country by the work of Mr. C. E. Lucke, about ten years ago. It is a striking commentary upon the complexity of present-day life and the enormous volume of literature which must be scanned by advanced workers in science that not only Mr. Bone seems to have been unaware of the work of Mr. Lucke, which was published in the proceedings of the American Society of Mechanical Engineers and is discussed in Hutton's 'The Gas Engine,' but editors of American journals devoted to mechanical engineering seem to have been equally uninformed. The proposed methods are suggestive, and when their mechanical drawbacks are eliminated by sufficient experiment, are likely to prove valuable.

OUR special correspondent who attended the recent meeting of the American Institute of Mining Engineers in New York City writes in frank criticism of certain features of the past management of the Institute and of the dinner arranged by the local committee. It has seemed worth while to print this criticism even though it is abundantly clear, as stated in his letter, that a new management is in control. Such trouble as now encompasses the Institute has come mainly from failure to make publicly criticism common enough in private. The best thing that could happen to the Institute would be to have its great membership more alive to the duties as well as privileges of being included in its ranks. There are many different programs that may be followed in the conduct of such an organization, and critics of all classes will concede that brilliant success in certain directions has resulted from the faithful work of those who have been in control. Our understanding is that, with full appreciation of the good in the past, the members have decided that a change of program is in order. We have a profound belief in the continued usefulness of the Institute, and we feel that it is but following the order of development in other lines of contemporary American life for 'Standpatters' to give way to 'Progressives' and for representative government to be replaced by the more democratic form that relies on the initiative, referendum, and recall.

RICH gold-quartz mines are not commonly thought of as characteristic of Alaska. The unusual success achieved in working the great low-grade orebodies near Juneau has drawn attention away from the possibility of finding smaller and richer veins. But rich quartz is well known at Nome, Fairbanks, Valdez, and at various widely scattered points in the interior and in southeastern Alaska. At the Cliff mine, when it was visited last July, the ore going to the mill was averaging $87 per ton in gold, and at the Klag bay properties, described in this issue by Mr. Adolph Knopf of the United States Geological Survey, specimen ore taken from the surface and transported to Sitka in canoes, paid for opening the mines. How many additional deposits of this sort await discovery, no man can say. The region is one where prospecting is particularly laborious, and attention has so far been mainly centred on other things. Supplementing Mr. Knopf's description of the DeGroff mine, it is interesting to note that a considerable share in this property was one of the principal items in the estate of the late D. H. Jarvis, that brilliant and likeable captain whose untimely suicide last summer startled all who had followed his interesting career. The Golden Gate mine, we understand, has now passed into possession of the Chichagof Gold Mining Company, owner of the neighboring DeGroff mine. The prospect for a fairly large as well as rich mine seems excellent, and success here should stimulate the search for more mines in the great replica of the California goldfields in which the channels and passages of the Inland sea have been cut.

San Francisco and the Mint

Proposals to so reduce the appropriation as practically, if not nominally, to close the mint at San Francisco, have aroused a not unnatural storm of protest throughout the West. The San Francisco mint was established in 1854 and has coined $1,672,000,000 in gold, and $185,000,000 in silver. In addition $74,000,000 has been coined for circulation in the Philippine Islands and considerable amounts of silver and gold for Central American and other countries. The mint has been the centre of the trade in gold and silver on the coast, and the money in the vaults proved the salvation of San Francisco in the time of its greatest distress in 1906. Sentiment clings strongly to the old stone building on Mission street and any plan for converting it into a mere assay office arouses deep-seated feelings. The proposal is made, nominally, in the interest of economy, and certainly that is a proper plea. It is no sufficient excuse for maintaining a government institution, be it navy yard, branch pension office, or mint, that it leads to spending money in a particular city or district. Public convenience and real service should be the basis of maintenance as well as establishment of government works. Legislation enacted at the last session of Congress and permitting the stamping of gold bars with weight and fineness in place of minting money for export, has reduced the demands upon the Bureau of the Mint and permits reduction of its force, as was expected. This is right and proper and in the interest of economy. The critical point is, where the reduction should be made. To this we believe there can be but one answer. The Director of the Mint should be director in fact as well as name. If the full value of his services is to be obtained, he should be permitted to conduct the service as seems to him best. If he proves wrong, remove him and get a better man, but do not hamper him in the exercise of his duties. Believing in this as a general principle, and knowing, further, that in Mr. George Roberts the Bureau has a most capable director, we urge that his recommendations be accepted. Meddling with technical matters by committees from Congress is all wrong. Congressmen are subjected to political pressure from every side and determinations made by them in matters relating to the internal organization of a bureau, or the conduct of its work, are necessarily based upon compromise rather than upon principles of

efficiency in operation. It is said, for example, that in this case the proposal to close the San Francisco mint is in retaliation for the closing of that at New Orleans and the decision to hold the exposition of 1915 in San Francisco. Whether true or not, there should be no question as to such determination of the matter. It is generally believed that the mint at Denver was established less because of real need than to secure the spending of money in that city by the United States Government. The day when that sort of thing could go unchallenged has passed, we hope permanently, from America. Let technical matters be decided on the basis of real economy and efficiency, and not with a view to 'solidifying the party.'

The mint service is peculiar in that it is one of the branches of the Government that turns into the Treasury more than it receives in appropriations. In part, this is due to the profit in refining and melting bullion, and in part to the seigniorage on silver. In the West people generally prefer metallic money. Gold and silver coins are the common media of exchange, and so long as metallic money circulates it must be coined and re-coined. It would seem proper that the people who demand actual coinage of money should enjoy whatever of advantage may flow from the maintenance of a mint in their midst. Such arguments should not, however, determine the question. It is a business matter and should be settled on a business basis, and one of the best rules for the conduct of any business is, follow the lead of the responsible head of the enterprise.

Research and the Government

Much confusion of thought has been made evident by the discussion of various bills now before Congress in which it is proposed that the Government shall undertake researches connected with metallurgy. There are a number of bills similar to those of Mr. J. E. Raker of California and Mr. J. A. Martin of Colorado in which is proposed the establishment of local stations for ore testing. Others provide for establishment of additional mine-rescue stations. Still others propose appropriations in aid of state schools of mines on substantially the same basis as the Congressional aid now given to agricultural colleges. There is furthermore the Foster bill, now on the Union calendar, defining and extending the duties of the Bureau of Mines.

It can hardly be said that there is no public sentiment in favor of some such extension of governmental activity, and it seems inevitable that now or later steps in this direction will be taken. As conditions change and the need of help becomes greater, people everywhere demand more from their governments, and whether it be liked or not, government not only in the United States but in Canada, England, Germany, indeed throughout the world, is becoming increasingly paternal. Crowding people together results in more points of contact, and, human nature being what it is, more regulation of human relations must result. Government regulations to accomplish good must be informed, and of the harm done by uninformed action numerous instances might be readily cited. It is not only right and proper, but it is necessary, that the Government should itself have every facility for keeping in touch with the latest advances in technology as in other lines of human activity and on the basis of economy. United States laboratories and experiment stations are better than duplicate state plants. The states should have every facility, as is proposed in the Foster bill, for using the Government plant in determining such matters as the type of explosives that may be permitted in coal mines and the quality of those offered for use. The United States Government, too, should have the full benefit in all its branches of the best technical advice regarding the fuel that it buys, the cement it must use, and similar matters. So far we believe there is no disagreement, and details of legislation necessary to give these principles effect may safely be left to Congress. Another phase of the matter, however, invites discussion.

Research may be conducted with a view to: (1) elucidating fundamental principles and promoting development of technology with a view to improvements in practice; (2) testing individual specimens or lots of ore to determine which among standard methods of treatment are applicable in each case. While there is a certain border zone between the two, in the main we think the distinction is sharp and easily maintained. Recognizing that there is room for differences of opinion, we believe the first to be a proper field for the United States Bureau of Mines and the second to be one best filled by private agencies. The time may come when, in order to curb the deplorable recklessness and dishonesty of certain types of so-called assayers and metallurgists, the state will have to set standards and exercise some control over the business, but we are not prepared at present for that step. In the main, assayers and chemists are honorable men and their charges are reasonable, and any one having ore or minerals of probable value can readily learn through the use of existing agencies whether the material can be treated at a profit by any of the common methods.

All processes necessarily involve waste, and at best it can only be hoped by successive improvements to reduce this to a minimum. The large Government holdings of mineral land, to say nothing of the general welfare, warrant a reasonable expenditure of official funds in the effort to decrease waste and increase efficiency in production. There are furthermore many problems relating to the health and safety of mine workers that demand investigation. The United States Bureau of Mines should be given sufficient authority and funds to carry on a reasonable amount of experimentation along all these lines. This is in the interest of economy and efficiency, and in line with the work of the more enlightened governments elsewhere, and of our own experience in other lines. The Dominion of Canada has appropriated money for investigation of zinc smelting problems, and much of the work has been carried on by Mr. W. R. Ingalls of New York. We see no reason why such work should not be equally proper and profitable in the United States, though in this as other matters duplication should be avoided. It is also advisable to avoid waste of funds by fixed requirements in the form of local stations. Give the Bureau of Mines general authority and such money as can be spared, and let the officers of that organization work along whatever lines seem most likely to produce results. We particularly deprecate the effort to establish more mine-rescue stations at Federal expense. Not that more such stations are not needed, but that experience has shown that the mine-rescue cars are more economical and serviceable in the particular part of this work that the Federal Government should take up; namely, the demonstration of the work, and the proving of methods. The cars will be available for any emergency, but the routine work of actual protection should rest on the states, districts, or mines actually benefited. Where so much is to be done it is a pity to have time and energy wasted in controversy over methods and limits. The Geological Survey and the Bureau of Standards have prospered and have given excellent service because they were not hampered by petty restrictions in their organic acts, but could turn attention at once to problems as they arose, as fast as Congress was able to supply the funds. The Reclamation Service has also been singularly free from such restrictions, and has made substantial returns for its freedom. Efficiency is needed in the Government service, and freedom from 'red tape' is only possible under broad laws dealing with principles rather than details.

Gold Deposits of the Sitka, Alaska, District

By Adolph Knopf

*Klag bay is on the west coast of Chichagof island and is part of an extensive archipelago of which Khaz bay forms the entrance from the Pacific Ocean. The coast north of Khaz bay is flanked for several miles seaward by rocks, reefs, and low wooded islets. Khaz bay lies 16 miles northwest of Salisbury sound, and the voyage from the mines to Sitka necessitates a coastwise run of 8 to 12 miles in the open ocean. The total distance to Sitka is 50 miles, and the operating mines maintain their own gasoline boats. Freighters plying between Seattle and the southeastern Alaska bring in occasionally heavy machinery and supplies, and take out shipments of accumulated concentrate. During the winter the upper three miles of Klag bay is frozen over.

The two productive gold mines in the Sitka mining district are at the head of Klag bay. The high grade of the ore, which yields, as milled, from $15 to $90 per ton in gold, greatly exceeds that of the average value of the gold ore of southeastern Alaska, which in 1909 was $2.78 per ton. This has naturally attracted considerable attention to the region, and has stimulated prospecting of the shores of the neighboring bays, inlets, and passages.

Gold was found at Klag bay by chance in the summer of 1905 by an Indian engaged in salmon fishing, who went ashore to obtain water from a small stream near the head of the bay. While stooping to drink he noticed gold in one of the numerous fragments of quartz in the bed of the stream. On further examination he found that the ore contained considerably more free gold, and soon thereafter the find was reported at Sitka. The aid of white men was enlisted and the cropping from which the quartz float was derived was quickly discovered. Claims were thereupon located in accordance with the mining laws, the original discoverer retaining one-fourth interest. A small stampede from Sitka ensued soon after, and a large number of claims were staked on both flanks of Doolth mountain in September 1905. Two properties, known as the Chichagof and Golden Gate mines, have been brought to the producing stage.

The general geology of the region at the head of Klag bay is exceedingly simple. The rocks consist essentially of thick, massive beds of graywacke interstratified with clay slates. The only igneous rocks are a few narrow dikes of diorite aplite. To the northeast these rocks are succeeded by a wide belt of greenstones (altered amygdaloidal basalts in part), calcareous schists, limestones, and highly contorted black phyllites and amphibolitic schists. This belt of metamorphic rocks is succeeded inland by diorite, which appears at the coast 15 miles northwest of Klag bay and is exposed northward to Lisianski strait. The graywackes and slates are well exposed along the shores of the bay. As a rule they are not intimately interstratified, as is common among the graywacke-slate formations of the Juneau region, Prince William sound, and Kenai peninsula, but form alternating belts several hundred feet thick. The graywacke is by far the dominant rock and forms massive exposures that are hundreds of feet thick and are without discernible stratification. Some strata, as shown by absolutely continuous exposures along the shore-line, attain a thickness of 1400 ft., and thicknesses in excess of 3200 ft., in which perhaps a few narrow belts of slate are included, have been measured at the head of Klag bay. The strike of the rocks ranges from N.40°W. to N.50°W. and the dip is 70°S. Whether the massive beds of graywackes maintain their great thickness for considerable distances along the strike was not determined, but it is believed that they will be found to dovetail with lenses of slate. The basis of this surmise is the fact that near the head of Ogden passage a marked lenticular interstratification of graywacke and slate was observed. The lenses of graywacke range from a few inches to several feet in thickness and swell and pinch abruptly. The rocks show a cleavage or fissility which is best displayed in the argillaceous members and is but poorly developed or absent in the graywackes. It coincides in direction with the stratification. Locally the slates show considerable plication, with tearing and kneading of thin intercalated strata, but no evidence was procured that folding on a more extensive scale has taken place.

The orebodies at the head of Klag bay consist of quartz veins occupying shear zones in graywacke. They coincide in strike and dip with the stratification and schistosity of the inclosing country rock. On account of the thick-bedded character of the graywacke, only the roughly schistose structure and not the stratification of the wall-rocks is, as a rule, determinable near the veins. The orebodies range in thickness from a few inches to 18 ft. or more; in the producing properties the average thickness is perhaps 5 or 6 ft.; in the prospects it is a few inches or at most a few feet. The gold is localized in short shoots. In some lodes the fissuring is continuous for considerable lengths, but the fissured zone is barren of quartz and consists of sheared triturated graywacke; in other veins the quartz is continuous, but the gold content absent. In the vicinity of the veins the graywacke has been reduced to a black, highly polished, and irregularly schistose or slaty condition. In the midst of the sheared rock there remain numerous lenses and horses of massive graywacke. In places the shear zone may be 30 ft. or more in width and correspondingly leanly mineralized.

The veins show a well-marked ribbon structure, which is emphasized by the fact that the individual ribbons of quartz are separated by thin slabs of black schistose graywacke. These partings range from mere filaments to slabs several inches thick. As the quartz breaks free and clean from them, they often deceptively appear to form the walls of the orebody, but when they are broken through, more ore is commonly found behind them. Slabs of the lode slack off across the orebody up to such apparent walls, but however regular and well defined these walls may appear to be, not much reliance can be placed on the presumption that they mark the limits of profitable ore. Where the partings of schistose graywacke become thick and numerous the orebody becomes a typical stringer lode, and a corresponding decrease in the grade of the ore takes place. In the ore-shoots, however, the veins consist practically of solid quartz.

The foregoing structural features of the orebodies suggest that from a principal level driven along the general trend of the shear zone numerous cross-cuts should be made into both the hanging wall and the foot-wall. Not only do the apparent walls prove unreliable guides concerning the orebodies, but it is conceivable that where large horses of graywacke occur in the shear zone, the vein may split and curve around the massive rock, and on resuming its general trend may follow a parallel course at a distance of some feet in either the foot-wall or the hanging wall of the original course.

The mineralogy of the ore is simple. The gangue is a milk-white quartz of drusy texture, with which a small amount of carbonate is associated. This weathers red on the dumps and is therefore plainly evident. In addition, the microscope shows that some albite occurs with the carbonate. The quartz carries a considerable number of fragments of slaty graywacke, which are found microscopically to be completely sericitized.

Pyrite is the most abundant metallic mineral; galena and free gold are the only other metallic minerals. The presence of galena with the pyrite indicates everywhere high

*Abstract from *Bull.* 504, U. S. Geol. Surv., 'The Sitka Mining District.'

gold content. The pyrite occurs not only in massive form, but as deeply striated cubes in the vein quartz and also as minute cubes in the neighboring wall rock. Galena is relatively rare and is as a rule intergrown with pyrite; it does not occur in the wall rocks. The gold is found both as isolated particles embedded in the quartz and as particles intergrown with the sulphides. The ores are fresh and show little evidence of oxidation, the unaltered sulphides extending practically to the surface—a fact undoubtedly due to the glacial abrasion that the region has undergone in the recent geologic past.

The Chichagof mine, usually known as the DeGroff mine, is now the property of the Chichagof Gold Mining Co. It is situated at tidewater at the head of Klag bay (see Fig. 1). The milling plant in operation during 1910 consisted of two batteries of two 850-lb. stamps, dropping 104 times per minute in triple-discharge mortars. The ore was crushed to ¼-in. mesh, and the pulp passed to a 10-ft. Chilean mill. The concentrating equipment includes a classifier, two Wilfley tables, and one Wilfley slime-table. The capacity of the mill was 20 tons per day. At present the tailing, which averages nearly $10 per ton, is impounded for future cyanidation. Electric power is employed, which is transmitted 4½ miles from the generating station on Sister lake. The hydro-electric plant and transmission line are under the control of a company jointly owned by the Chichagof Gold Mining Co. and the Golden Gate Mining Co., both of which it supplies with power. The plant is rated at 150 hp. and is driven by a turbine under 44 lb. pressure. In summer enough water is available to develop several times this power, but the capacity of the plant is fixed by the minimum winter flow. In the summer of 1910, because of increased development of the mine and the inefficiency of the Chilean mill, it was decided to erect a new mill of standard design equipped with 10 stamps of heavier pattern.

The orebody was found in 1905, as already related, by tracing to its source the quartz float so abundantly strewn in the bed of the small stream. The vein did not outcrop along the shore, but was found in place one-quarter of a mile inland, at an elevation of 275 ft. At the outcrop the vein ranged from 2 to 4 ft. in width. The float ore was carefully gathered and shipped to the smelter at Tacoma. This ore was rich enough to yield between $15,000 and $20,000. The proceeds were applied to development work, and the mine has paid its own way from the start. An adit 220 ft. long was driven on the vein and two ore-shoots were found, the second of which was 18 ft. wide at a maximum and averaged $63 per ton across this width. Later a second adit was driven 162 ft. vertically beneath the upper adit, starting behind the mill, which is situated at the beach. Ore was found at 800 ft. from the portal, apparently belonging to the bottom of the first ore-shoot. A raise was put through to the upper level, and the ore thus developed is now being stoped. Unexpectedly it was found that the ore-shoot had a considerably greater strike length in the intermediate levels than was indicated on either the upper or lower adit levels. In addition to this encouraging feature, the ore-shoot maintained its width and remarkably high average value. Meanwhile development was vigorously continued on the lower adit in order to undercut the second ore-shoot.

The geologic features at the mine are simple. The bedrock at the discovery outcrop is glaciated and covered with several feet of glacial drift containing striated blocks and cobbles of graywacke and some of diorite. The country rock inclosing the orebody is a nearly massive graywacke of dark blue-gray color and dense texture. It proves to be exceedingly hard and tough under the drill. In the main adit some thin beds of slaty argillite were found 200 ft. from the portal and show that the stratification trends N.55°W. and dips 70°SW., conforming to the general strike of the rocks at Klag bay.

Near the vein the graywacke has been powerfully sheared and has been transformed to a black, brilliantly lustrous, schistose rock resembling a polished and slickensided slate. The strike of the shear zone along which the ore makes is approximately N. 15° W., and its dip is 70° SW. Rich ore is limited to short shoots, but on account of the youth of the mine the shape of the shoots is not well known. It is a fair inference from the data at hand, however, that they are lenticular in both strike and dip. The vein shows in places a pronounced ribbon structure and is traversed by numerous false walls. Some of these walls are remarkably well developed, and it might often be thought unlikely that ore would be found behind them.

On the main adit level a spur vein was found making out into the foot-wall country rock at an angle of 30° to the main orebody. It was about 8 ft. thick, but pinched out at the end of 75 ft. The rock included in the angle between the main vein and the spur is more or less shattered and penetrated by quartz stringers and impregnated with pyrite. The metallic minerals in the ore are pyrite,

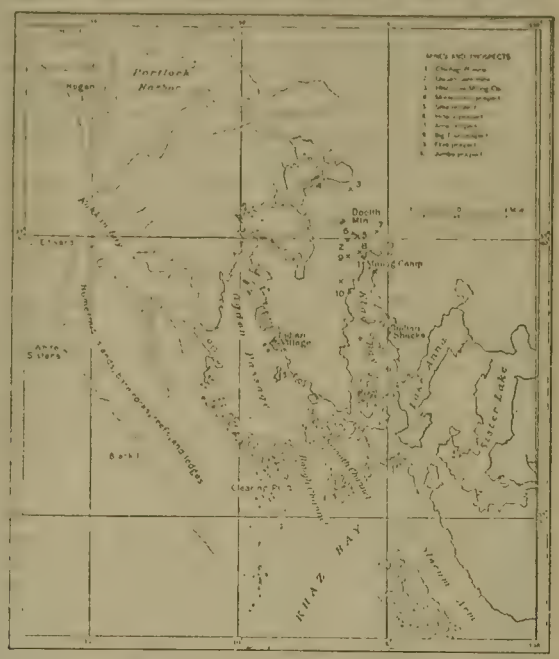


FIG. 1. PROSPECTS AT KLAG BAY.

which is by far the most abundant, galena, and free gold. According to the mill returns, the sulphides constitute from 2 to 3% of the ore.

The Golden Gate property, which is often referred to as the Mills property, one of the principal owners being W. P. Mills, of Sitka, is situated on what is undoubtedly the northwest extension of the Chichagof vein. The main haulage adit is situated at an altitude of 1000 ft. and is connected by an aerial tramway with the stamp-mill on the beach. The mill is of 10-stamp capacity, but only five stamps were installed at the time the mill was started in 1910.

The original discovery was made in September 1905 on an outcrop exposed at an altitude of 1520 ft. Great slabs of the vein lie scattered on the mountain side, many over a hundred feet from their position in place. Some of these slabs are 10 to 15 ft. long, 5 ft. or more wide, and several feet thick. The vein is 10 ft. thick at the discovery cropping, where a spur vein making a narrow angle with the main vein extends 300 ft. into the hanging-wall country rock. A shoot of richer ore was later discovered lower on the mountain, and the development work has so far been directed toward exploring this ore. An adit at an altitude of 1080 ft. was driven on the vein and undercuts the ore-shoot at a maximum depth of 127 ft. Subsequently a new adit, 80 ft. below the older, was driven, and forms the main haulage-way of the mine.

Surveys indicate that the Golden Gate and Chichagof mines are situated on the same vein, but actual continuity cannot be traced on the surface, either because glacial drift

and vegetation cover the apex of the vein or because the shear zone is barren of quartz mineralization along the intervening stretch. Either condition is equally probable. The geologic and mineralogic features of the orebody are similar to those of the Chichagof. The average width of the explored portion of the orebody is somewhat smaller, and the grade of ore is lower, although it was reported late in June 1910 that a shoot of a richness comparable to that of the older property had been found.

On the surface 150 ft. in the foot-wall of the vein is a dike, which is 100 ft. wide at its widest point. It trends parallel with the formation and can be traced a few hundred feet only. On the hanging-wall side the dike consists of a white coarsely granitoid rock, which the microscope shows is composed essentially of quartz and albite in hypidiomorphic arrangement, but much crushed. Toward the foot-wall the dike changes, apparently by gradation, into a rock resembling a greenstone. The microscope shows that this green rock formerly consisted of a coarsely granular assemblage of plagioclase, probably albite, hornblende, and biotite, but that it now consists of brecciated fragments embedded in a fine-grained matrix of attrition products composed of hornblende, chlorite, and feldspar.

The Hirst Cove property is situated on the northwest side of Doolth mountain. An adit 800 ft. long is driven on the vein at 400 ft. altitude, at a point one-half mile inland from Mine cove. The vein averages 3 ft. in thickness, and the ore resembles that of the Chichagof and Golden Gate mines, though metallic minerals are materially less abundant and are usually concentrated in the slaty material inclosed in the vein quartz. Some pay-streaks remarkably rich in free gold have been found. The vein is sometimes considered the northwestern extension of the Chichagof vein on the southeast side of Doolth mountain, but it lies too far to the northeast—that is, in the foot-wall of the Chichagof vein—to be the extension of that orebody.

A considerable number of prospects, such as the Monte Cristo, Flora, Jumbo, Big Four, and others, have been located in the region around Klag bay. The amount of development is generally small, and as the geologic features are entirely similar to the orebodies already described, individual descriptions are hardly necessary. The presence of these prospects indicates that mineralization is widespread throughout the region. The showing at the various prospects is commonly not impressive, but it must be confessed that if only the barren portion of the shear zone of the most productive mine of Klag bay were known, it would hardly present a more encouraging appearance than that shown by the poorest prospect in the region.

The Princess Pinder prospect is not on the peninsula between Klag bay and Ogden passage, as are the others previously described, but is near the entrance of a bay locally known as Pinta bay, six or eight miles northwest of Mine cove. Ore was discovered here in June 1910 outcropping in the cliffs at the water's edge along a shoreline that had been more or less thoroughly examined by various prospectors. This fact is of some interest and leads to the belief that the shore-lines have not been so carefully examined but that other prospects will be discovered. The orebody shows a face of 7 ft. of coarse white quartz carrying some scattered bunches of pyrrhotite admixed with chalcopyrite. The trend of the deposit is probably S.40°E. (true), and the dip is 80°SW. The foot-wall is a blue-black slaty rock and the hanging wall is a greenstone breccia. Assays of samples taken across the entire width of the vein show an average value of $10 per ton in gold.

The rocks in the vicinity of Sitka are mainly graywackes and slates striking N.70°W. and dipping steeply to the south. Some fine-grained quartzites, in places so extremely fine grained as to resemble light greenish cherts, are associated with them at various localities. Igneous rocks are rare. A few dikes of diorite aplite cut the graywackes and slates. One of these dikes has been found to be mineralized and to carry free gold. A crushed dike of dark gabbro, somewhat impregnated with pyrite and pyrrhotite, is exposed on the northeast side of Bear bay, an indentation of Silver bay. The rock consists essentially of plagioclase feldspar, near bytownite in composition, and hornblende, probably secondary. At Bear lake, east of the bay of the same name, quartz diorite occurs. It is a medium-grained granitic rock composed of plagioclase, quartz, hornblende, and biotite, and is of uniform grain, color, and appearance. The diorite is somewhat gneissic and banded near its contact with the sedimentary rocks, which appear to have been considerably altered as a result of the intrusion.

The orebodies occupy shear zones in graywacke and strike parallel to the stratification of the country rock. The dips are steep—nearly vertical. The lodes form massive outcrops of white quartz up to 15 ft. or more in thickness which are apt to show a short lenticular structure along the strike and to split up into stringer veins. They are irregular in shape, bellying out and constricting abruptly. Near the veins the country rock is much sheared and is penetrated by numerous transverse stringers, as well as by veins parallel to the shear planes. A characteristic feature

FIG. 2. PROSPECTS NEAR SILVER BAY.

of the orebodies is the insignificant amount of metallic sulphides—in many veins an almost negligible quantity—contained in the vein quartz. Pyrite, pyrrhotite, and arsenopyrite are the principal sulphides; galena and sphalerite have been observed, but are extremely rare. The sulphides are at many places concentrated in and around fragments of slate or sheared graywacke included in the veins, even though the quartz itself is barren. Orebodies of a type different from the auriferous quartz veins already described have attracted some attention. These consist of beds of shattered quartzite, which is flintlike in texture, recemented by quartz veinlets, carrying in places, though rarely, pyrrhotite and arsenopyrite. Some quartzite strata weather so that the surface exposures somewhat resemble vein quartz, but the mineralization is so feeble that it is difficult to understand why they should have been located as orebodies.

The Cache mine, located in October 1872, and originally known as the Stewart mine, is situated $1\frac{1}{4}$ miles east of the head of Silver bay, at an elevation of 720 ft. above sea-level (see Fig. 2). A 10-stamp mill was built in 1879, but has long ago fallen into ruins, and the tramways leading to it are thicketed with new growth of alders. The mine has been in litigation for many years. The orebody, which is nearly vertical, is opened on three levels by adits aggregating 300 ft. in length. The lowest adit is 160 ft. long and trends S.70°E.; at the mouth the orebody is 4

ft thick and increases to a maximum of 1.5 ft. solid quartz, its average thickness being about 10 ft. The walls of the orebody are extremely curved, dipping in reverse directions from place to place. Practically no metallic sulphides are visible in the quartz, except a streak on the south wall, which is fairly mineralized with pyrite. The other two tunnels, the upper being about 80 ft. above the lower, show essentially the same features, but not so much quartz.

The Bauer mine lies 2 miles southwest of the head of Silver bay. The main development consists of an adit at an altitude of 1250 ft. This adit, which is 900 ft. long and intersects the main orebody at a depth of 400 ft., traverses thick massive beds of graywacke, which are gritty or conglomeratic at the portal, and crosses several smaller veins striking parallel with the formation. At the end a drift 150 ft. long is turned off on the orebody and trends S.45° E. The hanging wall is slate and the foot-wall is graywacke. The orebody consists of cryptocrystalline quartzite traversed by narrow quartz veinlets and leanly mineralized with pyrrhotite.

The Cascade claim is on the east fork of Indian river, 3 miles from Sitka, and is the only one discovered in the vicinity of Sitka or Silver bay in recent years. The country rock at this locality consists of cherty quartzite and slate striking N.55° W. and dipping approximately vertical. The quartzite, which is flintlike in texture, weathers milk white, so that it resembles a quartz lode. The orebody consists of shattered quartzite cemented by quartz veinlets and is in places mineralized with pyrrhotite and arsenopyrite. Chalcopyrite is present as an extremely rare constituent. A 5-ft. bed of slate appears to form the wall-rock on the southwest side of the orebody, but toward the northeast the boundary is indefinite. The orebody is exposed by open-cutting and is 300 ft. long. Its width apparently ranges from 4 to 20 ft., but these dimensions will doubtless be dependent upon assay returns.

The Lucky Chance mine is situated in a precipitous mountain range, 2000 ft. above sea-level and 4 miles as the crow flies, or 7 by wagon-road, from the head of Silver bay. The quartz vein has a maximum width of 8 ft. where it outcrops, but in the adit it is not constant in width and appears to merge into a series of narrow stringers penetrating the mineralized slate hanging wall. The foot-wall, of graywacke, is locally known as diorite because of its compact, massive structure. A 600-ft. adit follows the vein and connects through a raise with a surface pit. The surface improvements comprise a 10-stamp mill, a sawmill, and a water-power plant. High assays are reported from parts of this vein and many specimens of free gold have been obtained.

Many other prospects, partly developed, notably the Lower Ledge, Bullion, Free Gold, Liberty Lode, Silver Bay group, and the Boston, are still held in this area, some of which have very favorable surface showings, but lack of capital and inefficient management have caused a suspension of explorations for the last few years.

The Caisson Disease

By Walter Peet

Compressed-air illness or caisson disease, has been recognized for many years, but it remained for Paul Bert, a French physiologist, to discover the exact cause. He worked the whole matter out theoretically, and then proved it practically by experiments on animals. Normally we live under a pressure of atmosphere of approximately 15 lb. to the square inch, and at this pressure a certain amount of gas goes into solution in the fluids of the body (and the human organism is three-quarters liquid), as it would dissolve in any other fluid. The air is not a chemical compound but a mechanical mixture. Leaving out of consideration about 0.4 to 0.5% of other gases, it consists of about 24 parts of oxygen and 79 parts of nitrogen by volume. When a man or animal goes into compressed air the blood takes into solution an increased quantity of oxygen and nitrogen from this compressed atmosphere, the quantity of these gases absorbed being in direct proportion to the increase in the pressure. These gases taken up by the blood at the lungs are gradually distributed throughout the body. When a man suddenly comes up into the normal atmosphere, as he usually does after work, the abnormal pressure is taken off and he undergoes rapid 'decompression.' When the pressure is released, the nitrogen gas, which had been held in solution by the pressure, forms in little bubbles in the blood. This is the cause of the whole trouble. These bubbles act as emboli (obstructions) and block up the capillaries (little blood vessels) in one or another part of the body, and, by thus cutting off the blood supply or by direct mechanical violence, cause the various symptoms of compressed-air illness. The harmful results, which take place only after the patient goes into normal air, where the extra pressure is taken off the nitrogen, may be prevented by making the change from the highly compressed atmosphere slow enough to allow the absorbed nitrogen to escape by the lungs.—*Harper's Weekly.*

Production of Primary Spelter[1] in the United States

By C. E. Siebenthal

Apportioned According to Source of Ore

United States:	1906.	1910.	1911.
Arizona	64	2,594	2,336
Arkansas	1,801	286	385
California	....	.....	1,099
Colorado	32,456	23,238	42,233
Idaho	573	3,454	3,180
Illinois	282	1,551	2,884
Iowa	201	40	.....
Kansas	3,902	10,220	6,843
Kentucky	335	29	205
Missouri	130,348	140,652	127,540
Montana	1,415	12,408	22,115
Nevada	1,768	1,516	1,595
New Jersey	11,206	20,217	15,128
New Mexico	555	4,911	3,778
Oklahoma	....	2,297	2,247
Tennessee	124	925	1,000
Texas	8	.....	.....
Utah	2,449	7,221	7,004
Virginia	1,143	1,168	228
Washington	7	.....	12
Wisconsin	11,057	19,752	31,809
Total domestic	199,694	252,479	271,621
Foreign:			
Canada	201	3,304	1,598
Mexico	24,875	13,401	13,307
Total foreign	25,076	16,705	14,905
Grand total	224,770	269,184	286,526

Apportioned According to Locality in Which Smelted

Illinois	47,939	73,038	83,130
Kansas	129,564	105,697	98,413
Oklahoma	....	34,760	46,315
Other States	47,267	55,689	58,668
Total	224,770	269,184	286,526

Production of Secondary Zinc in the United States

	1910.	1911.
Secondary spelter, redistilled	12,784	[2]14,000
Secondary spelter, remelted	28,439	[2]26,500
Recovered zinc in alloys, excluding old brass remelted	2,709	[2]2,500

[1]Primary spelter is made directly from ore, while secondary spelter is recovered from such sources as drosses, skimmings, and old metals.

[2]Subject to final revision.

Surface Combustion

By Raymond C. Benner

The fundamental principle underlying surface combustion, which has been extensively studied by W. A. Bone, is that all hot surfaces accelerate chemical changes in gaseous systems. In the case of electrolytic gas enclosed in smooth glass walls, say at 450°C., a negligible amount of steam may be formed. Certainly, this may be said to be the tendency there. By placing in this vessel some porous substance, so that a much larger surface is exposed to the gas, chemical union is caused to take place at a measurable rate at the surface, not rapidly enough, however, to cause an explosion. It is therefore necessary to distinguish between two possible conditions under which gaseous combustion may occur: (1) Homogeneously—that is to say, equally throughout the system as a whole, at temperatures below the ignition point, slowly and without flame, and at temperatures above the ignition point rapidly and with flame; (2) heterogeneously, or only in layers immediately in contact with an incandescent surface. The latter is surface combustion and the process is much more rapid than is the normal combustion in ordinary flames.

The fact that metals of the platinum group aid in the chemical union of gases has long been known, but that hot surfaces in general have this acceleratory influence on gaseous combustion has, in all probability, escaped recognition of technologists because of the idea possessed by Siemens, that combustion was retarded by hot surfaces. Before Siemens' time this subject seems to have received the attention of a number of men such as Döbereiner, Davy, and others, but with no explanation of the phenomena or practical results other than Döbereiner's lamp.

The fact that all surfaces, depending on their chemical and physical properties, accelerate combustion at temperatures below the ignition point, is not the only point to be considered. Treatment in various manners can change the rate greatly. For example, if a surface consisting of a non-oxidizable metal or non-reducible oxide be exposed to H or CO before use, its action in bringing about their union with O is greatly stimulated. If previously exposed to O the rate of combustion is decreased. The relative affinities of different substances for O in ordinary combustion may be changed in the presence of hot surfaces; under ordinary conditions O has a greater affinity for CH_4 than for H or CO. This is reversed in the presence of a hot surface. H_2O is probably essential to the burning of CO under ordinary conditions, but it has been shown to greatly retard surface combustion.

Mr. Bone's experimental work leads him to believe that the accelerating power of surfaces increases with temperature; and the difference which different bodies show in the rates of acceleration tends to disappear with increase of temperature. When explosive mixtures of gases are forced through incandescent porous substances, the rate of combustion is so greatly hastened that combustion takes place within the pores at a rapid rate. Therefore the surface of the porous diaphragm is kept in a state of incandescence without flame. The two chief points here emphasized are, that the term 'pore' is not used in the gross sense, but in that of molecular dimensions, and that the incandescent surface plays a truly important part in inciting chemical action.

The advantages claimed for surface combustion are: (1) Great concentration of heat in a small space, because of the greatly increased rapidity of combustion; (2) combustion takes place without excess of air, thus doing away with one great loss of heat essential to ordinary combustion operations; (3) temperatures, due to the foregoing reasons, are higher than otherwise possible without regenerative devices; (4) the large amount of radiant energy developed makes the transference of heat much more rapid. The heating diaphragm, shown in Fig. 1, is made of granules of fire brick bound together with a suitable material. This diaphragm, the structure of which is readily seen in the figure, is quite porous, so much so that ⅛-in. water pressure readily forces air through it. The air and gas are supplied to the mixing chamber 'A' either by means of a Y-tube and low pressure (2 to 3 in. water) gas and air or by means of an injector, by the use of which gas can be supplied at two pounds pressure.

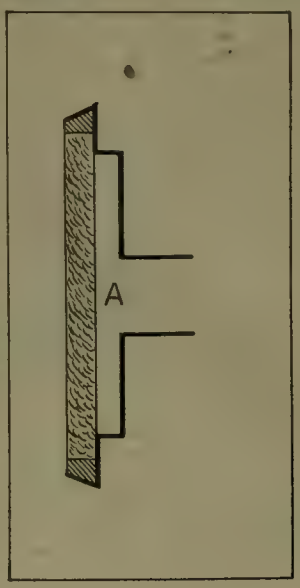


Fig. 1.

In starting, the gas is admitted alone and ignited, after which the air is turned on gradually. The flame becomes non-luminous and smaller in size until the correct percentage of air and gas is being used, when it disappears and only an intensely hot surface without flame remains. But a thin surface layer of the diaphragm becomes hot (⅛ to ¼ in.), while the back of the apparatus remains cool enough to touch with the hand. Unburned gases do not escape from the surface and the temperature rises immediately upon increasing the supply of gas. Temperatures up to 850°C. are easily maintained on a freely radiating surface. The diaphragm can be used equally well in any position and with any of the ordinary forms of fuel gases, the amount of heat generated depending, of course, upon the kind of gas used. The gas surrounding the incandescent surface has no effect whatsoever upon the combustion; in an atmosphere of CO_2 the diaphragm acts as well as in air.

An interesting experiment, showing one of many applications to which this method of heating can be applied, is the evaporation of sodium silicate solution by placing the diaphragm above the dish containing the solution, so that the upper layers of the solution are heated by radiant heat. As evaporation takes place the dry silicate can be skimmed off. This method is much easier and more satisfactory than trying to evaporate a solution of this nature by heating from below.

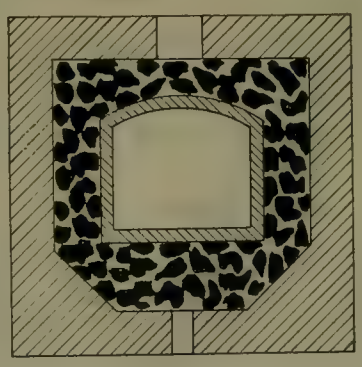


Fig. 2.

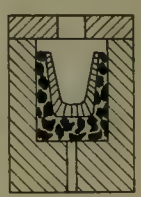


Fig. 3.

The second application of the process can be used equally well for gases and vapors. Fig. 2 and 3 make the explanation simple. The explosive mixture of air and gas is forced through an orifice in the base of either a muffle or a crucible furnace at a rate more rapid than that of back firing. The combustion takes place in the bed of granular refractory material, no flame coming out of the top of the furnace. The intensity of the temperature obtainable may almost be said to be limited only by the fusibility of the refractories. These furnaces are started in the same way as the dia-

phragm, but at the expense of more time. The following table shows the great efficiency of this arrangement, when it is remembered that in order to maintain a muffle of similar size and shape at 1055° C., 105 cu. ft. of gas per hour is required, when the muffle is heated by the ordinary method employed in gas furnaces.

RESULTS OF TEST ON A MUFFLE FURNACE

(Dimensions of muffle, 9½ by 5¼ by 3¼ in.)

Temp. muffle of muffle:		Gas consumption to maintain temp. constant, cu. ft. per hr. at 15° C.	Temp. of products:	
°C.	°F.		°C.	°F.
815	1499	21.0	540	1004
1004	1840	35.3	645	1195
1205	2201	58.0	870	1598
1424	2596	79.0	1085	1985

Mean net cal. val. of gas, 540 b.t.u. per cu. ft., at 15° C.

The application of the principles of surface combustion to steam-boilers becomes of great interest, remembering that the average thermal efficiency of gas-fired boilers is not far from 65% and that nearly 95% efficiency has been obtained by the new method. The arrangement used with a small boiler of cylindrical section three feet in length traversed by tubes three inches in diameter is simple. The whole length of the tubes is packed with granular refractory material of the proper size, the front end fitted with a clay plug, containing an opening of such size that the speed of entering explosive mixture will be greater than that of back firing, each tube communicating with a mixing chamber of especial design. The products of combustion leave the boiler at not more than 70°C. above the temperature of the water in the boiler and pass through a feed-water heater, which they leave with a temperature of less than 100°C. The details of the experiment with a 10-tube boiler bring out the advantages possessed by this system:

Pressure of gas and air, 17.3 in. (water gauge).
Steam pressure, 100 lb.
Products of combustion leaving boiler, 230°C.
Products of combustion leaving feed-water heater, 95°C.
Water entering feed-water heater, 5.5°C.
Water entering boiler, 58°C.
996 cu. ft. of gas of 562 b.t.u. per cubic foot.
559,800 total b.t.u. of gas.
527,800 b.t.u. used in heating water.
94.3% of total heat generated used in evaporating water.

The advantages of this system of combustion when applied to boilers may be briefly summarized as follows:

(1) Little if any excess of air is necessary to obtain perfect combustion; (2) with 0.5% oxygen in the products of combustion, combustion was complete; (3) steep heat gradient; (4) 70% of the evaporation occurs in the first third of the tube, 22% over the second third, and only 8% over the last third; (5) the mean evaporation is very high, over 20 lb. of water per square foot of heating surface; (6) while evaporating 20 lb. of water with an efficiency of nearly 95%, the equipment can be forced 50% higher with but little loss in efficiency.

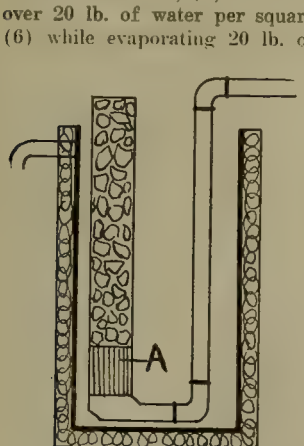


FIG. 4.

Among the many openings for the application of this new method of heating, that of melting metal and other low-melting alloys, seems to be one of the most attractive. This is simplicity in itself and the method of operation is quite evident (Fig. 4). The explosive mixture of gas and air is forced through a clay plug (*A*) into a pipe fitted with several pieces of a suitable refractory material. There the combustion takes place in a manner entirely similar to that described for the crucible and muffle furnaces. The following table gives a good idea of the efficiency of this process when applied in this way:

LEAD MELTING TEST

	°C.	°F.
Temperature of metal charged	15	60
Temperature of metal tapped	372	682
Temperature of gases leaving apparatus	500	932

Lead melted per hour, 1176 lb.

Heat required per hour to raise metal from 15 C. to 372° (1176 by 32.57), 38,420 b.t.u.

Gas burned per hour, 100 cu. ft. at normal temperature and pressure.

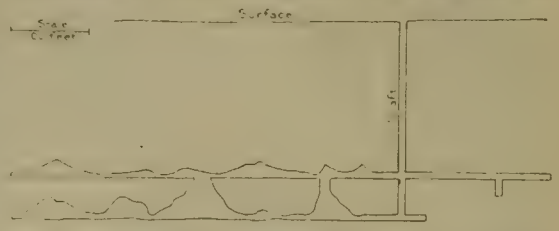
Net cal. val. of gas, 559 b.t.u. per cu. ft. at normal temperature and pressure.

Ratio, 38.42 : 55.90 = 0.686.

Ore Not In Sight

By H. FOSTER BAIN

Measuring ore reserves is a work that calls for much common sense as well as experience. Many mistakes have been made by assuming ground to be ore-bearing that afterward proved to be barren. The safest and most generally accepted plan is to regard as 'positive' ore only that which has been exposed on four sides. Even this rule, however, fails in places. In the figure below is sketched a case in



point observed some years since in a small zinc mine at Dubuque, Iowa. The stopes indicated were all in zinc ore of good grade, as was also the bottom of the lower drift and the sides and ends of the drifts on which stoping had been done. Old shallow pits were known at the surface along the vein. A Western engineer examining such a property might easily be led to assume an ore-shoot about 450 ft. long, and a considerable amount of ore as actually 'in sight.' As a matter of fact, neither assumption is correct. The Dubuque orebodies at upper levels are developed where vertical crevices cross favorable flat-lying beds of dolomite. Along these horizontal intersections the ores have been formed as crusts on the walls of what are known as 'openings.' Little work, usually, is necessary to convert an opening into a level and where minor quartering crevices cross the main fracture vertical shoots or chimneys connect one such level with another. It is easy under such circumstances to get a mine in such shape as to readily deceive a stranger, though to the credit of the local mining men it is fair to say that I never knew of it being purposely done. Several Western 'practical' men have at various times insisted on deceiving themselves in this manner, and I remember yet the comical half-convinced look on the face of one such when I explained the true situation to him and reduced his ore reserve by a few hundred thousand tons. Mining in the Upper Mississippi Valley is now almost entirely in lower lying beds where the mode of occurrence is different from the one sketched above. It is sufficiently peculiar itself, but not quite so deceptive. Even in these lower beds, however, serious mistakes have been made and absurd estimates published. The characteristic occurrence is a series of outward dipping fracture planes known as 'pitches' and surrounding a 'core' of rock. Part of this interior core is usually mineralized and much of it is now worked. It is easy to convert optimism into figures and determine a large tonnage as 'in sight.' It is sometimes much harder, however, to find the ore called for by these estimates. It all enforces the necessity of knowing the local geology when making an examination.

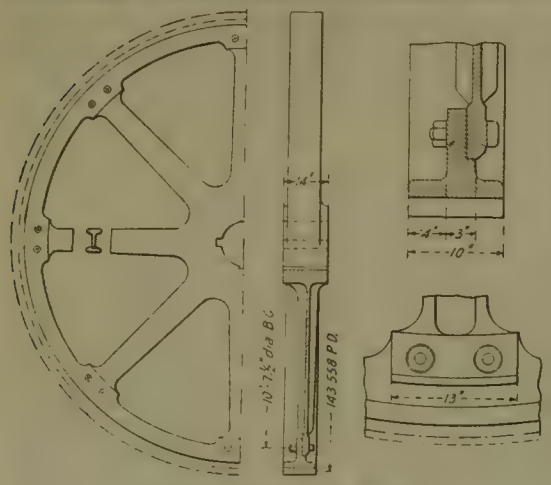
Mechanical Features of the California Gold-Dredge—II

By Robert E. Cranston

*Bucket Drive.—The buckets are driven by a chain of gears mounted on the main gantry. The use of a chain or shaft drive from the lower deck has now been entirely abandoned in California practice. Some dredges drive direct from the digging motor to the pulley shaft on the main gantry. Others use a countershaft on the main deck, from which also is driven the ladder hoist. Neither type has any great advantage over the other, and if properly designed either method will give satisfactory results.

The upper tumbler may be driven by a gear at one end of the tumbler shaft, or one at each end, with a double set of intermediate pinions, gears, and pulley-shaft pinions. The single drive is, of course, cheaper and simpler, but experience has shown that after many years of service the single drive is inclined to get out of line, even when very solidly built. I very much favor the double drive and would advise its use.

Bull Wheel.—The bull wheels or tumbler-shaft gears are



BULL-WHEEL, 9-CU. FT. DREDGE.

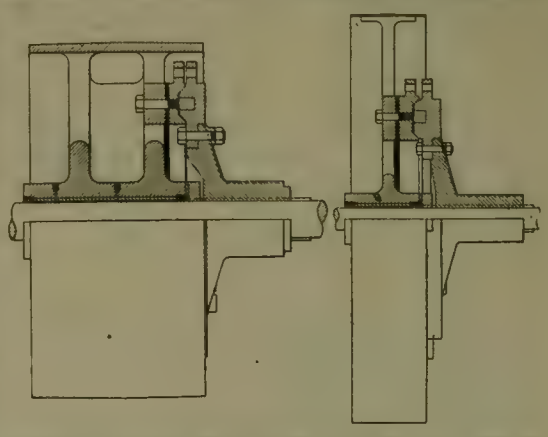
cast of steel in sections, sometimes with a split and sometimes with a solid hub. The rim is cast in one piece or in halves. Some designers use cut teeth, others rough cast. There can be no doubt but that the cut teeth run more smoothly, but for the rough work in hand I do not believe that the extra cost is warranted, particularly since the teeth are soon worn down and the benefit of the cut teeth disappears. In order to prevent breaking, all sharp angles should be avoided in the design of the spokes. They are subjected to constant shocks and vibration, and the gears will invariably break at a sharp re-entrant angle should such occur at a vulnerable point. In order to make a snug fit and also to keep the rim from becoming elliptical, the spokes should either have a shoulder fitting on a machined inner edge of the rim, or the ends of the spokes should be turned to fit a machined shoulder on the rim. The latter method is preferable, since it does away with sharp corners which, as explained above, are always points of weakness. It has been common practice to use one large bolt to fasten each spoke to the rim. Two smaller bolts are better, since a more even distribution of spoke cross-section can be maintained by this design and it gives a longer spoke end to bear against the machined rim. A good many spokes have been broken near the rim where the cross-section is ample but where a point of weakness exists owing to the re-entrant shoulder above mentioned.

Intermediate Shaft Pinions.—The intermediate shaft pinions are made solid and as small in diameter as is consistent with good design. These pinions wear out quite rapidly and should be so arranged as to be easily replaced.

Intermediate Shaft Gears.—The intermediate shaft gears are designed of a size to give the bucket line the desired speed. They are often made with separate rims, so that they may be replaced when worn without throwing away the rest of the gear.

Pulley-Shaft Pinion.—The pulley-shaft pinions are made similar to the intermediate shaft pinions and as small as good design will allow.

Clutch.—Whether the digging motor is belted direct to the bucket-drive pulley shaft, or to a counter-shaft on the ladder-hoist foundations and from there to the bucket-drive pulley shaft, some form of friction clutch is used to connect and disconnect the bucket drive, and for purposes of safety in case the buckets encounter obstructions beyond their strength. Any of the standard forms of friction clutches may be used, but I prefer the electro-magnet clutch and use it in all designs. It is by far the simplest to



MAGNETIC CLUTCHES FOR BUCKET DRIVE AND MAIN WINCH.

operate, is positive, and will slip at exactly the same pull every time according to the amount of current sent through its coil by the rheostat controlled from the pilot-house. The clutch used is very simple in design. A cast-iron pulley is made so that there is a flat ring or web joining the spokes at about half the distance from hub to face. To this web is bolted a soft cast-iron ring. Between this and the pulley are inserted two thin sheets of copper and one of soft iron between the copper plates. These ring-shaped sheets are used in order to keep the lines of force where they are most wanted and to prevent the current making a permanent magnet of the pulley and shaft, which would cause the clutch to drag when released. The pulley has a long hub bushed with bronze and runs free on the shaft. A long cast-iron hub with two feather keyways at 180°, and a web extending out to the same diameter as the ring on the pulley is made to slide along the shaft. To this web is bolted another soft iron ring similar to the one bolted to the pulley. An annular groove of rectangular cross-section is machined in this ring midway between its inner and outer circumference into which fits a coil of magnet wire. By introducing an electric current into this coil through controller rings, magnetic lines of force are induced which will draw the two soft iron rings together, the pressure depending on the amount of current put through and the number of turns in the coil. The edges of the soft iron rings are beveled so as to make a female joint on the pulley and a male joint on the sliding hub. The steeper the slope of these edges the less current will be required to do the

*Abstract from the *Journal* of the American Society of Mechanical Engineers. Continued from *Mining and Scientific Press*, page 303.

requisite work, but if the cones are made too steep it will be difficult to disconnect the clutch; 45° does very well. Good results are given by 440 turns of No. 16 magnet wire, and 4 amperes at 110 volts are put through the coil when working average ground. These figures are for a 200 hp. clutch.

Shafts. The shafting for the bucket drive should be made of ample dimensions and of good material. I use nickel steel, annealed, and a factor of safety of 10. The gears should be fitted very neatly and securely keyed.

Bearings.—The upper tumbler-shaft bearings are made on an angle so as to have the bearing cap at right angles to the average line of pull of the bucket line. Cast-iron liners are sometimes used, but I prefer a babbited bearing. The bearings should be well fastened so that they cannot slide forward, there being a very heavy pull in this direction. These bearings, like the others of the bucket drive, are made of cast steel. The intermediate and pulley shaft bearings are made of the ordinary type of babbited base and cap, but are heavier than standard and use very large diameter belts, which should be made of a soft grade of iron or steel, since unless this is done they are likely to crystallize and break.

Brake. It is customary to have the pulley shaft extended and a brake wheel keyed on. This brake is operated from the pilot-house and is used by the winchman to hold the buckets from going over the upper tumbler when the bucket line breaks, to stop quickly in case of an accident, and to hold the bucket line when making repairs or changing buckets.

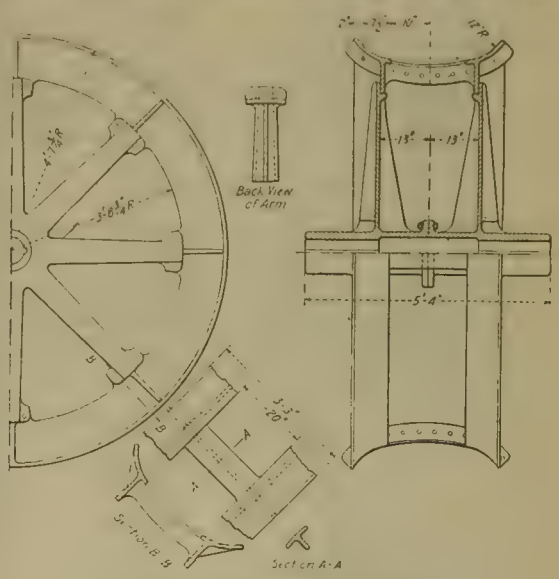
Pulley.—Standard medart pulleys are generally used. They give considerable trouble on account of broken spokes. I have recently used with success a wooden bucket-drive pulley similar to that commonly employed in stamp-mills, and on the last boat I designed a medart pulley with spokes made extra heavy near the hub and tapering to a little more than standard cross-section at the rim, since nearly all the trouble arose from spokes breaking near the hub. If a cast-steel hub and spokes could be made, it would be the best pulley for the purpose. Several of the steel foundries say that they would not care to attempt to cast a spider with as small spokes as the standard medart, and that a very heavy spoke would have to be made in order to overcome shrinkage trouble. If spokes could be made of cast steel and of as light or lighter design than the standard medart, it seems as if it would be an ideal pulley for dredge use.

Foundations.—Too much attention cannot be given to making the supports for the bucket drive of strong construction. In the first place, these foundations are 20 to 30 ft. above the main deck and are subjected to constant and racking strains. If any portion of these supports gives, it throws the shafting out of line with obvious results. One form of support now much used and considered very good has the upper cord of the main truss made high enough to take the upper tumbler-bearing supports directly on its top. By this method the main gantry is braced fore and aft in an excellent manner, and it is a much more rigid construction than where the gantry extends above the cord. Large steel castings are used to tie the timbers together and to support the bearings directly. The details vary on different dredges and apparently have all given good service. One point which should be carefully looked into when designing this part of the dredge is so to place all bolts that they may be readily accessible and replaceable.

Bucket Idler.—Where the depth of gravel to be dug demands a long string of buckets, an idler is used to support the sag. This idler is placed at the throat of the well as low down as convenient. It is made up of a cast-steel hub and a double set of spokes bolted onto a wide rim made to fit the curve of the bucket lip. The shaft is keyed to the hub and revolves in two bronze bushed bearings set on the deck or other convenient place.

Catch-all.—Below the dump hopper an inclined set of grizzly bars is put in. These extend as far forward as the sag of the buckets will allow. The bars are put ¾ to 2 in. apart. Below this grizzly is a collecting pan which directs the gravel to the forward end of a sluice with riffles, occupying the space between the gantry posts and sloping toward the after portion of the dredge. This sluice is run back as far as the grade will permit and then dumps its contents into riffled side sluices running forward, one on each side of the well. These discharge into the well 15 or 20 ft. forward of the well throat. Water is furnished from one of the pumps and washes the material dropping through the grizzly bars.

Dump Hopper.—The hopper into which the buckets dump diverts the gravel into the screen. It is made either with a steel lining or by having a depression left at its bottom which fills up with rocks and gravel, thus forming its own lining. It is obvious that the last method is much more economical than the steel-lined hopper and that so far as its bottom is concerned it will last indefinitely; the only difficulty is that unless the hopper is left of ample dimensions it is likely to clog up when digging large quantities of material, particularly clay. By using a steel



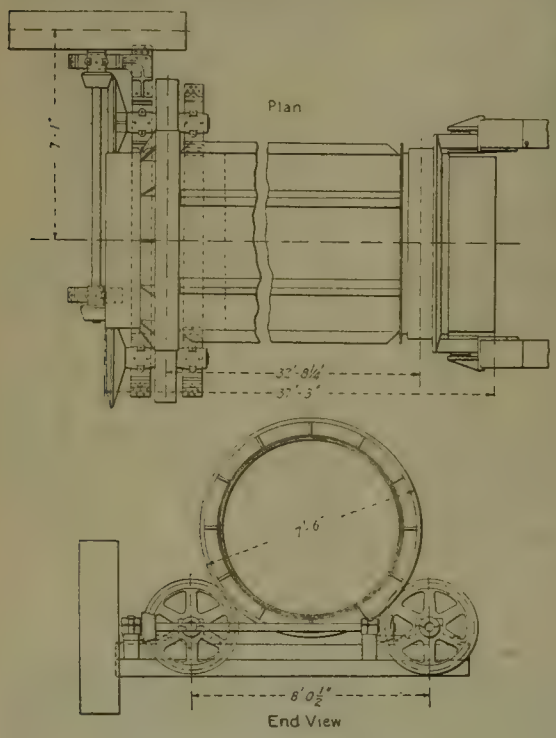
BUCKET IDLER, 9-CU. FT. DREDGE.

lining for the bottom of the hopper a little space may be saved, and if a large quantity of clay is to be handled, the latter method might be preferable, but for ordinary conditions the rock bottom seems to be all that is necessary. The hopper is built up on three sides of the upper tumbler, the top being at about the level of the bucket lips as they go over the tumbler. The forward upward edge is built to such a height as to miss the bucket lips by a few inches when the ladder is in its lowest position, and it is of advantage to put inclined guide plates on each side of the bucket line to divert the slop-over of the buckets into the hopper below. The rear vertical wall of the hopper is subjected to considerable wear by the striking of the rocks and gravel against it when the buckets dump, and it should be lined with an easily replaceable steel plate. A good way is to suspend a ½-in. plate from the top by means of a few bolts, leaving the bottom entirely free.

Screen.—Two types of screen are in common use, the revolving and the shaking. The first dredges used the revolving screen, then the shaking type was introduced at Oroville and for a time most of the dredges were built in this way. On the Yuba it was found that these did not break up the clay in a satisfactory manner, and revolving screens were introduced. This type proved better for this district, and since then many have gone back to the revolving screen even in other districts. The object of a screen is not only to size the material passing through it, but also to disintegrate and wash it. This the revolving screen does more thoroughly than the shaking screen where clay or

cemented gravel is present. The shaking screen gives a more even distribution of the fine, requires less power to operate, and its plates last longer and are more easily replaced. For easily washed material I prefer the shaking screen, but for gravel hard to wash, the revolving type is decidedly preferable.

Revolving Screen.—The design of the revolving screen has been well worked out, and very little trouble is experienced with this part of the dredge. Most of the delays in its operation are caused by the necessary replacement of worn plates. These plates should be put in so as to be readily removable and not too close a fit made; rather leave considerable space between them, since if this is not done they will spread and be hard to take out. Bolts with counter-sunk heads on the inside and split washers under the nuts on the outside are used in preference to rivets. They hold as well and can be removed more readily. The screens are built up in sections, usually with cast-steel ribs at intervals to retard the movement of the gravel. These



REVOLVING SCREEN, 9-CU. FT. DREDGE.

steel ribs also serve as a framework, to which are fastened the perforated plates. The size of perforations depends on the conditions and varies from $\frac{3}{8}$ to $\frac{3}{4}$ in. Around each end of the screen is a steel ring or tire, preferably made in halves so as to be readily removable. Two drive rollers, on which the ring at the upper end of the screen rests, are used on most of the older dredges, but a single drive roller under the centre with two side guide rollers is coming into use on the newer boats. The rollers driving the screen are themselves driven by beveled gears and pinions. Owing to the difficulty of keeping grit out of these gears they are made of manganese steel, with a soft iron core cast in the hub. Rollers are used at the lower end to support the screen, and a pair of manganese-steel thrust-rollers are provided to keep the screen from moving toward the stern. The bevel gears are driven from a countershaft above the screen, the driving motor also being placed there. The countershaft is used in order to reduce the speed properly, so that excessively large gears or pulleys need not be used. At the lower end of the screen is a hopper, which directs the coarse gravel upon a belt-conveyor. In order to prevent clogging at this point the hopper should be placed on a grade of not less than 30°, and should be raised on the side on which the revolving screen moves upward, the gravel being carried up on this side of the screen.

Shaking Screen.—The shaking screen is built with channel-iron sides. The bottom is formed of angle-iron cross-pieces, to which are bolted the perforated plates. The angles should extend beyond the sides, so that the top of the channels may be braced from their ends. The screens are built in pairs and mounted tandem so as to balance each other, one moving forward when the other moves aft. They are suspended from the timbers above, some using adjustable, others non-adjustable rods. The upper and lower bearings for these rods should be made of ample size, since they wear surprisingly fast, considering the small movement. The lower end of the after screen is constructed so as to direct the coarse material from the short discharge-chute upon the conveyor. This part of the screen is not perforated. The size of screen perforations depends on conditions, and, as in the revolving screen, varies from $\frac{3}{8}$ to $\frac{3}{4}$ in. The shaking screens are driven by means of four connecting-rods, operated either by cranks or eccentrics on a thwart-ship shaft. I am inclined to favor the eccentric drive, owing to its larger wearing surface. If eccentrics are used, they should have long hubs and double keyways, otherwise they are likely to work loose under the constant pounding. The drive shaft may be placed at any convenient point, but a central position between the two screens is perhaps the best. The bearings for this shaft are placed outside the screens, and as near as possible to the cranks or eccentrics, and should be long enough so that they will not beat out under the constant hammering. Buffer springs are sometimes used to take up the strain at the end of each stroke, but this practice is not common. The connecting-rods are usually made adjustable, and any of the standard methods of fastening rod ends may be employed.

Sprays.—The ordinary form of spray for washing the gravel as it passes down the screen is a perforated pipe or pipes. The water from the high-pressure pump is used, and the holes vary from $\frac{1}{4}$ to $\frac{3}{4}$ in. diameter. These holes are so placed as to direct the water where most needed. The spray pipes should have quick-opening valves at their lower ends, so that they may be flushed out when the holes become clogged with roots, grass, and other small particles of matter. Where much clay has to be washed, some of the dredges are using large-sized nozzles, set in groups at each end of the screen. It is thought that the large streams break up the clay in a more satisfactory manner than the greater number of smaller-sized streams furnished by the perforated pipes.

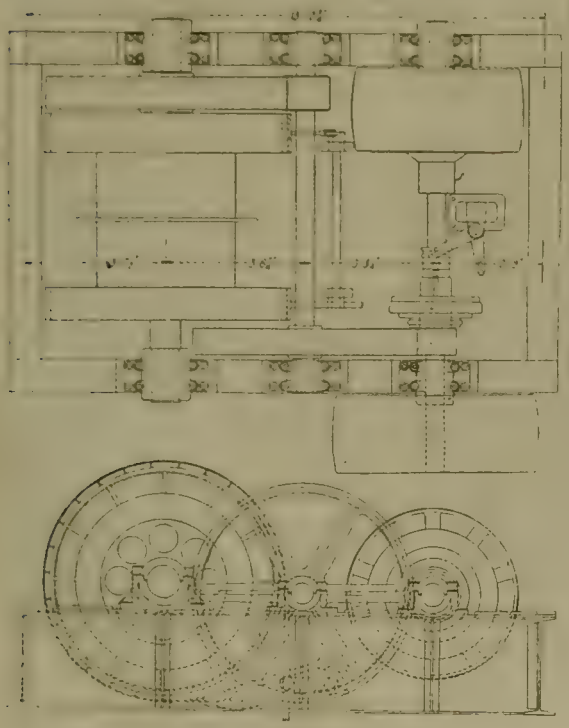
STACKER.—*Ladder.*—The design of a stacker-ladder is a simple matter, since the loads and conditions are fairly constant. The lattice girder is the most common type, and the strains in each member may be readily ascertained by graphic methods. I use a factor of safety of 8 for this ladder. The lower end is supported near the stern of the boat, and should be so designed as to allow the ladder to move up and down and also to allow the ladder to swing from side to side. The upper portion is supported by a bridle near the end and another near the middle. The ends of a wire rope are made fast to these bridles, its middle portion passing over a sheave which is in turn attached to the stacker-ladder hoisting-blocks. Instead of a single loop arrangement I prefer to fasten one end of the rope to the ladder-hoist block, thence passing it around a sheave at the upper bridle, then over another at the ladder-hoist block, fastening the end to the middle bridle. This puts nearly double the supporting power at the upper end and prevents the buckling upward of the ladder when the dredge is surging badly.

Conveyor Drive.—The common method of driving the belt-conveyor is by means of a motor set on supports above the ladder, 15 ft. or so back from its upper end. The motor is belted to a pulley-shaft mounted near the end of the ladder, to which is keyed a pinion with cut teeth which meshes into a cut gear on the conveyor-belt pulley-shaft. I recommend a large-size drive-pulley, covered with rubber belting. In order to make the belt contact greater, an idler is placed near this pulley, which brings the belt up and in

contact with it for a large portion of its circumference. By mounting the motor inside the ladder near the upper end a direct gear drive may be used, but this method has not been found as satisfactory as the belt drive described above. A silent chain drive is now being used a great deal. It allows the motor to be set nearer the drive, and is said to work very well.

Conveyor Belt. Rubber conveyor-belts are used, and should have an extra thickness of rubber on the wearing side. The most important point is to select rubber of the best quality.

Distributor. Below the screen is a hopper or distributor which is used to distribute the screened material to the gold saving tables. Here the ingenuity of the engineer may have full sway. The main object is to get the screened gravel evenly distributed on the gold-saving tables, and the way that it is accomplished makes very little difference. The distributor should be designed so that a certain amount of adjustment will be allowed to meet varying conditions.



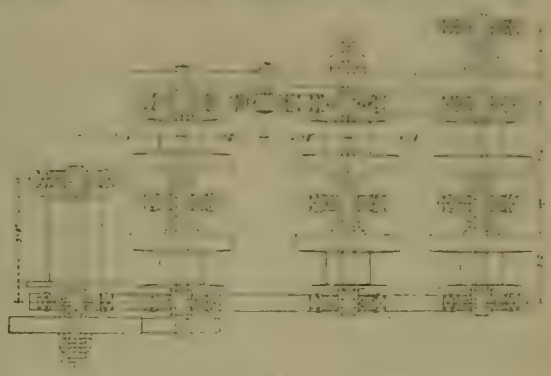
LADDER HOIST, 9-CU. FT. DREDGE.

Where a shaking screen is used, the problem is simpler than for a revolving screen.

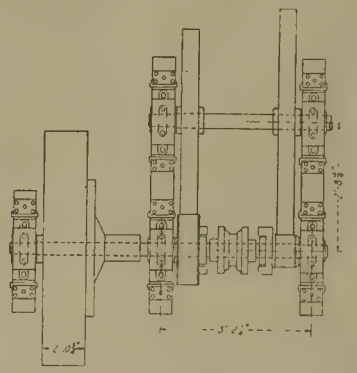
Gold-Saving Tables.—This part of the dredge belongs more to the province of the mining than the mechanical engineer, so it will not be discussed at any length in this paper. Suffice it to say that the gold-saving tables should be specially designed to meet each different set of conditions. They occupy the greater portion of the dredge back of the main gantry and may be built either of plate steel or wood. I prefer steel. The tables are covered with riffles made of angle iron or strips of wood covered with strap-iron. The fine material is discharged either at the stern or some distance aft, according to conditions.

Ladder Hoist.—The ladder hoist is now usually driven by the digging motor from a counter-shaft on the main deck. In a few cases it is driven from the bucket-drive pulley-shaft on the main gantry. Owing to the load it has to carry, it is made very heavy. A structural or cast-steel base is provided, on which are mounted the bearings. Single gearing is used and ordinarily the teeth are not cut. A friction clutch is provided on the pulley-shaft to connect this part of the dredge machinery. From the standpoint of rope efficiency the drums should be made much larger than is common practice, but excessively large drums are not warranted, unless the sheaves through which the same rope passes are made of corresponding dimensions. This entails increased construction cost, but I am inclined to the opinion that it would reduce operating costs sufficiently to warrant some increase in this direction beyond common practice.

The brakes on the ladder hoist must be adequate in capacity and made so that there may be no possible danger of their giving way. If the brakes on the main winch should give way, little damage is likely to occur, but if they fail on the ladder winch, a broken digging-ladder is the probable result, if nothing worse. The following arrangement has been found very satisfactory. Two band-brakes are used, one being operated by hand from the pilot-house, the fixed end of which, instead of being fastened to the deck, is attached to a lever arm, which through a cross-shaft operates the other brake, thus giving almost unlimited power with very little effort. On most ladder hoists the drum-shaft gear is keyed to the drum shaft, and it is nearly always placed very close to the drum. It is a much better plan to design the side of the drum in such a way that the gear rim can be bolted to it, thus doing away with the gear spokes, making a much stronger job and taking all driving strain off the drum shaft.



MAIN WINCH, 9-CU. FT. DREDGE.



MAGNETIC CLUTCH AND DRIVE FOR MAIN WINCH.

Main Winch.—The main winch operates the swinging lines, both bow and stern, raises the spuds, and is usually fitted with one or two head-line drums for wrecking and repair work and to step up with when one spud has been broken. The winch is driven by a variable-speed motor, which, together with the levers actuating the clutches, is operated from the pilot-house. Some form of friction-clutch is commonly used on each drum. I have for some time been using an electro-magnetic clutch on the pulley-shaft of the winch, similar to the one described for the bucket-drive, and jaw clutches for each drum. The jaw clutches are extremely simple and require no attention, whereas a friction-clutch is likely to get out of adjustment. Also, each winchman wants his clutch set differently, and unless great vigilance is exercised they will be constantly adjusting these clutches, which means lost time. The fric-

tion-clutches on each drum are easier to operate, but with a litle practice the jaw clutches give perfect satisfaction. A good many dredges have a separate drum mounted on the after part of the dredge, driven from the counter-shaft of the screen drive and used to raise and lower the stack ladder. The drum is driven by a worm gear of such pitch that it will not run backward from the weight of the ladder. Other dredges have an extra drum mounted with the main winch for this purpose. It is kept from reversing by a pawl and ratchet. Considering the little use this drum gets, its position and design seem to be of very little moment, but a worm-drive and separate drum mounted aft are preferable.

Swinging-Lines.—On deep ground and for the larger dredges, the bow swinging-lines pass from the drum to a sheave, or combination of sheaves, placed near the bow, then to a sheave on the shore, and from there to the lower end of the ladder. By this method of rigging, very little side strain is put on the digging ladder or well hole. The disadvantage of this method is the necessity of a shore sheave and the consequent wear and time lost in moving and handling it. Where the ground is not too deep, a single line, which is simple to operate, but which puts a large side-bending strain on the ladder and well hole, is used. If the ladder and hull are built strong enough, this is not an objection. For the 13 and 16-ft. dredges, a single line would have to be very large and would hardly be advisable.

Brakes.—All winch drums are provided with band brakes operated from the pilot-house. The connection between brakes and clutches and pilot-house are made through bell-cranks, rods, etc. Flexible wire rope running over sheaves is used in several instances for the brakes.

Foundations.—Cast iron, cast steel, structural steel, and wood are used for foundations. I have been using wood in my recent designs on account of its producing less noise and vibration than metal foundations.

(To be Continued)

ASPHALT is being exported from Trinidad in increasing quantities. The output in 1910 was 159,000 tons, but the 1911 statistics will show increased sales. The natural supply of gold seems good for at least a thousand years. Large amounts of both local and foreign capital have been invested in exploring for oil during the past year. Modern machinery and supplies have been imported from the United States and Great Britain to be used in drilling wells and establishing necessary camps for laborers, while expert drillers have been engaged to ascertain the value of the deposits. Some wells have been opened with a large flow for a few hours and then failed to repeat the performance. Drillers have found great difficulty, owing to the liability of the wells to get sanded and choked on reaching a depth of a few hundred feet, where apparently there is a sand stratum of unknown thickness permeated with oil. Although there are large deposits of iron ore in Trinidad and comparatively easy of reach, foreign capital has not been sufficiently interested to develop the mines, and local capital unemployed is not sufficient to warrant exploitation to any great extent.

THE NEW ZEALAND mining amendment act of 1910 provides that in addition to the duty payable on the exportation of gold under the gold duty act of 1908, there shall be payable a duty of 3d. per ounce of weight of gold of the fineness of 20 carats and upward, and in proportion for gold weighing a fractional part of an ounce, or of a lower degree of quality. Under the act of 1908 an export duty of 2s. per ounce troy of gold is levied on gold produced in the North Island only. The act of 1910 is applicable to all gold, whether produced in the North Island or the South Island.

Portland Cement Production in 1911

Complete statistics for the year 1911 were received by the United States Geological Survey during the month of January from about 70% of the portland cement manufacturers in the United States. Based on these returns, an estimate has been made by Ernest F. Burchard of the U. S. Geological Survey for the entire output for the year. It is believed that this estimate is within 2% of the exact quantity of portland cement manufactured in 1911. There was apparently a slight increase in the production of 1911 over that of 1910, amounting to about 1,300,000 bbl., approximately 77,877,236 having been made in 1911, as compared with 76,549,951 in 1910. This represents an increase of only 1.7%, as compared with the increase of 17.7 that occurred in 1910 over the previous year. The figures for 1910 and 1911 are so close that when complete returns are received possibly a slight decrease in production may be shown. The average factory price per barrel, not including packages, was 86.7c. in 1911, as compared with 89.1c. in 1910, a decrease of 2.4c. per barrel, or 2.68 per cent.

An attempt has been made to estimate the shipments of cement by districts for 1910 and 1911, but with regard to such statistics there are fewer data and the figures are not regarded as quite so accurate as those of production. The first year in which inquiries were made by the Survey with regard to stocks on hand was 1911.

States.	Active plants. 1910.	1911.		Production and shipments. 1910. Bbl.	1911. Bbl.	Change, %	Average factory price per barrel. 1910.	1911.
Eastern Pennsylvania and New Jersey (Lehigh district)	24	23	Prod.	26,315,359	25,924,516	— 1.5	$0.729	$0.763
			Ship.	27,033,313	25,634,671	— 5.2		
New York	8	7	Prod.	3,296,350	3,314,217	+ 0.5	0.808	0.841
			Ship.	3,059,539	3,058,463	— 0.04		
Ohio and western Pennsylvania	9	9	Prod.	6,072,987	6,675,249	+ 9.9	0.775	0.770
			Ship.	5,615,662	6,553,895	+ 16.7		
Kentucky and southern Indiana	3	3	Prod.	2,824,832	2,818,820	— 0.2	0.799	0.802
			Ship.	3,016,413	2,738,630	— 9.2		
Michigan and northeastern Indiana	14	12	Prod.	4,524,591	4,570,033	+ 1.0	0.870	0.849
			Ship.	4,508,738	4,436,462	— 1.6		
Illinois and northwestern Indiana	6	6	Prod.	8,376,450	8,617,341	+ 2.9	0.940	0.836
			Ship.	8,151,294	8,537,442	+ 4.7		
Southeastern states (Maryland, Virginia, West Virginia, Tennessee, Georgia, and Alabama)	8	10	Prod.	3,071,009	4,005,001	+ 30.4	0.793	0.810
			Ship.	2,800,563	3,723,183	+ 32.9		
Iowa and Missouri	6	7	Prod.	5,722,971	6,060,261	+ 5.9	0.916	0.911
			Ship.	5,261,160	6,008,503	+ 14.2		
Great Plains states (Kansas, Oklahoma, and central Texas)	16	16	Prod.	7,723,253	6,904,468	— 10.6	0.996	0.871
			Ship.	7,087,296	6,743,060	— 4.8		
Mountain states (Colorado, Utah, Montana, Arizona, and western Texas	8	7	Prod.	2,236,531	2,111,930	— 5.3	1.288	1.156
			Ship.	2,065,393	1,974,476	— 4.4		
Pacific Coast (California and Washington)	9	11	Prod.	6,385,588	6,869,400	+ 7.6	1.354	1.407
			Ship.	5,941,340	6,523,106	+ 9.8		
Totals	111	111	Prod.	76,549,951	77,877,236	+ 1.7	0.891	0.867
			Ship.	74,540,711	75,931,891	+ 1.9		

Treatment of Matte From Mill Clean-Up

By M. W. von Bernewitz

Matte is a by-product from the smelting of gold precipitate from cyanide plants, and the subsequent refining of the bullion by sulphur. Its formation cannot be prevented; it carries high gold content, is difficult to treat, and is generally a nuisance.

There are many methods of treating matte; among others being the roasting and smelting, acid treatment, and the cyanide reduction. On the whole, results have not been too satisfactory. I recently made an attack on an accumulation of matte at the Associated Northern Blocks. This material was produced from the cyanide bullion by refining with sulphur. It is high in Cu, and contains Fe, Zn, and Pb. It is melted in a No. 50 crucible, and lumps of sulphur are kept under the surface by means of a small inverted clay pot held by tongs. The contents are poured into a conical mold, the matte broken off the bullion as clean as possible, and the latter finally remelted. It may be mentioned here that the matte sticks to the bullion, and has almost to be chopped off.

In reducing the matte, I used the cyanide method, as described by A. E. Drucker, in the *Mining and Scientific Press* of May 18, 1907. Briefly, this consists of crushing the ingredients to pass a 4 by 4 screen, and putting layers of borax, matte, and cyanide in a No. 60 crucible, and so on until the parcel is through. The matte and cyanide was crushed by pestle and mortar. Some 50% by weight of cyanide and borax was used, less flux and reducer give low results.

The crucible when hot, was charged with layers of each material. This did not take long to run down, and a thick scum or dross filled the pot. This was skimmed off by means of a half-round skimmer, about 6 by 2 in. at the widest part. More matte and flux was added during a three days' campaign of some 6 hours each. During the melting, a good deal of fume was given off, and it was necessary to be careful. At the end of each melt the crucible was poured into a conical mold, and a most noticeable point was that some unreduced matte did not stick to the bullion at all, this being due to the cyanide flux. I would therefore recommend the addition of a little cyanide before pouring any melt that contained matte, preferably mixing it a trifle. Following are some details of the treatment:

	Pounds.
Weight of matte	145
Weight of cyanide used	72
Weight of borax used	72
	144
Bullion recovered	30.5
	Au per ton, ounces.
The first matte assayed	4640
The second matte assayed	500
The slag, dross, or residue	54

This shows a high concentration and extraction. The second matte and dross was bulky and difficult to treat; it was therefore fed into the ball-mills during the next two days, and treated along with sulphide ore. The gold in this stuff must be in an extremely fine state, as it could not be detected in any samples. There was only about 40 lb. of the second matte. Sulphur did not act readily on the final bullion from the matte, so it was poured and assayed. The fineness was 540 in gold and 220 in silver, base being 240. The cost of the above treatment was as under:

	£	s.	d.		
Wages	2	0	0	=	$9.70
Fuel	1	0	0	=	4.85
Cyanide	3	2	6	=	15.15
Borax	1	11	0	=	7.49
Sundry	0	6	6	=	1.56
	8	0	0	=	$38.75

Not wishing to make more rich matte by further sulphur refining, and not liking to use nitre, we decided to try bessemerizing the bullion. A temporary pipe-line from the air-compressor to the furnace was made out of ¾ in. pipe and ½ in. rubber hose. It was necessary to take the air from this point, as it was warm, averaging 91 F. at the furnace. For conducting the air into the molten bullion, we used the long clay 'Churchwarden' pipe-stem, the rubber hose being bound on with asbestos twine. The stems were gently heated, and lowered into the bullion after air at 90 lb. pressure was turned on. It takes very little air indeed to keep 400 oz. of bullion well agitated. A little borax flux was used, and this picked up the base as it rose to the surface. Fairly dense zinc fume went off for some time; the air did not in any way cool the bullion; but quite the reverse, the whole mass seemed to be very hot and active. After an hour's air treatment the pipe stems got too short to be easily handled, so the bullion was skimmed with sand, and poured. The final bar was 590 fine in gold, 210 in silver, and 200 in base, showing that, with a prolonged bessemerizing of, say, 3 hours, with decent apparatus, bullion 900 or more fine could be produced. So, along with the matte treatment described, I would recommend bessemerizing low-grade bullion, as it is a cheap and easily worked method. Although not really conclusive, the bessemerizing shows that the bullion can be refined in this way, as described by Rose. Further experiments with proper apparatus will be tried.

The Tin Market

According to Vogelstein & Co., Straights shipments for the first half of February are cabled as having been 3060 tons, and for the entire month are estimated at 4700 tons. As this is not a Banca sale month, the total supplies will approximate only about 5700 tons, including 'standard' tin in the United States, but not elsewhere. Statistics will hereafter be made inclusive of 'standard' tin (99% or better), and it will be necessary to bear this in mind in making comparisons with previous months or years, just as it is necessary to bear in mind that the London Metal Exhange quotations are now for standard tin and not Straits or Australian as heretofore. The quantity of tin available for trading on the London Metal Exchange is increased by the new contract, but the quantity of tin available to consumers of the metal is not affected by the change. Granting supplies as above mentioned, and assuming usual deliveries, the visible supply will decrease by the end of February somewhere between 2000 and 3000 tons. March is a Banca sale month, but the outlook being for continued good deliveries and small supplies, statistics will probably break even in that month, just as they did in January, while in April there will be a further large shrinkage in the visible. In 1911 and 1910 stocks decreased, end of January to end of April, 4000 to 5000 tons, respectively. Should a like decrease occur this year—and there is every prospect of it—stocks at the end of April will be the lowest since 1907. Cargoes afloat will be required for consumption as fast as available, and in addition stocks must be drawn on as above indicated. The heavy syndicate sales in January consisted wholly of contracts. The stock is still entirely in their hands. Under these circumstances lower prices can scarcely be expected.

Southern Rhodesian ores do not, as a whole, provide such metallurgical plain sailing as do the auriferous conglomerates of the Witwatersrand. A company has recently been formed which is called the Rhodesian Refractory Minerals Process, Ltd. The company expects to have completed, at an early date, an experimental plant for the treatment of all grades of ore. A plant is now being erected by the company, adjacent to the New Found Out Mine Gadzema. This plant, besides having the necessary machinery for the Martin process for refractory ores, is equipped with a complete concentrating unit consisting of Buss coarse and fine concentrators, Luhrig vanner, and convex slime-table.

New York Meeting, American Institute of Mining Engineers

By Our Special Correspondent

The 102nd annual and business meeting of the American Institute of Mining Engineers was begun on the evening of February 18, 1912, by the calling to order of the assemblage in the hall of the Institute, 29 West Thirty-ninth street, New York, by Benjamin B. Lawrence, chairman of the executive committee of the New York section of the Institute. After a few amusing and cordial welcoming remarks, Mr. Lawrence introduced the president of the Institute, Charles Kirchhoff. Mr. Kirchhoff reviewed the work of the Institute during the past year, and referred in his characteristic, tactful, and graceful manner to the difficulties with which the management had to contend, and its hopes and aspirations for the future in broadening the work of the organization. In this connection it is but proper to pay tribute to the unselfish devotion of Mr. Kirchhoff to the interests of the Institute during the past year. No president within my recollection ever strove harder and more unselfishly for its welfare. All honor to Mr. Kirchhoff for his devoted and ceaseless efforts in behalf of this organization. Mr. Kirchhoff ended his remarks by introducing James F. Kemp, the expected president-elect. Mr. Kemp entertained the audience by a delightful account of his amusing and fanciful experiences while on a prospecting trip in British Columbia, and followed, as an encore, with an amusing description of how ore veins are formed in Mexico and of their subsequent development by American capital. The meeting then adjourned to the ninth or office floor of the building, where an informal smoker and what the English call a 'conversazione' followed. Punch, lemonade, and cigars were served. On the whole, the evening was a delightful one, for there was a turning out of old members such as has not occurred at business meetings within the past fifteen or twenty years.

The business session of the Institute was called to order the following morning, February 20, at 10:15 o'clock, with Dr. James Douglas, vice-president of the Board of Directors, in the chair. After the reading of the minutes of the previous meeting, the regular order of business was changed. The chairman announced that, inasmuch as it was intended that a committee should be appointed to investigate the affairs of the Institute, he would call upon J. Parke Channing to introduce the motion. Mr. Channing thereupon offered the following resolution:

"*Resolved* that Messrs. James F. Kemp, Christopher R. Corning, George C. Stone, W. H. Nichols, Jr., and A. R. Ledoux be and are hereby appointed a committee of five to investigate all of the affairs and the operations of the Institute, to see whether an increase in dues cannot be avoided, and to report to the Board of Directors by May 1, 1912, making such suggestions as they may deem best for the welfare of the Institute, and that said Board of Directors shall cause such report to be printed and distributed at once by mail to each member, so that it may be considered and acted on at an adjournment of this meeting to be reconvened June 3, 1912.

"*Resolved* also, that this committee be directed and empowered to engage, at the expense of the Institute, independent clerical and auditing assistants."

As there was no opposition to the resolution, it was unanimously adopted. The matter had previously been thoroughly discussed and the program prepared by the signatories to the circular of February 3, 1912; in fact, it appeared that the investigation was welcomed by all, especially as Mr. Channing's motion provided that any action on the proposed amendments to the constitution be postponed pending the report of this committee.

The election of directors followed. F. Lynwood Garrison nominated for the three vacancies on the Board of Directors, Messrs. Edmund B. Kirby, George C. Stone, and Charles F. Rand. This nomination was seconded by F. F. Sharpless. E. G. Spilsbury then renominated the retiring directors, Messrs. Theodore Dwight, Arthur L. Walker, and Joseph Struthers. The nominations being seconded, a contest was on. Tellers were appointed by the chair, and after the lapse of sufficient time to count the votes and proxies, the following result was announced: Kirby, 1057; Stone, 926; Rand, 926; Dwight, 340; Walker, 336; Struthers, 328. Messrs. Kirby, Stone, and Rand were therefore declared elected.

Following this election came the balloting for officers and members of Council, according to the ticket previously mailed to members. During the interim between these two elections, the chair had been taken by A. R. Ledoux. Various motions to have the secretary cast the ballot and avoid the appointment of tellers, etc., were made, but objections to this procedure were offered, and a regular election insisted upon. The tellers reported the following results: President, James F. Kemp, 1262; vice-president, Benjamin B. Thayer, 1263, Karl Eilers, 1263, Waldemar Lindgren, 1263; members of Council, Jos. W. Richards, 1263, John H. Janeway, Jr., 1263, Sidney J. Jennings, 1263; secretary, Joseph Struthers, 377.

It should be explained that the signatories of the circular issued February 3, 1912, held about 900 proxies, and voted them for all the candidates save Mr. Struthers. This was done for the reason that many, if not most, of these proxies were sent to the signatories with the understanding that they should not be voted for him. It is to be regretted that this invidious distinction had to be made, but those having possession of the proxies had no option in the matter. They either could not vote them at all for any of the candidates, or could vote them in the way they did. Not to have voted them for Mr. Kemp and his associates would have been contrary to the wishes of those giving the proxies. In view of this vote, it is impossible not to feel that Mr. Struthers is the victim of circumstances and a bad system inherited by him. The office he fills is a difficult one at any time, and especially during the critical reconstruction now at hand. The relation of the secretary to the membership has in the past been obscured, and the fact that the Institute belongs to its members, and the secretary is the servant of the organization, has never been clearly observed.

With the announcement of this vote it was evident that a new *régime* had come into the management of the Institute. The Board of Directors is the all-powerful body in the peculiar make-up of the Institute's management. It has been the custom for years, at the annual meeting, which was usually attended by a mere handful, to renominate and elect the retiring directors and thus perpetuate the old Board year after year. Obviously this was an objectionable practice. Now new blood comes into the Board, as well as into the Council. While at this meeting there was some suppressed feeling, it fortunately did not manifest itself in any unpleasant incidents. After the election was over, expressions of satisfaction were heard from all sides, from the defeated as well as the successful, and all seemed anxious that the Institute should prosper and continue its career of usefulness.

A luncheon followed the morning session, which was attended by many of the old members, thus affording opportunities for renewing old acquaintances and making new friends. A notable feature of all the sessions of this meeting was the absence of guests and ladies; in fact, it was a serious affair, and those people who belong to the Institute merely for 'a good time' had no interest in the gatherings. It is hoped that in the future there will be more such meetings.

The afternoon session on Tuesday was devoted to the reading and discussion of a number of interesting papers. And the discussions were not the least valuable and important part of the proceedings. Reading papers 'by title' is evidently, and it is hoped for all time, a thing of the past in the Institute. A man who takes the trouble to write a paper should be given an opportunity to read it and his friends to discuss it. This was one of the original objects of the founders of the Institute, but, like many

other of its primary functions, had fallen into desuetude. Among these papers were the following: 'The Sintering of Fine Ore,' by B. G. Klugh; 'Agglomeration of Fine Materials,' by W. S. Landis; 'The Grondal Briquetting Process,' by N. V. Haskell; 'Sintering and Briquetting of Flue Dust,' by Felix A. Vogel; 'The Shumacher Briquetting Process,' by Joseph W. Richards.

The banquet of the Institute was held in that gilded hostelry for the *nouveau riche* known as the Hotel Plaza, on the evening of the same day. It was 7:30 before the members—some hundred odd, with a score of ladies—sat down to the small round tables in the 'Palm Room.' The dinner was poor, but could the expensive decorations and indifferent music have been turned into food, one might have ended with a square meal. As it was, the diners got little for their five dollars each.

Mr. Kirchhoff admirably presided as toastmaster; his tactfulness and graceful remarks were characteristic of the man, a delight to his friends, and were appreciated by all. Some of the other speeches were extremely tiresome. One of the appropriate after-dinner speeches of the evening was an amusing recitation by A. M. Hay, of Toronto. He made everybody laugh, which was refreshing, and a relief to the dull monotony of this dreary affair. The meeting of Wednesday, February 21, was devoted to the discussion of papers; in other words, was a technical session.

On the whole, it is probable the future historian of the Institute will record that the business meeting held in New York on February 20, 1912, was one of the most, if not the most important event, in the history of the organization since its foundation. For truly the very existence of the Institute as a technical or semi-technical organization trembled in the balance. Those in charge of its management could not or would not see wherein and how it could be improved and developed from an invertebrate to an organization having character and vitality, as well as backbone and stability. Had this been realized years ago, there would have been no need for a Mining Congress, a Mining & Metallurgical Society, and the number of smaller mining and allied organizations which have sprung up throughout the country within recent years. The Institute could have done all this work; the men who have vitalized and made the little Mining & Metallurgical Society a thing of importance and of weight as a national organization would have been only too glad to lend their brains and strength to the work of the Institute, developing its character, broadening its scope of work, and making it a national organization in fact as well as in name. The American Institute of Mining Engineers should claim and have the interest and sympathy of every earnest and honest man connected with the mining industry. There is no need or call to change its name, for with all its faults, which were chiefly those of omission, it has done nothing to dishonor that which it has proudly borne for forty-one years. The essential thing to remember is that its strength will be governed by the character of membership, and above all, that it, as an organization, belongs to all its members and not to any few who happen to be elected its officers.

An extensive deposit of naturally concentrated monazite sand has been discovered near Quilon, Travancore, India. This sand contains 4% of thoria, and consists of from 46 to 50% of monazite, with ilmenite and zircon as the other chief constituents, together with some rutile and traces of spinel, garnet, quartz, and hornblende. A specimen of pure monazite separated from the sand contained 8.5% thoria. The monazite can be concentrated by an electro-magnet. A specially prepared concentrate contained 8.87% thoria, and pure monazite separated from this contained 10.08% thoria. The commercial concentrate contains 5 to 6% thoria, as compared with less than 4% in the Brazilian sand, and the pure monazite from the Travancore deposit is richer than that from the Brazilian and Carolina deposits, resembling the monazite from Ceylon. Monazite is chiefly used as a source of the rare metal oxides which are so extensively used at present in the manufacture of mantles for incandescent burners.

Goldfield Consolidated Report

During the month of January the total production of the Goldfield Consolidated Mines Co., according to the report of J. F. Thorn, general superintendent, was 28,870 tons, containing $733,344, or an average of $25.40 per ton, the whole being milled with an average extraction of $24.14 per ton, or 95.02%. The total net realization was $471,140, or $16.32 per ton.

During the month 3302 ft. of development work was performed. The total cost of mining, development, milling, office and general expense was $7.92 per ton, distributed as follows:

Mining:		
Development	$1.00	
Stoping	3.14	
		$4.14
Transportation		0.07
Milling		1.98
Marketing		0.50
General expenses		0.50
Bullion tax		0.21
Construction		0.52
Total cost of operation		$7.92
Miscellaneous earnings		0.10
Net cost per ton		$7.82

The 413-sill of the Clermont was again extended, and produced 722 tons of ore averaging $24.18. The new 428-sill, now being cut from the 466-ft. intermediate between the 600 and 750-ft. levels, produced 500 tons of ore averaging $41.34. The 604-11 raise from the 1000-ft. level, going up toward the 534 on the south end of the 900-ft. level, produced 381 tons of ore averaging $72.06.

The 3-E sill in the Mohawk, on the 150-ft. level, near the old Sheets-Ish workings, was again extended, and produced 503 tons of ore averaging $56.43. The sill in the 111-K was extended and produced 571 tons of ore averaging $57.46. The 111-M sill produced 218 tons of ore averaging $18.19. The 415-X cross-cut from the 491-ft. intermediate, between the 450 and 600-ft. levels, produced 174 tons of ore averaging $38.44. The 305-DX stope in the Red Top was extended above the second level, and the resulting sill produced 70 tons of ore averaging $22.73. The 403-CX stope on the fourth level, at the 442-ft. cross-cut, produced 70 tons of ore averaging $22.53. The 403 sill was extended and produced 18 tons of $28.52 ore. The third level has been connected with the Laguna shaft, and station and pocket completed at this point, and during the present month the Red Top surface plant will be dismantled. In the Combination, the 295-X on the fourth level, south and west of the Hampton stope, produced 45 tons of ore averaging $41.34. The roasting plant has been completed, and both furnaces are now in successful operation. The results from the new plant have fully justified all expectations.

Mexican Mineral Production

According to the statistics of the Department of Finance, Mexico produced in the fiscal year 1910-11 gold to the value of ₱49,615,289.25, and silver to the value of ₱80,913,799.32. This was an increase of over ₱1,000,000 in gold, and more than ₱4,000,000 in silver, compared with the preceding fiscal year. The statistics are based on exportation, gold and silver coin being eliminated. Any gold and silver bullion that was being held in the republic probably was exported during the year under review, due to disturbed conditions. The production of copper is placed at ₱26,300,228; lead, ₱6,539,098, and zinc, ₱899,925. Compared with the fiscal year 1909-10, there was a slight increase in the production of copper, and decrease in the production of lead and zinc. This is a good record, considering the disturbed political conditions.

The Reno Co-operative Potash Laboratory

There has been established at the Mackay School of Mines, Reno, Nevada, a laboratory for the examination of natural material suspected of containing potash. It is under a co-operative agreement between the Mackay School of Mines, the Bureau of Soils of the United States Department of Agriculture, and the United States Geological Survey. It is in charge of George J. Young, of the Mackay School of Mines, with A. R. Merz, of the Bureau of Soils, as chemist. Facilities have been provided for the examination and assay of potash-bearing materials, and of saline waters and minerals. It will be possible, also, to examine a limited number of samples for contained nitrates. Samples of suspected potash or nitrate bearing materials will be examined free of charge for prospectors and others, so far as limitations of time and equipment of the laboratory will permit, but all samples must be accompanied by: (1) the name and post-office address of the owner, locator, or discoverer of the deposit; (2) the exact place from which the sample was obtained; (3) a description of the material and its surroundings, and of the manner of taking the sample.

This information, or any part of it, will be kept confidential if so requested. However, it should be noted that the laboratory does not agree to make complete analyses or to make quantitative assays, except as rendered desirable by the result of qualitative tests.

Potash occurs in nature in two classes of compounds, those soluble in water and those insoluble. Insoluble compounds, such as alunite, leucite, certain feldspars, and various other minerals, may prove of value as a source of potash, but as yet no process has been developed for the successful commercial extraction of potash from these materials, excepting possibly in the case of alunite, which is used in Italy as a source of potash alum. The co-operative laboratory does not agree to examine such insoluble materials. The soluble potash compounds, which are the only ones of present commercial value, include potassium nitrate or nitre, potassium sulphate, potassium chloride, and various double salts of potassium with other elements, notably kainite, a compound of potassium chloride and magnesium sulphate; and 'manure salts,' a variable mixture of chlorides and sulphates of potassium, sodium, magnesium., etc., containing from 15 to 40% of potash. The supply of all these materials is now obtained from Germany, excepting potassium nitrate, which comes mainly from India, and the present prices on the Atlantic seaboard are approximately as follows, all being expressed in dollars per ton of 2000 lb.: potassium nitrate or nitre, about $65; potassium sulphate, about $45; potassium chloride, about $35; kainite, about $8; manure salts, about $13.

The value of any natural material containing soluble potash salts will depend upon the percentage of potash and upon the other materials, especially the other soluble salts which are present and from which the potash must be separated. Materials which do not contain too large proportions of these other salts, and in which the potash occurs as salts other than nitrate, will be worth from 50c. to $1 per unit of potash per ton. Similar materials containing potassium nitrate will be worth 75 to 100% more. The decision as to whether any particular material can be profitably worked will depend upon so many special and local conditions that no general statement can be made.

Among the possible places of occurrence of soluble potash salts within the United States are the inclosed basins of the Western deserts. Ordinary surface waters usually carry small quantities of potash, and, since these basins have no outlet to the sea, any potash salts which have been carried into them by streams must still be there. It is conceivable that in some of these basins workable deposits of soluble potash salts may have accumulated either on the present surface or in the beds which underlie it. The latter possibility is being tested in one of the basins by the well now being drilled by the United States Geological Survey near Fallon, Nevada, as described by H. S. Gale in Bulletin 530-A of the Geological Survey. In addition to this, the surface conditions in other basins are being examined by agents of the Bureau of Soils and the Geological Survey, and the indications for or against the occurrence of potash are being studied. A preliminary report of the fertilizer resources of the United States containing a discussion of available surveys of potash salts will be found in Document No. 190, United States Senate, Sixty-Second Congress, second session. If potash occurs on the surface of any of these undrained basins it is doubtless associated with the saline materials of various kinds usually found on and underneath the central sink or *playa*. Its presence therein will probably be detectable by examination of the salts of this *playa* or of saline springs in and about it. Such springs may also furnish information as to possible potash deposits in the deeply buried beds.

The identification of potash in the field is by no means easy, since the other salts with which it is associated usually mask its peculiarities. The best general field test is conducted as follows: A fragment of the suspected material is moistened with potash-free water, placed on a platinum wire or strip, and inserted in the flame of an alcohol lamp or other lamp the flame of which is colorless, the flame being at the same time observed through a piece of blue glass of a special kind, known as cobalt glass. If any considerable quantity of potash is present it will give to the flame thus viewed a peculiar violet color, which is quite characteristic and easily recognized after once being seen. The platinum wire, alcohol lamp, and cobalt glass employed in this test can be secured from any dealer in chemical supplies. By the use of the spectroscope the delicacy and accuracy of this test can be somewhat increased, but the spectroscope is both expensive and difficult to operate, and it cannot be recommended to persons inexperienced in its use. Potash salts of high purity can be recognized by taste, but those occurring in nature are usually so impure that the taste ceases to be characteristic. Interested prospectors are advised to procure the materials for the flame test and become proficient in its use, and to retain for chemical analysis any samples which give the potash color.

The Rise in Silver

The recent quotation of 59 3/8c. per ounce for silver represents approximately 5c. rise since the first of the year. This advance means much to the silver-producing properties, as each 1c. per ounce over and above the cost of production represents additional income. Thompson, Towle & Co. gives the following list of the largest silver producers in the United States, Canada, and Mexico, with their annual production in ounces, and the increased yearly income which these companies should make, due to this 5c. rise in the metal.

Property.	Annual Prod. (Ounces.)	Increased Income Annually.
Anaconda	10,000,000	$500,000
United States S. & R. Co.	10,000,000	500,000
American S. & R. Co.	7,000,000	350,000
Nipissing	5,500,000	275,000
Tonopah Mining	4,700,000	235,000
Tonopah Belmont	4,000,000	200,000
La Rose	3,700,000	185,000
Wettlaufer	925,000	46,000

A PAIR of 300-hp. gas-engines to be served by a wood-burning producer have been built in England for shipment to Brazil, where the plant is to be installed in a cotton-mill extension. Two single-cylinder, double-acting, two-cycle engines drive on a countershaft so arranged that the stoppage of one engine need not interfere with the working of the other set. About 300 hp. is taken from the countershaft by the shafting of the mill extension and the other 300 hp. by an electric alternator which supplies current for the motor-driven machinery of the dye house. The wood-burning plant is adapted for ready conversion to coal consumption.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Making Mine Ladders

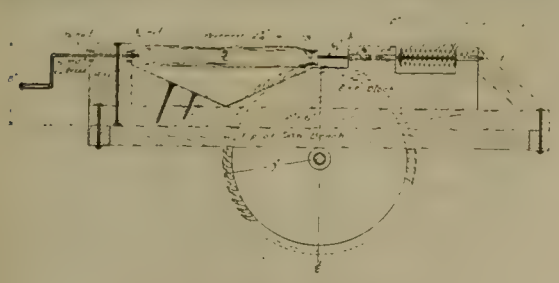
The Editor:

Sir—Some time since it was necessary to equip our 2000-ft. shaft at Nueva Luz with ladders, and for a shaft of this depth it was important to design a ladder of long life, easily constructed, lending itself to prompt repair, and with all risky elements eliminated.

The spacing of the plats being 15-ft. centres, it was decided to make all ladders of a uniform length of 18 ft., constructed of clear lumber of 2 by 4-in. sides, each ladder having 17 rungs, which involved the purchase or manufacture of 2200 rungs.

A native wood known as *pala dulce* (a species of hickory) is renowned for its strength and longevity, especially in wet places, and the employment of this was decided upon, but the question of having these turned true, straight, and uniform, without a lathe, next arose. However, having a circular saw, and 'necessity being the mother of invention,' by the ingenuity and resourcefulness of our master mechanic and superintendent, J. M. Lovret, a simple attachment was evolved for the saw bench, with which it has been possible to shape rungs of excellent form, true

MAKING LADDER RUNGS.



DETAILS OF SAW ATTACHMENT.

to a centre line at each end, with a slightly increasing shoulder which gives the desired rigidity when the bolts are tightened. The pipe spreaders are useful in preventing the application of too great a pressure, which might cause splitting of the sides.

The sides are bored, two at a time, in an ordinary horizontal boring machine, equipped with a 1¼-in. wood bit, driven by the same motor that runs the saw. It takes an average of four minutes to bore the seventeen pairs of holes. One man can easily turn out ten finished ladders, including dipping in carbolineum, to which treatment all timber is subjected before being sent into the mine, in a day of ten hours. The illustration shows a rung just finished, by a native boy who prepares 320 rungs easily in a ten hour day. The details of the attachment are shown in the drawings, and while the apparatus may be worthy of patent, I prefer to offer it for what it is worth to other brothers in the profession who may want to get themselves and men out of a hole, in more ways than one.

H. VINCENT WALLACE.

Nueva Luz, Guanajuato, February 8.

Is 'Cheap' Labor Economical?

The Editor:

Sir—I have read with interest your recent articles on China and Chinese labor, and the following table, based on my experience out here in various places, may interest your readers somewhat. The rate of pay is in gold dollars (or cents) per day, and the efficiency is figured on the basis of an American miner taken as 100 per cent.

	Efficiency, %.	Rate of pay.
Russians	100	75c. to $1
Koreans	90	20 to 30c.
Northern Chinese	70	10 to 20c.
Southern Chinese	60	10 to 20c.
Japanese	60	40 to 80c.
Javanese	40	12 to 30c.
Filipinos	40	50 to 75c.

These figures are based on trained men in their own countries under average conditions.

In the Federated Malay States the southern Chinese working for whites get from 25 to 40c. (gold) per day, and in Sumatra the southern Chinese get the same as the Javanese. Much depends on the personality of the white foreman, in any case; and the advantage of the white laborer is that he uses his head, while, with the exception of the Korean, the others do not, except in some cases when they are contracting. This applies to underground work. There are good men among all of them, and if you have the time and patience, a good crew can be beaten out of most any material, but it is certainly wearing on the nerves of the white man, and not many of them can do it successfully. A good, sober, husky bunch of Russians can do as much as any other kind if they are well handled, but the same lot with indifferent handling can do as little as possible just as well. It all comes down to the personal equation and the methods employed. The Filipino is the worst I have yet found, but if you take enough trouble and have enough material to work with, a fairly good crew can be had. But for the prevailing wages they are the most expensive of any Asiatic labor I have seen.

F. L. COLE.

Manila, January 12.

Survey Reports and 'Boosters'

The Editor:

Sir—The conclusions expressed in certain reports of the U. S. Geological Survey dealing with mining districts in Colorado have been so often misquoted or misconstrued in the daily press as to call for some general protest, which may best be made by reference to two recent examples.

In a review of mining published in a Denver paper of recent date, in reference to Lindgren's work at Cripple Creek (Professional Paper No. 54, U. S. Geol. Surv.) it is stated that:

"While the people of Cripple Creek, or some of them, questioned the accuracy of his report on that district, wherein it was in substance intimated that the endurance of rich shoots to points far below 1200 to 1500 ft. was quite doubtful, no hard feeling resulted."

The foregoing words, with some other phrases not quoted, give the impression that the Federal geologists (Messrs.

Waldemar Lindgren and F. L. Ransome, who, it should be noted, were joint authors of the report and equally responsible for its conclusions, although only Mr. Lindgren is mentioned in the article) discouraged development below 1200 to 1500 ft., and that their opinion has since been proved erroneous. The following paragraphs from the Cripple Creek report (pages 231-232), if read with care at all commensurate with the attention bestowed by the authors on their phrasing, will, we believe, show that the implications put upon them in the article cited are unwarranted.

"As has been pointed out in the preceding pages, the largest known orebodies of the district are apparently confined within a zone which extends from the surface to a depth of 1000 ft. In general, explorations below that depth have been much less satisfactory as regards quantity of ore than exploration above. It is certainly true that some large orebodies as yet show no signs of depletion in depth, and that some good pay-shoots have been found at a depth of 1400 to 1500 ft. On the other hand, the number of ore-shoots that have been exhausted with increase in depth is considerable.

"It is probable that the orebodies, known or unknown, occurring below the 1000-ft. zone are neither so large nor so abundant as those nearer the surface. The discovery and exploitation of these deeper orebodies is, moreover, beset with increasing difficulties, chief among which is the problem of dealing with the underground water. For these reasons it is unlikely that the zone between the 1000-ft. and 2000-ft. levels will yield as much as the zone between the surface and the 1000-ft. level, but it is probable that some strong fissures may carry payable ore to far greater depths than those yet attained.

"As regards the zone above the 1000 or 1500-ft. levels, it is well to bear in mind that it still contains much ore, both as parts of known ore-shoots and as yet undiscovered orebodies. It is certain that many of these undeveloped orebodies will be mined in the near future and that this zone will contribute the most important part of the production.

"It is probable that the production of the district, while exhibiting fluctuations, will, on the whole, slowly decline. New orebodies will undoubtedly be discovered from time to time, and individual mines may be as profitable in the future as they have been in the past, or even more so. An increased output may be expected to follow each successful step in deep drainage. But existing conditions indicate that if the maximum production of $18,000,000, in 1900, is to be surpassed, the increase will be due to the orebodies found in the upper zone."

We maintain that our well-considered statements made in 1906 are correct and are in accord with such facts as have been brought to light by subsequent mining developments.

Similarly, in another Denver paper with reference to the Breckenridge report (Professional Paper No. 75), Ransome is credited with the statement (given as a quotation) that "probably nowhere in the Breckenridge district does profitable lead ore extend below a zone 300 ft. below the surface", and reference also is made to "the Ransome barrier, beyond which barrenness was predicted." Neither the sentence quoted nor the prediction referred to is to be found in the report. The actual expressions in that publication that appear to have suggested them to the press correspondent are as follows: In the outline prefixed to the report appears the statement that "Lead ores of shipping grade probably nowhere in the district extend to a depth of much more than 300 feet." In the body of the report it is said of the Lucky, Minnie, Ella, and Cincinnati mines that "all had some galena or cerussite ore of shipping grade near the surface, but at various depths, not accurately ascertainable, though probably nowhere exceeding 300 ft., this ore gave place to more pyritic material." On the following page appears this paragraph:

"Doubtless if complete records were obtainable of all the idle or abandoned mines, they would largely be a repetition of the same story—partly oxidized lead ores near the surface and sphaleritic or pyritic ores below. Even the imperfect data now available establish without much question the limitation of the lead ores to a zone ranging from 200 to 300 ft. deep and corresponding roughly to the present strongly accidented topography. There may, of course, be exceptions to this apparent rule; the underground workings are not extensive enough to afford a basis for sweeping assertion. The statement made, moreover, is far from implying that there is no galena below a depth of 300 ft.; but all available evidence indicates that in this district 300 ft., or perhaps more safely 400 ft., is the limiting depth for the occurrence of considerable bodies of essentially galena ore as opposed to sphaleritic or pyritic ores."

This article also credits Ransome with an alleged erroneous statement regarding a fault in the Dunkin vein, whereas there is no reference whatever to this fault in the report.

There appears to be a perhaps unconscious tendency on the part of writers for the daily press to seize upon any generalization in an official report that may be at all unfavorable to a mining district, to exaggerate this and to disregard those careful qualifying statements that are an essential part of the conclusions reached by the geologist. The plain duty of the latter is to base his results squarely and honestly on the evidence obtainable at the time when he does his work, and to state these clearly and impartially. It is equally incumbent upon those who criticize these results to verify impressions and hearsay by direct reference to the original publication and to quote with fairness and fidelity.

F. L. Ransome,
W. Lindgren.

Washington, D. C., February 13.

Mineral Production of California

By W. H. Storms

The State Mining Bureau is rapidly compiling the statistics of mineral production of the state for 1911, and the following figures on some of the minerals produced have been prepared by E. S. Boalich, statistician for the Bureau.

Advance report of mineral production in California in 1911. Amount and value of crude product at the mine, as reported by the producer. Subject to a possible increase in the final bulletin for 1911.

Barytes—	Tons.	Value.
1911	309	$2,207
1910	860	5,640

This represents the output from Mariposa and San Bernardino counties. Never produced in the state previous to 1910. The outlook is for an increased and regular production, as the general use of ground barytes in the manufacture of mixed paints, white enamels, and asbestos cement is gradually increasing.

Feldspar—	Tons.	Value.
1911	740	$4,560
1910	760	5,720

Output from Monterey and Tulare counties. This is also a new industry, the first product being sold in 1909. Most of the feldspar is used for the manufacture of pottery.

Graphite.—The total graphite production of California amounts to only 106 tons, marketed in 1901 and 1902. Deposits of the mineral are known, and the owners of a graphite mine in Sonoma county are preparing to resume work in 1912.

Infusorial earth—	Tons.	Value.
1911	2,194	$19,670
1910	1,843	17,617

This is from Monterey and Santa Barbara counties and is about an average annual production. The demand for infusorial earth is not strong, or other properties would be worked.

Iron—	Tons.	Value.
1911	558	$558
1910	579	900

Special Correspondence

TORONTO, CANADA

DECLINE IN PORCUPINE SHARES.—POWER IN PEARL LAKE DISTRICT.—MINES MAKE GOOD PROGRESS.—SETTLEMENT OF NORTH DOME CONTROVERSY.—SALE OF GREEN-MEEHAN.

For some time there has been a continuous depreciation in Porcupine stocks, with occasional short-lived rallies, but on the whole a steady downward tendency and little market activity. The frequent postponement of the date of actual milling operations by the trading companies, and the giving up of options on properties taken over conditionally, but which proved disappointing, have considerably weakened the faith of the public in Porcupine ventures. No doubt the experience of Cobalt, where many of the earlier enterprises gave quick returns, has tendered to make many investors unduly impatient for results and unwilling to make allowance for the necessarily slower and more elaborate and costly processes involved in gold mining.

The mines in the Pearl Lake district have at last secured a supply of electric power from the Sandy Falls on the Mattagami, the installation having been a good deal delayed by the nondelivery of equipment when expected. Connections with the system have now been made by the Vipond, the McIntyre, and the McEnaney (the last operated by the Crown Reserve company), and the Hollinger and Pearl Lake will very shortly be using the power, so that development work in this area will receive a great impetus. The Dome has its stamp batteries and tanks erected, and it is now expected that the mill will be in operation by the middle of March. Good progress is being made in blocking out ore on the 50-ft. level. At the Dome Extension a rich stringer cut at 90 ft. in No. 4 shaft has been found to widen considerably a few feet lower down. Another has been found in an adit on the 100-ft. level from No. 8 shaft.

The purchase of a controlling interest in the North Dome by the directors of the Temiskaming aroused a strong feeling of opposition among the shareholders of the latter company. The American shareholders appointed Ernest C. Whitbeck and Wallace Thayer to represent them and investigate the deal. They have just presented their report exonerating the directors from all blame and pronouncing favorably on the transaction as resulting in obtaining a splendid property at a low price, and likely to perpetuate the dividend-paying power of the company. The annual report of the Crown Reserve is of an optimistic character, showing a production for 1911 of the value of $1,833,516 and net profits of $1,279,739, of which $1,061,288 was paid in dividends. The total surplus on hand was $764,851, and the estimated value of ore on the dump, $500,000. The shareholders of the Green-Meehan, at a meeting held on February 12, authorized the sale of the property for $150,000, in payments spread over a term of six years. The purchasers are a syndicate of American capitalists, who propose to resume development and to erect a mill in the near future. There is reported to be $75,000 worth of ore on the dump. Kerr Lake has declared a dividend of 5% for the first quarter of the year. The payment of an extra bonus has been abandoned. The production of the Trethewey for 1911 amounted to 716,464 oz. of silver, valued at $273,486, a figure slightly below that of the previous year, owing to the amount of time devoted to development.

At Larder Lake the Dr. Reddick is doing steady work. The 20-stamp mill is in operation, though not to full capacity all the time, the ore supply not yet being sufficient. A new drill has been added to increase the output, and as soon as the orebody is sufficiently blocked out, a Hardinge mill will be added, which will double the capacity of the stamps. The Harris-Maxwell is erecting a 40-stamp mill, having already 30 stamps in place. Electric power is being developed in the neighborhood, which it is anticipated will be available early in the spring.

GLOBE, ARIZONA

SIX UNITS IN OPERATION AT MIAMI.—DRILLING ON OTHER PROPERTIES.—NEW SUMMIT COMPANY.—NOTES OF DISTRICT.

The Miami Copper Co. is producing at the rate of 2500 to 2600 tons of ore per day, with five of the six units of the concentrator in operation. The three 8-ft. Hardinge pebble-mills for the sixth and last unit have arrived, and the sixth unit is now running also. The type of skip known as the Original Con. Mines Co. skip has been discarded in favor of the old Kimberly type of skip, which is reported to be giving better satisfaction with much less repair cost. Exploration of the company's ground northeast of the present developed orebody continues, by means of churn-drilling. Hole No. 2 of the Southwestern Miami Development Co. is down 780 ft. and is now in iron-stained silicified schist. Two more churn-drills are to be added in the near future. F. W. Hoar, of Globe, is manager. The churn-drill hole in the 300-ft. shaft on the Barney group, under option to the Lewisohns, is 1030 ft. deep and still in the dacite formation. A large flow of water was met at 965 ft. and water is now flowing out of the top of the hole.

At the Live Oak mine, enlargement of No. 2 shaft to three compartments is progressing rapidly under the management of the contractor, Jack McIvor. The boilers are being bricked in and the double-drum hoist is being erected. A small amount of development work is being done from No. 1 shaft. One churn-drill is in operation on the property of the New Keystone company near the shaft. The hole is being drilled through the granite formation that caps the ore in this vicinity. E. B. Tinker is superintendent. There is nothing new on the Inspiration Consolidated. Construction work will not be started until a jury in the district court has awarded a compensation to the property-owners along the proposed right-of-way from the town of Miami to the Inspiration and Live Oak mines. This will not occur for at least thirty days. In the meantime, construction of the dam across Pinal creek, sinking of the well on the Inspiration ranch, and operation of the experimental mill continue. A statement has been issued by the directors to the shareholders of the Summit Copper Co., which recently surrendered its lease and option on the Gibson mine, 16 miles west of Globe. The report shows that $164,000 was derived from the sale of stock and $28,000 from the sale of ore; $141,000 was expended at the mine in its development, and $46,000 was paid on the property. The report states that in the opinion of the directors a sufficient tonnage had not been developed to warrant further expenditure on the property. The directors have secured an interest in a gold prospect in the Radersburg district, Montana, and offer to holders of Summit Copper Co. stock two shares in the Summit Gold Mining Co. for every five shares in the Summit Copper Company.

GLOBE, ARIZONA.

The Gibson mine is being worked in a small way by the Gibson Copper Co., to whom the mine reverted. Ten men are at work under the supervision of Tip Henderson, one of the original owners of the mine, and a small amount

of high-grade chalcopyrite ore is being taken out on the fourth level. Ore is now being hauled to Miami, preparatory to making a carload shipment to the El Paso smelter. Another carload of silver-lead ore was shipped from the Copper & Silver Zone group last week. Four parties of lessees are at work on this group two miles east of Globe, and all are now working in ore. The ore is coming from near the surface, there being as yet no deep workings on these claims. The silver occurs as the chloride or horn-silver, and the lead as the carbonate and galena.

JOPLIN, MISSOURI

HYDRAULIC MINING TRIED SUCCESSFULLY IN OPEN-PIT PROPERTY.—STRENGTH OF SPELTER MARKET ENCOURAGES OPERATORS.—OLD LAND IS REOPENED.—ZINC AND LEAD NOTES.

By utilizing high pressure from a centrifugal pump, prospectors in the open pit of the old Wyssbrod mine, at Zincite, west of Joplin, are able to do successful hydraulic mining at a depth of 100 ft. The new company is known as the Two Mikes; this is the first time hydraulic mining has been done in the Joplin district. The prospectors at first shot down the dirt from the sides of the pit, but found this expensive. When it was decided to try hydraulicking, a pipe was run from the pump and a T placed in such a manner that the water is forced at high pressure into a large pipe which may be easily moved. The method is of great assistance in finding the richer ore deposits. Chunks of almost pure zincblende and galena, larger than a man's body, have been washed down. The necessary volume of water is obtained from the pit; the used water flows into a sump, from which it is pumped to the surface and discarded. The ore is milled in a 100-ton plant.

Despite the tariff agitation, which may result in the removal of the protection on zinc, the metal is unusually strong, closing February at $6.65 to $6.75, only 7 points beneath the record price of last December, which was the highest metal figure in years. East St. Louis quotations are given. As a result of high spelter, producers of zincblende are getting a reasonably strong price for their output, as high as $48 per ton, assay basis of 60% metallic zinc, having been paid for many lots. This brought the top price for choice blende to $51 per ton. Weekly shipments were badly curtailed through February because of heavy snows and freezing weather, which combined to cut down the output from the mines as well as to curtail the removal of much of the concentrate in the bins. The heaviest week's shipment, 6000 tons including calamine, was made about the middle of the month, prior to and after which time the shipments almost invariably fell to 5000 tons or below. Lead, on the other hand, weakened, metal dropping from $4.40 per 100 lb. to $3.925, then recovering to $4 toward the close of the month. Ore as a result dropped in price from $64 per ton to as low as $48 per ton, then recovered and went to $52.

The old I-Know land, in the west part of Joplin, which has not figured in the production columns for years, is coming into notice through numerous good discoveries, both in virgin ground and in old workings, made during the past few weeks. It would seem that there is some truth in the local saying that a Joplin mine can never be worked out. Although this old tract was mined extensively—once being the foremost producer of the district—it has lain dormant for years until recent operations have revealed big deposits of ore. The Old Dominion Mining Co., of which C. M. Sheldon, of New York, is president, has first lease on the land and has sub-leased it to several small prospecting and operating companies. Half a dozen of these sub-leasing companies are at work, and the old mill on the tract has been overhauled and remodeled to be used as a custom plant for those mines producing mill-dirt. Many of the mines, however, are operating in soft ground and the dirt is cleaned on hand-jigs.

Mining land in the new Lawton, Kansas, district, is no longer confined to the 320 acres opened by the Eastern Lead & Zinc Co., the pioneer concern of that field. On adjoining properties many churn-drill rigs are hammering away, and in half a dozen instances north and northeast of the Eastern property, good drill strikes have been made, at depths ranging from 120 to 150 ft. West of the tract, ore has also been found on one lease. Both zinc and lead are found, but the water is troublesome. Up to this time the single company has been forced to handle all the water, but with new concerns starting, the drainage problem should be greatly simplified. Among the new companies at Lawton are Walter Ragland, C. H. Stoats, and R. L. Milton (two drill-holes into 9% dirt); Gates & Gray (five drill-holes into dirt of varying richness); Walter Koontz & Co. (no finds reported yet); George Playter (12-ft. face of zinc and lead in several drill-holes).

LONDON

OIL FLOTATION PROCESSES. — ELMORE ANNUAL REPORT. — MINERALS SEPARATION STATEMENT. — RESULTS WITH THE MUREX MAGNETIC PROCESS.—THE CORDOBA COPPER MINE.

The various flotation and oil processes of concentration have been prominently before the public in London, owing to the chairmen of the controlling companies having addressed their shareholders at considerable length. The first meeting held was that of the Ore Concentration company, which controls the Elmore patents. The progress reported was not great. The Sulitjelma plant, treating copper tailing in Norway, has been increased from 12 to 18 units; two new plants have been started recently in Canada; and a mine in Mexico has enlarged its plant to three units. The company has not yet arrived at the stage where a profit and loss account can be rendered.

The meeting of the Minerals Separation company was held shortly after, and John Ballot, the chairman, made a long statement containing a great deal of interesting matter. He was able to present a profit and loss account for the first time, and showed an income from royalties and profits from treatment of £82,600. He recommended that all administration and experimental expenses should be written off, and full allowance made for depreciation of plant, so that the company should be able to go forward in the future free from incumbrance and in a first-class financial position. He estimated that the net divisible profit from present contracts would be £30,000 per year, which on a capital of £50,000 is sufficiently good. The company is continuing to treat tailing and old residues at the Sulphide Corporation's Central mine at Broken Hill, and is able to treat low-grade zinc tailing and also slime at a profit. The company prides itself on having been successful in making a better profit on the material owned by the Zinc Corporation than the Elmore plant could do. Over a year ago the Minerals Separation plant was substituted for the Elmore plant, and the controversy between the rivals has been acute ever since. Mr. Ballot's process has given more efficient results, acording to the comparative figures given by him. Taking the returns over the period of treatment during the five months, March 1 to July 31, 1911, when the two processes were running side by side, he showed that 66,450 tons of zinc tailing and slime was treated by the Minerals Separation process, producing 27,525 tons of concentrate, and yielding a profit of £35,109, or 10s. 6d. per ton. The Elmore plant treated 61,550 tons, giving 18,897 tons of concentrate and yielding a profit of £13,300, or 4s. 3d. per ton. Mr. Ballot announced that a Minerals Separation plant is to be adopted at a South American copper mine owned in the United States, the name of which I am not allowed to disclose. It has already been announced that James M. Hyde has started a Minerals Separation plant at Butte, on his own account and in defiance of the company's patent rights. The lawsuit for infringement will be heard before long. Mr. Hyde was engaged by the company as engineer, two years or so ago, and while in their employ he learned the details of operation. From the standpoint of professional honor he ought to use his

information only for the benefit of the company, but relying on the fact that oil, bubbles, and flotation were not entirely unknown thirty years ago, he considered that the United States courts would afford him protection against the alien inventor and litigator.

The third company holding its meeting was the Murex Magnetic, which was formed by people connected with the Shell oil interests (whence its name), in April 1909, for the purpose of acquiring a concentration process invented by A. A. Lockwood. The process consists of adding magnetite or other magnetic substance to the ore together with some liquid that will make the particles of magnetite and the sulphide or other mineral in the ore agglomerate and form granules that are susceptible to magnetic influence. It is claimed that the process is effective under many circumstances when the flotation processes fail. Full details were given in the issue of *The Mining Magazine* for October 1909. When the process was first started, arrangements were made to test it at Broken Hill Block 14 mine, where it was supposed that it would be welcome, as the sulphide ore is not being mined. But the mine did not afford proper facilities for demonstration, so the plant has been removed to the Amalgamated Zinc (De Bavay's), where it will be worked and watched by interests that will acquire the Australian patent rights if the results are favorable. Another step in connection with Broken Hill is the financing of the South Extended mine. The reason for this policy is that otherwise there was no opportunity for applying the process in this district, owing to the metallurgical problem having been solved in other ways to the satisfaction of the various boards at all the other mines. The company, with the help of friends, has undertaken to subscribe for a maximum of £55,000 debentures in South Extended, to be paid in installments according to the success of the development; £30,000 is to be spent for that purpose and £25,000 later on plant. The results of development work thus far obtained are reported as satisfactory, and large bodies of ore assaying 24½% zinc, 11½% lead, and 2.8 oz. silver have been proved. As regards the application of the process in other parts of the world, good results are reported from the Cordoba copper mine in Spain. The plant at Malines in France, where zinc-lead sulphide in a barite gangue is to be concentrated, has been delayed, owing to lack of power, but is now running satisfactorily. During the past year several important new contracts have been obtained. One is with the Prussian State in connection with a mine in the Harz mountains, where a finely disseminated lead ore, intimately mixed with silica and barite, is to be treated. A plant is being erected at the Mazapil mine in Mexico to treat a complex ore containing lead, zinc, silver, and iron, and another contract in Mexico is pending. The Whim Well copper mine in northern West Australia is being supplied with a plant that is to treat carbonate ore; if the process is as successful at the mine as it was on the bulk sample, the beneficiation of carbonate ores in this way will mark a notable epoch in concentration.

CONCENTRATING MILL OF THE BROKEN HILL PROPRIETARY.

NEW YORK

DULL DAYS IN WALL STREET.—THE COPPER SITUATION. PRODUCTION IN 1912. ACTIVITY AT GIROUX. MIAMI DEVELOPMENT. ALASKA COPPER MINES. NIPISSING DIVIDENDS.—THE SAN TOY.

Most of the ordinary topics of discussion in Wall Street have been laid aside for the time being, and wherever men congregate the talk is of the evil days upon which the Street has fallen. It is well within the truth to say that there never was a time when business conditions and political conditions were so generally and universally the chief topic of conversation, and equally true that there has never been a time when there existed so many divergent opinions, both as to cause and effect. The one thing which is certain is, that Eastern financial centres are facing an increasingly serious situation. It is quite out of the question for Wall Street as an institution to long maintain itself on the present volume of business, and the Street is beginning to recognize the fact that the present depression is not a mere slowing down between waves of speculation, but is in reality a change in the method of investment business by the public at large. It is merely a coincidence that the public has turned away from speculation in Wall Street at a time when the spirit of unrest is worldwide, but the natural business depression in Eastern financial centres is thereby intensified. So far as the drift of affairs concerns mining, it may be confidently said that when the public attempts to once more go into mining enterprises on an adequate scale, the methods of mining promotion will be much improved, many of the just causes of complaint heretofore existing will be removed, and the shareholder who has very often been treated as of no importance beyond the mere furnishing of money, will hereafter be considered a partner in the enterprise. When this result shall have been achieved, some of the real progress now being made will become apparent. It is not to be expected that the coming year will see any important mining enterprises launched. For the time being it is utterly impossible to secure any public support for the development of mines. The uncertain situation in Mexico closes that field until an adequate police power shall have been established by the Mexican Government, whether that of Madero or his successor.

The copper situation is paradoxical. In explanation of the failure of the share market to respond to improved conditions in the metal market, it is now said in some quarters that J. R. Finlay's position is a correct one, and that the prices which have ruled heretofore in copper have been almost uniformly too high. If it is true that the public is accepting and acting upon the principle that all dividends paid by mining properties are in part liquidation of assets, this is, in and of itself, a long step forward. The copper situation was the subject of a very wide, well planned, strong manipulative movement, beginning before the close of last year. There is no way of absolutely determining the fact, but there is a widespread public impression that refinery figures were manipulated by operating pools, to show the largest possible decrease in surplus, the object being threefold: to obtain better prices for the metal; to frighten the domestic consumer into laying in supplies; and, if possible, to work up something of a boom in copper shares. This manipulation was based on, or at least assisted by, the buying of the European Governments for armament and arsenal requirements. Apparently, the price movement did not reach the hoped for levels. The domestic consumers, while interested, very largely stood pat. The share market did not secure enough public support to result in any movement worth chronicling. There was one tangible result achieved, however, and that was a marked stimulus to production. The Amalgamated Copper Co. is to turn out 30,000,000 lb. per year in excess of last year's production. Utah Copper is expected to increase its output by more than 20,000,000 lb. The Alaska properties are unknown quantities, but recent shipments from the Bonanza mine aggregate some 2,500,000 lb., and inasmuch as this is by way of initial output, the rate may be expected to increase rather than otherwise. It is safe to predict a record-breaking production for 1912. The all important question is, whether consumption will continue to absorb the metal in such quantities as to prevent demoralization. There is one strong factor now to be considered which has not previously existed; the controlling interests in the production of copper constitute a much smaller circle than at any preceding time, and a rigid policy of curtailment can be instituted and much more readily enforced in the future than at any time in the past. If this were not true, the threatened over-production of copper would be a real menace instead of a possibility.

The distribution of the cash and the Anaconda shares in the treasury of the Butte Coalition will begin March 12. In addition to the Anaconda stock, shareholders will receive a fraction more than $4.41 per share. The transfer books close March 1. Boston is taking more interest in the development of new properties than any other financial centre of the East. Two years ago Lake and Indiana were the sensations of the Boston market. At the present time Old Colony and Mayflower are absorbing the attention of speculators and investors. In both properties the drill has shown some surprising cores, and in each case it is expected that an important producer will be developed. H. H. Rogers has been with the majority for some years. It hardly seems appropriate that F. Augustus Heinze should have issued a court summons for important figures in the copper world without including the name of the late Standard Oil Amalgamated master. The United Copper Securities Co., which was organized just after the 1907 panic for the avowed purpose of rehabilitating the various copper properties controlled by Heinze, has recently begun a suit against the Amalgamated Copper Co., the Anaconda, the Butte Coalition, which is just going out of existence, the Lewisohns, and the executors of the estate of the late H. H. Rogers, John D. Ryan and James Stillman. To those who are familiar with the days when Heinze so hopelessly enmeshed the courts of Montana in litigation, the present suit will seem like a page out of history. Upon what charges the present action is based does not as yet appear.

Expected production from the Giroux is the cause for considerable activity for both the Giroux company, which is making every effort to get the Morris shaft into shape, to turn out 900 tons of ore per day, and the Steptoe plant at Ely, which is making preparation to handle the additional tonnage to be shipped under the recent contract. The water problem at Ely is a serious one. The smelter has not as much water as it needs, while in the Giroux getting rid of the water has been a problem. At the Steptoe plant they are installing additional settling-tanks and re-pumping apparatus.

The Ahmeek, in the Lake Superior district, was one of the particular bones of contention in the bitter fight over the Calumet & Hecla consolidation. The property is making good the claims which were made for it. The final figures for the year 1911 have not been given out, but it is expected that they will show something less than a 7c. copper cost for 1911, and this, with all construction charges debited against this account. The average recovery during 1911 was 25½ lb. of copper per ton of ore treated.

The development of the Miami Copper Co. has been somewhat overshadowed by its larger neighbor, the Ray Consolidated. However, Miami is now expected to be the first of the developing properties to enter the dividend class. It is announced semi-officially that the first disbursement will be made during the coming spring. Miami is now earning dividends at the rate of $1,800,000 per year, which is equivalent to $2.40 per share upon its outstanding stock. The January output of the Miami figured something under 8½c. per pound. During the coming year, copper costs are expected to be reduced to between 7c. and 8c. The Bonanza Copper Co., which is a close corporation, the stock being practically all divided between J. P. Morgan & Co., Kuhn, Loeb & Co., and the Guggenheim interests, has just paid its initial dividend. Shipments were begun in April last with the Copper River railroad completed as far as the Bonanza mines, and the ore that was sent out aggregated something more than 16,000 tons averaging close to 70% copper. It is not within the range of possibility that shipments of this nature will continue indefinitely. A concentrating plant has been nearly completed, and low-grade ores will be shipped in the near future. It is reported that Cappel, Radycliffe & Co., of London, have purchased a copper mine in Glacier Creek, 42 miles east of the Bonanza mine, owned by the Guggenheims, in Alaska, for a sum in excess of $1,000,000.

The annual report of the Nipissing is in process of compilation, and will be completed about April 1. Figures covering the ore reserves will show an increase of 1,300,000 oz. above the estimated reserves of December 1910. The total ore reserve as of December 1911 is estimated at 7,800,000 oz. The dumps are estimated to contain an additional $1,000,000 worth of ore. The cost-sheet will not vary materially from that of the preceding year, when Nipissing made its silver for 14.71c. per ounce. Prospecting in 1911 was nearly at a standstill, the company doing not more than one-fourth of its usual amount of exploration work; nevertheless, the property produced bullion to the amount of approximately $2,500,000, and, so far as ore reserves are concerned, stands with its position unchanged. The maker of old proverbs who first propounded the theory that "there is greater pleasure in anticipation than there is in possession" must have had mining enterprises in mind. From a mining standpoint, Nipissing has been a continual triumph. Its producton today shows an enormous profit. It sold up to $30 and better before it was a regular producer, and at the present time it has not any regular market following at less than one-fourth of its record high price.

The amount of stock to be issued by the International Smelting & Refining Co. for new construction will be $2,000,000, or 20% of present capitalization of $10,000,000. It may be late this year or early next year before allotment is made, as the company is in no immediate need of money. One of the objects of the increase will be the enlargement of the Raritan refinery. Since its organization three years ago, the International has constructed a copper refinery at a cost of $2,000,000 or $3,000,000, and a lead plant. In addition, the capacity of the Raritan refinery has been greatly enlarged. The company will also build a lead refinery. All this construction work has been done without increasing capital stock from the original $10,000,000. Net earnings this year are expected to reach 15 per cent.

General Mining News

ALASKA

Juneau

The Alaska Treadwell has declared dividend No. 96, of 75c. per share, payable February 28.

The December returns for the Alaska United G. M. Co. show that the Ready Bullion mill (120 stamps) ran 29 days, 10 hr., during the month, and crushed 18,200 tons of ore, containing $22,193 in free gold, and saved 474 tons of concentrate containing $18,967. Of this, $40,756 was recovered at an operating profit of $11,484, or $2.20 per ton milled. Construction expenses amounted to $330. The 700-Ft. Clam mill (120 stamps) ran 29 days, 17 hr., and crushed 19,593 tons, with a total gold content of $50,121. Operating expenses were $45,501, leaving a profit of $4119. This corresponds to a yield of $2.55 per ton, as the operating expense includes $15,000 paid in settlement of the Mexican powder explosion. Dividend No. 65, of 20c. per share, payable February 28, has been declared.

The report of the operations of the Alaska Mexican for December shows that the 120-stamp mill ran 29 days, 17 hr., and crushed 18,858 tons of ore of a gross content of $59,403. Of concentrate, 484 tons, of a content of $32,456, was saved. The operating profit for the month was $34,648; the yield per ton milled was $3.15. Construction expenses amounted to $3792; development work done during the month was 209 ft.; the stock of broken ore was increased 9661 tons. Dividend No. 65, of 20c., payable on February 28, has been declared.

ARIZONA

Gila County

P. S. Tate and the Lyle brothers, who are leasing on the 100-ft. level of the Black Warrior mine, are shipping a carload of copper-silicate ore to the smelter at El Paso.

The concreting of the Kingdon shaft of the United Globe is progressing satisfactorily under the supervision of Paul Michaelson, contractor, and C. H. Weideman, construction engineer. The first section of 160 ft. has been completed, and the work has been going at the rate of about 12 ft. per day. Work on the second section will begin at once. C. B. Eades is concrete inspector for the United Globe company.

From the Duquesne group, 15 miles west of Globe, there has just been shipped another carload of gold-lead ore. The last shipment of 39 tons, a few weeks ago, netted about $18 per ton, and this shipment is expected to run even better. The ore is peculiar in that it contains gold and lead, but no silver. John F. Shaw is manager for the company.

It is reported that the Miami Copper Co. has taken an option upon all the unsold ground in lower Miami, but the report is unconfirmed.

Mohave County

Twelve men are at work on the tramway from the Rainbow mine, and it is hoped that it will be transporting ore by the end of this month. It is planned to ship a carload daily to the smelter. The new hoist is in place at the Badger, and the main shaft is being sunk. The adit will also be driven farther in the vein. A good body of ore has already been blocked out.

Santa Cruz County

The Providencia G. M. Co. has been incorporated with O. P. Posey as president; E. Titcomb, vice-president; E. K. Cumming, treasurer, and A. G. Fraser, secretary. Nogales is the headquarters. The Float Gold Amalgamated M. Co. mill is ready to start, and a new hoist has been installed at the mine. Lew Hartman is manager. It is reported that a large body of high-grade ore has been found in the Three R mines, near Patagonia.

Yavapai County

The unwatering of the main shaft of the Arizona Bonanza mine, near McCabe, is progressing well, and when the water is all out, sinking to the 200 ft. level will be started. J. H. Farrell is general manager.

Yuma County

J. M. O'Brien, O. W. Picotte, Joseph Nelson, and H. Osburn have bought the Roberts mine for $25,000, bond and lease, one-fifth payable in six months and the remainder in one year. Twenty men will be employed, and a road will be built and a tramway constructed from the main adit. This mine is the old Aviata property, in the Riverside mountains. J. M. O'Brien will be in charge.

CALIFORNIA

Amador County

In the Fremont mine, in the Drytown district, good ore has been found on the 1950-ft. level and promises to persist. A. Goodall is manager of the property and Wales Palmer is superintendent. At the Pacific mine in Plymouth, supplies are being received daily and additions are being made to the working force of 20 men.

Butte County

Much excitement has been caused at Oroville by the find made by Charles Willet on the Ida McCallum place, about 200 ft. from the county road, at Berry Creek. Willet has been working on the claim for two years and has made a living from what gold he has been able to pan. He asserts

BALAKLALA SMELTER, CORAM.

that very high returns per pan can be gotten from the vein, which is reported to be 2½ ft. wide.

Calaveras County

(Special Correspondence.)—The Ingomar Con. G. M. Co., which has just been examined by Alexander Hamilton of San Francisco, is about to resume operations. The mine is in the Campo Seco mining district, near the Penn Chemical Co., and shows a large low-grade orebody which has been developed to the 300-ft. level and is still in the gold-bearing zone. With deeper development a copper deposit in many respects similar to that of the Penn is expected to be found. Mr. Hamilton will be manager for the company.

Campo Seco, February 20.

A local company has been formed at Mokelumne Hill to uncover old sluice-boxes, believed to have been covered by a landslide on the east side of Stockton hill, in 1857. The unusually heavy rains of the winter of that year caused a slide which buried the sluices to a depth of 30 to 40 ft., just before the clean-up. V. M. Weil and George Gilmour are visiting the mine of the Standard Amalgamated Exploration Corporation, at San Domingo. Miners from the Hanby mine are endeavoring to secure payment of their wages.

Eldorado County

A. Baring Gould has bought the interest of Phoebe Wilson in the Fortuna, Logan, Brighton, Belle, and Jackson lode claims for $1250. Hughes & Benny, having a lease on the old Landecker mine, have cleaned up $225 from 35 cars of ore.

Inyo County

Jack Curtin, L. W. Munzinger, and A. H. Swallow have discovered a strong vein of zinc ore in Wayland canyon, southeast of Bishop. M. C. Hall and Dick Kennedy have a lease upon L. W. Munzinger's claim north of Hamil and expect to ship a good many sacks of ore in the near future.

F. M. Myrick has made a contract with the Southwest Turquoise Co. for the total output of his bloodstone deposits. The report of the Skidoo Mines Co. for the month of January shows that 1615 tons of ore was milled and $18,316 in bullion produced at a net profit of $6377. Development cost was $824 and operating cost $8114.

Al. D. Myers has bought the old Panamint mine, near the foot of Telescope peak. This is an old silver producer which is reported to have yielded $2,000,000 to $3,000,000, but was closed down in 1893. Mr. Myers has had the property under bond for the past nine months.

Mariposa County

It is reported that the Honeycomb mine, near Hornitos, is rapidly being put in shape to resume production. Mr. Brace is superintendent. J. W. Barcroft, one of the owners of the No. 1 mine, states that the mine will soon be in operation.

Mono County

Both the Standard and Hydro-Electric power plants at Bodie are suffering from shortage of water, and the Standard has laid off 27 men for this reason. N. R. Taylor, weather forecaster, says that the Sierra Nevada and Siskiyou mountains are almost bare of snow, while in normal years there is 10 to 12 ft. of packed snow on their summits.

The Golden Gate mine, in Antelope valley, has been bonded to a Philadelphia syndicate for $250,000, according to Nevada reports. The engineer's report on the property shows $200,000 worth of ore blocked out. The main vein is 5 ft. wide and averages $14 per ton, free milling. Six miners are now employed, and two 50-ton Lane mills have been ordered.

Nevada County

(Special Correspondence.)—Two shifts are advancing the adit 500 ft. at the Native Son mine, near Blue Tent. The adit is expected to tap the vein at an approximate vertical depth of 80 ft. San Francisco people are principally interested. J. H. Bishop is manager. The adit at the Mark Alling group of claims, near Columbia Hill, is in 370 ft. and will be continued to the 600-ft. point, where a raise will be made hoping to cut the Grizzly Ridge channel. This deposit was worked years ago and yielded rich profits. Pasadena people are interested. A. B. Call is manager. Developments at the Champion group are progressing well and the recently installed pumps in the Champion and Providence shafts are handling the water without difficulty. It is understood the unwatering of the Champion shaft to the bottom level will soon be under way and that vigorous development will follow.

Nevada City, February 24.

J. A. Graves and H. O. Kohler have purchased the interest of Jacob Kohler in a group of mining claims on Poorman's creek. There are several veins on the claims, and all have good surface showings. The new owners will prospect the property.

Placer County

The Auburn Chamber of Commerce has passed resolutions endorsing H. R. No. 17033, introduced by John E. Raker, establishing a mining experiment station at Auburn. Samples of magnesite and asbestos have been sent to the State Mining Bureau in San Francisco for exhibition. H. Godds and Luther Eubanks were asphyxiated in the adit of the California & Hawaiian Development Co. at Ralston Divide. The adit is being driven to cut a buried gravel channel, and the men, who were going on shift, were overcome at a point 2000 ft. from the portal. The last round had been fired 2½ hours previously.

Shasta County

It is said that the big stack at the Balaklala smelter, 250 ft. high and 24 ft. in diameter at the base, is gradually falling to pieces, a large portion of the top having come away, leaving large cracks extending downward for 10 ft. The structure cost $30,000. Perry Skillman, who is in charge of the mine, says that the prospects for the resumption of work are encouraging. The plant of the Noble Electric Steel Co. is at present closed for repairs.

Siskiyou County

Twenty-nine power companies operating in this county and in southern Oregon have been joined in a $10,000,000 merger under the name of California-Oregon Power Co. The head office will be in San Francisco. C. L. Proebstal presented a paper at the Mining Congress at Medford, dealing with the mines of Siskiyou county, which have produced $6,911,425 in gold from 1901 to 1911.

Trinity County

The La Grange hydraulic mine is running only two giants, as the water-supply is unusually short for this time of year. Even these two have to be shut down at intervals to let the reservoir fill. There is but little snow in the mountains, and there is therefore little chance that the supply will increase much. J. H. Bennet, a laborer, who had been employed at this mine, committed suicide recently by drowning in one of the lakes above La Grange.

Tuolumne County

An electric pump of 600 gal. per min. capacity has been installed in the Springfield mine. At the Shawmut operations were resumed February 19, and 40 stamps are at work on good ore. Drilling is in progress on the Dondero gravel claim, near Yankee Hill, to determine its value. The hoist at the Confidence mine has been moved to the Cherokee, near Columbus, and exploration to determine the value of the latter will be carried on.

COLORADO

Clear Creek County

(Special Correspondence.)—A. Swanson has secured a lease on a block of ground at the Bellevue-Hudson mine on Columbia mountain. The shaft will be sunk 100 ft. from the 14th level. Ore is showing in the bottom that mills 700 oz. silver and 3.50 oz. gold per ton. Work has been put under way in the driving of an adit on Leavenworth mountain to intersect the Key West vein at a depth of 250 ft. E. J. Butts is manager. The Prudential adit on Republican mountain has cut another vein. Scattered ore is showing, but driving will not be started until the hanging wall is reached. F. A. Maxwell is manager. Heavy shipments are going out from the Linn mill. The concentrate consists of lead, zinc, and iron. Bishop & Gay, of Empire, have taken a lease on the Pittsburg mine on Silver mountain. Work is being carried on through the first level, and stoping is under way on an 8-in. streak of $24 ore. Shipments will start soon. The Denver adit is being driven steadily forward, having been advanced 1300 ft. A vein will be cut within 50 ft. F. Brady is manager.

Georgetown, February 24.

Smelting charges on zinc ore have been raised $1.50 per ton by the Western Chemical Co. As the railroads have been allowed by the Interstate Commerce Commission to increase their freight rates from Colorado to Kansas and Oklahoma points by 50c. per ton, some of the zinc mines and mills have closed down. Water rights in all the ditches of District No. 7 have been adjudicated by P. L. Palmer, as referee. The decision affects water rights in seven counties.

Lake County (Leadville)

Stewart & Murray are negotiating for the purchase of the Gordon-Tiger mine in the Twin Lakes district. The property has been in litigation for some years, but the title was recently quieted. The price mentioned is $300,000. The plans for the Helena mill have been approved, and the machinery will be contracted for soon. At the American Zinc Co.'s mill it is planned to put in a small conveyor to facilitate loading cars from the iron dump. The 54-hp. compressor and 37-hp. hoist for the St. Louis adit are in course of erection. Both are electric-driven, and will be used to sink a winze 450 ft. for prospecting. The tramway cable for the Mt. Champion was recently taken to the adit by unwinding it from the reels and making five small reels. The rest of the machinery will be conveyed on a specially constructed sled. The ore-bins and trestle at

the Clay are completed. Leadville operators are concerned over the recent ruling of the Interstate Commerce Commission raising the freight rate on zinc ores to Kansas and Oklahoma 30c. per ton. The recent rise in the price of silver has stimulated interest in the low-grade oxidized orebodies on Fryer and Carbonate hills, and it is possible that if silver remains at its present price, many old properties will resume operation.

OURAY COUNTY

The Camp Bird mine has apparently taken a new lease of life and 100 more men are reported to be put at work, following a good find of ore in winze No. 527, sunk from the fourth level of shaft No. 2, 1200 ft. below the outcrop and 1700 ft. east of the shaft. The ore is 3 to 4 ft. wide and averages $40 per ton.

SAN JUAN COUNTY

The Silverton section of the American Mining Congress, at a meeting held February 8, drafted a protest against the adoption of the Underwood act reducing the tariff on zinc, lead, and tungsten, and has sent copies to W. H. Taft, Murry Guggenheim, John A. Martin, and Messrs. Rucker and Taylor.

SAN MIGUEL COUNTY

The Smuggler-Union M. Co. is putting into operation in its mill the system of milling devised by the Portland G. M. Co. for its mill at Victor. When the alterations are completed it is expected that the gold recovery will be raised to 90% and the silver to 85 or 90%. The saving now being made is 85% of the gold and 65% of the silver. It is expected that the production of the Smuggler will be almost doubled by the alterations.

TELLER COUNTY

The Jerry Johnson shaft, on Ironclad hill, is being sunk by 3 shifts at the rate of 3½ ft. per day. Fred Johnson is breaking ore 30 ft. wide in the Pride of Cripple Creek. Lessees on the Maud Helena are shipping 2-oz. ore. Oscar Fogleman has taken a 3-year lease on the Old Gold mine, on Beacon hill. J. M. Roach, of Chicago, is backing him. In the Elkton, development is in progress on the 10th level; the main vein is three inches wider on this level than on the 9th. The water-level is receding 5 in. per day, and the shaft is now being sunk farther. The Six Points is producing 8 to 10 cars per month of 5 to 10-oz. ore. Three drills are at work, and a cross-cut is being driven on the 525-ft. level.

IDAHO

C. A. Stewart, professor of geology and mineralogy at the University of Idaho, presented a discussion of the need for a geological survey of Idaho at the Northwest Mining Congress at Spokane, and resolutions of endorsement were passed.

BLAINE COUNTY

Patent has been issued to the Hope Gold M. & M. Co., Ltd., for the Hope, Eclipse, and Eclipse No. 1 Extension lode claims. A. Richardson has located the Violet and the Agnes lode claims, about ¾ mile northeast of the Tiptop claim.

TWIN FALLS COUNTY

The Calidaho Extraction Co. is planning to erect a 10-ton plant at Twin Falls to treat black sand to recover its gold by an electro-chemical extraction process.

MONTANA

BROADWATER COUNTY

There is considerable excitement among those who have properties in the Radersburg district, in consequence of the finding of some unusually good ore in the Barnato, a property in which F. Augustus Heinze became largely interested last summer. The mine adjoins the Keating. The Barnato was located several years ago, but after some work had been done it was abandoned. Mr. Heinze had it examined last year, and on the strength of the report made to him, he secured the property after a personal investigation.

SILVERBOW COUNTY

New auxiliary hoists for the Diamond, West Colusa, Mountain View, Tramway, Pennsylvania, Badger State, Mountain Con., Neversweat, and St. Lawrence mines have been ordered from the Nordberg Mfg. Co. The adit of the Laurium Montana M. Co., 3 miles south of Butte, has cut the vein at 285 ft. Oscar Karri is manager. The new surface plant of the Tuolumne is now in operation. Three-deck cages are being used, but when skip pockets are cut on the 1200, 1400, 1600, and 1800 ft. levels automatic skips will be employed. Development on the lower levels is disclosing good ore, and it is expected to make arrangements with the Washoe smelter to ship 500 tons per day.

The Butte-Alex Scott is shipping 150 tons of ore per day to the East Butte smelter and expects to increase this soon to 200 tons. Air is being substituted for steam on the main hoist and is expected to make a considerable saving in operating expenses. The Butte-Ballaklava has applied for a transfer of its suit against the Anaconda from the district court to the United States district court, alleging that it cannot get a fair hearing before a Butte jury. Ore claimed to assay over 14% copper has been found on the 2800-ft. level of the High Ore.

NEVADA

LANDER COUNTY

(Special Correspondence.)—Utah and Nevada people are organizing the Austin Central Mining Co., with 1,000,000 shares of a par value of 10c., to operate the Austin Central. This property is in the Austin district, and the ore assays well in silver and carries some gold. The veins are said to be 10 to 22 in. wide. The King Midas Mining Co., operating in the Clear Creek district, has purchased a Beers roller mill, 40-hp. gasoline engine, air-compressor, and other machinery. They are expected to arrive soon and will be immediately erected. It is officially stated that ore valued at $100,000 has been developed. Willard E. Hales is manager.

Austin, February 23.

LYON COUNTY

Road building to the McConnell mine has been completed, and shipments to the Wabuska smelter have begun. The Mason Valley mine is shipping 300 tons per day to the smelter, using an 8-ton Jeffrey electric locomotive to haul the cars from the stopes to the belt-conveyor which fills the tramway loading-bins. The tramway is a 2-cable Leschen and cost $75,000 to construct.

NYE COUNTY

(Special Correspondence.)—The adit of the Mineral Hill Con. company is in about 490 ft. and is progressing rapidly. It will soon be under the Burr-Thomas workings, where a winze is being sunk on a rich shoot 10 in. wide. The Steffner lease on the Manhattan Con. reports finding a vein ranging 20 to 35 ft. wide, said to assay from $20 to $25 per ton, to a depth of 200 ft. The station on the 200-ft. level of the new shaft has been completed. The Associated Mining & Milling Co. has contracted to purchase 2000 tons of $20 ore from this lease, deliveries to be made during April and May. It is stated that a first payment of $5000 has been made. The Associated people are also said to have contracted for the output of the White Caps lease. A recent estimate placed the ore reserve developed in this lease at 5000 tons, ranging from $10 to $20, with a 3-ft. shoot declared to average $100 per ton. John Kirchen, manager of the Tonopah Extension company, and associates recently acquired control of the White Caps lease. The Lemon mill is treating 46 tons of ore per day, stated to run about $20 per ton, from the Big Four lease. Treatment costs average $3. It is said that 92% is recovered by amalgamation. The mill includes 10 stamps, tube-mill, Dorr classifier, an Oliver filter, and precipitation press. It is under lease to the Big Four Leasing Co. On the 300-ft. level of this lease the vein has been stoped for a distance of 110 ft. and shows a width of 46 ft. in places.

Manhattan, February 23.

White Pine County

Work at the Giroux is concentrated upon getting the Morris-Bunker Hill property in shape to ship by May 1. The Giroux shaft is now completely repaired, but sinking will not be resumed for the present.

In the Zack shaft of the Ely Consolidated Copper Co. a 3½-ft. vein containing 17.7% copper and $1 in gold and silver has been cut. The company now has ore of workable grade in the 400, 500, and 600-ft. levels, and plans are being made to sink the shaft 200 ft. farther.

The Lead King M. & M. Co., with claims near McGill, has found 80% lead ore. A. P. Spitke is manager. The Ely Gibraltar, north of McGill, is finding galena in its 860-ft. adit.

NEW MEXICO

Grant County

The Chloride Flat M. Co. expects to ship another carload of silver ore to the smelter at El Paso. It is rumored that the Phelps-Dodge interests may reopen the Leopold and Tyrone mines.

McKinley County

H. H. Holbert and John Schauer are opening coal mines in this county, and it is reported that Santa Fé engineers are surveying a branch line through Aztec canyon to the properties.

Socorro County

(Special Correspondence.)—February promises to be the record-output month for the Ernestine Mining Co. The clean-up for the first 10 days of the month produced 10,365 oz. of gold and silver bullion and 6 tons of concentrate. The third week's ore treatment was 675 tons. The new oil-engines are reported as a complete success. The Socorro Mines mill is again in full operation, on power from new De La Vergne oil-engines, which were started this week. Approximately 200 tons of ore is now treated daily. At the Deadwood Mines 6½ ft. of good ore has been cut on the 500-ft. level; other developments are equally satisfactory, a total of 40 ft. being driven the past week. The mill treated 225 tons. The semi-monthly clean-up is now in progress. A new find has been made in the Treasure Mining & Reduction Co. mine, specimen samples assaying as high as $5000 in gold and silver. The mill is treating over 75 tons daily. The lessees on the Deep Down have found 18 in. of ore assaying $48 per ton. The work is being pushed and arrangements made to begin regular delivery of ore to the Deadwood mill as soon as possible. The new Olds 12-hp. gasoline hoist, set up at the South shaft on the Pacific mine of The Oaks Co., was started last week and is proving entirely satisfactory. Sinking is in progress and a winze has been started in the adit at a point where good ore was discovered. All the ore produced in development is being treated in the Deadwood mill.

Mogollon, February 23.

OREGON

Douglas County

The Beaver Hill, near Anchor, owned by J. C. Olinghouse and N. G. Chandler, has 100 tons of ore on the dump and shows assays as high as $60 per ton. The adit cuts the vein at a depth of 400 ft., and another adit has been started.

Jackson County

Mrs. Cora Morgan will construct a custom mill near Gold Hill, and 2½ acres of land has already been donated for the purpose. It will be large enough to treat all the ore of the district, and if the project is carried out it will greatly aid the development of the many prospects of the county. T. D. Stoner reports that a 5-ft. seam of coal of good quality has been uncovered two miles north of Moonville.

Josephine County

The 5000-lb. display of gold and copper ore from Josephine county won first honors at the Northwest Mining Congress held at Spokane recently. H. G. Siskron recently cleaned up 52 oz. of bullion, worth $18 per oz., from a mill-run of 12½ tons of ore at the January First mine on Sucker creek, 4 miles from Holland. The property was located in 1905 and has several hundred feet of development work.

UTAH

Emery County

The Utah Coal & Coke Co. has been incorporated to develop 2000 acres of coal lands which it owns in this county. J. R. Sharp is president of the company. While the property is about 50 miles from a railroad, it is hoped that coal from it can reach the market by spring. Shipment will be by way of Price, Carbon county.

Juab County

The 400-hp. electric-driven hoisting engine for the Iron Blossom, furnished by the Nordberg Mfg. Co., will be delivered soon and will facilitate production from the lower levels. The Dragon is mining ore of 5 to 10% copper and 20 to 50 oz. silver on its 600-ft. level. The Eagle & Blue Bell shaft was sunk 200 ft. between January 8 and February 20, and will be continued to the 1400-ft. level. The Tintic Min. & Dev. Co. has installed a 50-hp. electric-driven hoist in one of the cross-cuts from its main adit, 200 ft. from the portal. Shipments from the district for the week ended February 22 were, in carloads: Iron Blossom, 52; Centennial Eureka, 46; Chief Con., 13; Colorado, 12; Yankee, 11; Gold Chain, 10; Grand Central, 9; Mammoth, 9; Eagle & Blue Bell, 6; Gemini, 5; Beck Tunnel, 4; May Day, 4; Victoria, 4; Opohongo, 4; Sioux Con., 3; Eureka Hill (lease), 2; Swansea (lease), 1; Dragon Iron, 1; Sioux mill dump (Depue lease), 1; Scranton, 2; a total of 200.

Salt Lake County

The Utah Copper Co. has declared a dividend of 75c. per share, payable March 30 to stock of record March 8.

The Ohio mill has handled 2400 tons per day with 16 of the Wall rolls in operation. The ore now being milled averages 1.3% copper.

Three ore-cars ran away just below the ore-bins of the Utah Copper Co., on February 15, and jumped the track just above the business section of Bingham. Two buildings were demolished and four men killed, two of them members of the train crew, and eight persons were injured.

The Montana-Bingham Con. M. Co. has been incorporated and will take over 300,000 shares of Montana-Bingham stock. Agreements have been made with the Bingham Amalgamated, Congor, Fortuna, and Starless. Work in the adit is being pushed, and it will be driven 400 ft. farther. At the Highland Boy back-filling of stopes is being employed to prevent caving. Waste is being employed for the purpose, thus making a saving in its handling.

Summit County

The new loading station of the Daly West is finished, and when the water and ore-supply are increased the mill will be operated on 3 shifts again. The annual meeting of the company was held at Denver, February 15. The mine is now producing 900 tons of shipping ore per week. The dividend of $67,500, paid in January, makes the total to date $6,322,500. The East Ontario meeting was held at Park City, February 20, and the old board of directors, J. H. Dieter, S. B. Schuyler, E. M. Curtis, A. Ramel, and J. B. Allen, were elected. Mr. Allen is manager for the company and made an optimistic report. Driving is expected to resume in the Snake Creek drainage adit by March 1, as the concrete work in the bad ground should be finished by that time. Steel rails have been used for reinforcement.

WASHINGTON

Spokane County

At the meeting of the Spokane section of the A. I. M. E., on February 17, R. S. McCaffery, professor of mining at the University of Idaho, presided. Among the papers presented were 'Mining Methods at Naeozari,' by D. C. Livingston; 'Replaceable Lips for Elevator Buckets,' by A. Maguire; 'Surveying Under Difficulties,' by C. H. Loux.

CANADA

British Columbia

The British Columbia Copper Co. made a net profit of $154,000 during 1911, nearly all of it in the last four months of the year. The company is now working properties of the New Dominion Copper Co. which furnish one-third of the ore now being smelted at the Greenwood smelter. The Granby smelter is increasing its output of blister copper. 2,589,000 lb. has been shipped so far this year. The Canadian Consolidated has secured the property on Five Mile creek, where rich ore was recently found. At the Granite Poorman, recent development work has shown encouraging results. Minneapolis people have taken over the Second Relief mine and mill, near Erie, and they are again in operation.

Ontario

The Temiskaming squabble has been settled, but a fight now threatens over the Trethewey. The annual report of that company shows total receipts of $372,622, as compared with $427,522 last year, and net revenue of $160,306, which is $77,494 less than in 1910 and $39,500 less than in 1909. The shareholders threaten to reduce the recently increased capital back to $1,000,000, to employ a consulting engineer, and to make public monthly statements of returns. At the meeting, held February 28, a lively time was expected. The Trethewey recently shipped 1983.48 oz. of bullion, worth $1155, and the Nipissing 24,385.3 oz., worth $14,174.

MEXICO

Hidalgo

The Compania Minera y Beneficiadora de Maravillas y San Francisco, of Pachuca, paid a dividend of ₱2 per share on February 25. The new Walker Bros. 250-hp. compressor on the La Blanca y Anexas property has been placed in commission.

Oaxaca

L. R. Wilfley, of Mexico City, and associates have purchased from C. A. Hamilton his interest in the San Juan mine, Taviche district. It is reported that the new owners are planning the construction of a large mill. The San Juan property has been operated by the San Juan M. Co., and before the recent sale steps had been taken for the construction of a 200-ton concentrator, to treat the low-grade ore from the mine. Mr. Hamilton has purchased the Santa Gertrudis *hacienda*, one of the best agricultural properties in the Oaxaca valley.

Sonora

(Special Correspondence.)—W. T. Calderwood, president and general manager of the Mexico Mining, Refining & Exploration Co., which owns several promising properties in Sonora, one of them being the Creston de Cobre, 30 miles west of Hermosillo, and the other, La Cobriza, in the Sahuaripa district, states that the Creston de Cobre has been prospected and developed for a number of years and now has over 2000 ft. of actual development work done on it, and during recent operations a large body of ore was found, the vein being 27 ft. wide at 500 ft. in depth. The average content of this is over $15. In addition to the equipment which the company already has, it is installing a 90-hp. compressor and two 65-hp. tandem boilers to put on enough air-drills to start producing 100 tons of ore per day. In view of this promising showing on the property, the company will in the near future install its own smelter at the mine.

Hermosillo, February 15.

Chihuahua

(Special Correspondence.)—A committee of local shareholders in the San Toy Mining Co. has sent out printed circulars to all the shareholders, alleging that for the past year and a half a part of the machinery and equipment of the company has been used by private interests without any return to the company. Donald B. Gillies, general manager of the San Toy, and associates have a lease upon the Quincede Mayo, which adjoins the San Toy, and can only be worked profitably through the San Toy ground. Recently it has been stated that $12,000 to $15,000 has been paid on account of the lease, and the local shareholders claim that the affairs of the company are not being properly managed and have asked for proxies to oust the present board of directors from control.

Chihuahua, February 10.

Among the Copper Mines

In the North Butte, on the 200-ft. level of the Snowball, it is reported that the vein is over 8 ft. wide, averaging 15 to 20% copper.

The Copper Queen, in exploring from its Spray shaft, has found a large body of rich sulphide ore within 18 ft. of the Calumet & Arizona boundary.

The Chino, according to its monthly report, is producing copper at a little over 8c. per pound, with only two units out of five in operation. Each of these is handling

CHINO MILL, WHILE UNDER CONSTRUCTION.

nearly 1000 tons per day of ore varying from 2.2 to 3% copper. The plant is making an average extraction of 70%. Good progress is being made in opening the pits, and in two or three months time the mine will be in shape to produce 5000 to 7000 tons per day.

The United Verde Copper Co. has advertised for bids for the construction of 6 miles of broad-gauge railway to the new smelter site from the 1000-ft. adit. The company has purchased a number of farms which might be damaged by the fume from the new plant, and these will be managed by W. A. Jordan. The new plant will have a capacity of 6,000,000 lb. per month and will be a purchaser of silicious ores. Charles W. Clark is manager.

The Nevada Consolidated has four steam-shovels at work on overburden in the Copper Flat pit, and one on ore. In the Liberty pit one shovel is at work on ore and one on overburden. A new 95-ton Bucyrus shovel is being assembled and tested at Ruth. At the Veteran, more than 300 men are at work, and a trainload of ore per day is being sent to the Steptoe mill. The ore from the Liberty pit is said to be higher grade, and with the Veteran ore will materially increase the copper content of the mill feed.

The Arizona Copper Co. has approximately 175 men at work in its new plant. Of these, 75 are grading and the rest shifting the line of the A. N. & M. railroad 30 ft. to the north. The contract for the steel work has been let to the Kansas City Structural Steel Co., and delivery is promised for May 1. A temporary power-plant has also been contracted for. The stack of the new plant will be 22 ft. diam. at the base and 300 ft. high. The roasters will be of the Herreshoff air-cooled type, and have already been contracted for. The copper production of this company during January was 3,200,000 pounds.

Market Reports

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, Feb. 29.		Closing Prices Feb. 29.
Adventure	6¾	Mohawk	$ 56
Allouez	41¾	North Butte	26
Calumet & Arizona	61¼	Old Dominion	47¼
Calumet & Hecla	450	Osceola	114
Centennial	21	Quincy	78¼
Copper Range	56	Shannon	10¼
Daly West	5	Superior & Boston	3¼
Franklin	12¾	Tamarack	29
Granby	35	Trinity	5¼
Greene Cananea, ctf.	7¼	Utah Con	14¼
Isle-Royale	25¼	Victoria	4¼
La Salle	5	Winona	7¼
Mass Copper	7¼	Wolverine	106¼

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, February 29.

Atlanta	$ .14	Mayflower	$ .02
Belcher	.52	Mexican	3.67
Belmont	9.90	Midway	.25
B. & B.	.16	Montana-Tonopah	1.10
Booth	.06	Nevada Hills	2.32
Chollar	.17	Ophir	1.45
Combination Fraction	.14	Pittsburg Silver Peak	1.22
Con. Virgina	.86	Round Mountain	.47
Florence	.65	Savage	.26
Goldfield Con.	4.55	Tonopah Extension	1.55
Gould & Curry	.07	Tonopah of Nevada	7.28
Jim Butler	.34	Union	1.22
Jumbo Extension	.23	Vernal	.16
MacNamara	.19	West End	.97

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, February 29.

Associated Oil	$43.25	Peerless	$ 4.50
Brookshire	.58	Pinal	3.62
Caribou (New Stock)	1.25	Premier	.53
Claremont	.08	P. S. Petroleum	.18
Coalinga National	.13	Republic	.36
Con. Midway	.02	Silver Tip	.75
Empire	1.05	Sterling	1.47
Enos	.04	S. W. & B.	.16
Maricopa 36	.85	Turner	.95
Midway Premier	.31	Union	98.25
Monte Cristo	1.32	United Oil	.40
Palmer	.74	W. K. Oil	2.25

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. Feb. 29.		Closing Prices. Feb. 29.
Amalgamated Copper	$ 67¼	La Rose	$ 3¼
A. S. & R. Co.	72¼	Mason Valley	12⅝
Braden Copper	5⅜	Miami Copper	24¼
B. C. Copper Co.	4⅜	Mines Co. of America	3¼
Butte Coalition	22⅝	Nevada Con	19¼
Chino	23¼	Nevada Utah	1 1/16
Davis Daly	⅝	Nipissing	7⅞
Dobie	⅜	Ohio Copper	1
Dolores	4	Ray Central	2¼
First National	2¾	Ray Con	17⅞
Foley O'Brien	⅛	South Utah	⅝
Giroux	4¼	Superior & Pittsburg	17
Goldfield Con.	4¼	Tenn. Copper	36⅝
Greene-Cananea	7⅝	Trinity	6¼
Guanajuato Con.	⅜	Tuolumne Copper	3⅜
Hollinger	16¾	United Copper	1¼
Inspiration	18⅝	Utah Copper	57¾
Kerr Lake	3	Yukon Gold	2½

ASSESSMENTS ON COMSTOCK MINES.

Company.	No.	Del. Board.	Sale Day.	Amt.
Yellow Jacket	10	Jan. 29	Mar. 6	0.10
Andes	75	Feb. 3	Feb. 28	0.05
Savage	23	Feb. 8	Mar. 7	0.10
Exchequer	21	Feb. 10	Mar. 6	0.05
Union Con.	28	Feb. 15	Mar. 12	0.15
Alpha Con.	17	Feb. 18	Mar. 13	0.05
Kentuck	1	Feb. 25	Mar. 19	0.05
Challenge	58	Mar. 2	Mar. 26	0.05
Best & Belcher	98	Mar. 15	Apr. 8	0.05
Crown Point	11	Mar. 25	Apr. 19	0.05

LOCAL METAL PRICES

San Francisco February 29.

San Francisco is not a primary market for the common metals except quicksilver. The prices quoted below therefore represent sales of small lots and are not such as an ore-producer could expect to realize. Ore contracts usually call for settlements on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksilver, which is quoted in dollars per flask of 75 pounds.

Antimony	11—11½c	Quicksilver (flask)	46.50
Electrolytic Copper	16—17¼c	Tin	47—48¼c
Pig Lead	4.25—5.20c	Spelter	8—8½c
Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50			

METAL PRICES

(By wire from New York.)

Average daily prices in cents per pound, based on wholesale transactions, standard brands.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Feb. 22	Holiday.	No market.		
" 23	14.28	4.00	6.55	58⅜
" 24	14.33	4.00	6.55	58¼
" 25	Sunday.	No market.		
" 26	14.33	4.00	6.60	58¼
" 27	14.33	4.00	6.60	58¼
" 28	14.33	4.00	6.60	58⅜

SILVER

Below is given the average New York quotation, in cents per ounce, of fine silver for the months indicated:

	1911.	1912.		1911.	1912.
Jan.	54.33	56.08	July	52.57	....
Feb.	52.23	59.06	Aug.	52.17	....
Mch.	52.76	....	Sept.	52.43	....
Apr.	52.32	....	Oct.	53.37	....
May	53.31	....	Nov.	55.77	....
June	53.04	....	Dec.	54.45	....

LEAD

Lead is quoted ordinarily in cents per pound or dollars per hundred pounds delivered at St. Louis or New York. The difference is normally 15c. per hundred pounds, and any larger or smaller difference is promptly met by sales. The daily price in New York is published each week in this column. Below are the average quotations by months:

	1911.	1912.		1911.	1912.
Jan.	4.49	4.43	July	4.50	....
Feb.	4.44	4.03	Aug.	4.50	....
Mch.	4.39	....	Sept.	4.48	....
Apr.	4.41	....	Oct.	4.27	....
May	4.37	....	Nov.	4.30	....
June	4.34	....	Dec.	4.45	....

ZINC

Zinc is quoted as spelter, standard Western brands, and based upon St. Louis or New York delivery. While New York quotations, as a matter of convenience, are commonly used, relatively little spelter actually goes to or comes from New York. The bulk is shipped direct from the plants in the Mississippi Valley to manufacturers, due allowance being made for freight. New York daily quotations are published in this column each week. Below are given averages by months:

	1911.	1912.		1911.	1912.
Jan.	5.47	6.42	July	5.70	....
Feb.	5.52	6.50	Aug.	5.95	....
Mch.	5.56	....	Sept.	5.86	....
Apr.	5.40	....	Oct.	6.10	....
May	5.35	....	Nov.	6.38	....
June	5.50	....	Dec.	6.30	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average monthly quotations in dollars per flask of 75 lb., are given below:

	1911.	1912.		1911.	1912.
Jan.	44.60	43.75	July	48.00	....
Feb.	48.40	46.00	Aug.	50.00	....
Mch.	52.50	....	Sept.	47.50	....
Apr.	50.90	....	Oct.	46.12	....
May	46.50	....	Nov.	45.50	....
June	46.50	....	Dec.	44.50	....

TIN

New York prices are fixed in the American market for tin, since the metal is almost entirely imported. San Francisco quotations, averaging about 1c. per lb. higher than New York, are quoted weekly in this column. Below are given average monthly New York quotations in cents per pound.

	1911	1912		1911	1912
Jan.	41.25	42.53	July	42.40	....
Feb.	41.61	43.00	Aug.	43.32	....
Mch.	40.16	....	Sept.	39.75	....
Apr.	42.18	....	Oct.	41.18	....
May	43.11	....	Nov.	43.12	....
June	44.61	....	Dec.	44.65	....

COPPER

Daily quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Below are average monthly quotations in cents per pound.

	1911	1912		1911	1912
Jan.	12.39	13.92	July	12.47	....
Feb.	12.59	14.10	Aug.	12.41	....
Mch.	12.14	....	Sept.	12.20	....
Apr.	12.02	....	Oct.	12.19	....
May	11.99	....	Nov.	12.61	....
June	12.39	....	Dec.	13.89	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months.

	U. S.	Foreign.	World.
January 1909	122,357,266	124,716,480	247,073,476
January 1910	141,766,111	244,204,800	385,970,911
July "	168,276,017	232,863,680	401,139,697
January 1911	122,030,195	187,705,280	309,735,475
July "	157,434,164	157,184,280	314,618,444
September "	133,441,501	149,887,360	283,328,861
October "	140,894,856	150,841,600	291,736,456
November "	134,997,642	138,512,640	273,510,282
December "	111,785,188	131,447,680	243,232,868
January 1912	89,454,695	158,323,200	247,777,895
February "	66,280,643	154,851,200	221,131,843

UNITED STATES PRODUCTION AND CONSUMPTION

(Compiled from reports of the Copper Producers' Association)

	Production.	Domestic deliveries.	Exports.
February, 1911	109,828,297	50,518,998	45,111,019
March	130,532,080	66,080,789	59,081,127
April	118,185,223	52,407,650	62,129,599
May	126,962,544	64,543,963	61,078,557
June	124,554,312	61,655,561	71,460,519
July	112,167,934	56,982,582	74,880,658
August	125,493,667	59,935,364	69,885,660
September	115,588,950	57,311,584	50,824,011
October	118,255,442	64,068,656	60,084,349
November	111,876,601	68,039,776	67,049,279
December	122,896,697	65,988,474	79,238,716
Total for 1911	1,431,938,338	709,611,945	754,932,733
January, 1912	119,337,753	62,343,901	50,167,904

Current Prices For Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ℔ 100 lb	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ℔ 100 lb	1.00	1.50
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ℔ lb	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ℔ lb	0.09½	0.12
Acid, muriatic, com'l, carboy, ℔ 100 lb	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ℔ lb	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ℔ lb	0.10½	0.15
Acid, nitric, com'l, carboy, ℔ 100 lb	5.25	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ℔ lb	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ℔ lb	0.12½	0.15
Argols, ground, bbl., ℔ lb	0.20	0.25
Borax, cryst. and conc., bags, ℔ 100 lb	2.75	3.85
Borax, powdered, bbl., ℔ 100 lb	3.00	4.00
Borax glass, gd. 3 mesh, cases tin lined, ℔ 100 lb	10.00	11.00
Bone ash 60 to 80 mesh, bbl., ℔ 100 lb	3.50	5.50
Bromine, 1 lb. bottle, ℔ lb	0.45	0.65
Candles, adamantine, 12 oz., 40 sets, ℔ case	4.00	4.15
Candles, adamantine, 14 oz., 40 sets, ℔ case	4.00	5.25
Candles, Stearic, 12 oz., 40 sets, ℔ case	4.75	5.50
Candles, Stearic, 14 oz., 40 sets, ℔ case	4.65	5.20
Clay, domestic fire, sack, ℔ 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100 lb. case, ℔ lb	0.20½	0.24½
Cyanide, 98 to 100%, 200 lb. case, ℔ lb	0.20	0.24
Cyanide, 129%, 100 lb. case, ℔ lb	0.27½	0.28½
Cyanide, 129%, 200 lb. case, ℔ lb	0.26½	0.27½
Lead acetate, brown, broken casks, ℔ 100 lb	8.75	9.65
Lead acetate, white, broken casks, ℔ 100 lb	10.00	10.25
Lead acetate, white, crystals, ℔ 100 lb	11.75	12.25
Lead, C. P., test., gran., ℔ 100 lb	13.00	15.00
Lead, C. P., sheet, ℔ 100 lb	15.00	18.00
Litharge, C. P., silver free, ℔ 100 lb	10.50	13.00
Litharge, com'l, ℔ 100 lb.	7.50	9.00
Manganese ox., blk., dom. in bags, ℔ ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ℔ ton (85% MnO_2—½% Fe)	42.50	50.00
Nitre, double ref'd, small cryst., bbl., ℔ 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., ℔ 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., ℔ 100 lb	7.25	8.00
Potassium bicarbonate, cryst., ℔ 100 lb	12.00	15.00
Potassium carbonate, calcined, ℔ 100 lb	15.00	18.00
Potassium permanganate, drum, ℔ lb	0.11	0.12½
Silica, powdered, bags, ℔ lb	0.03	0.05
Soda, carbonate (ash), bbl., ℔ 100 lb	1.50	1.75
Soda, bicarbonate, bbl., ℔ 100 lb	2.00	2.50
Soda, caustic, ground, 98%, bbl., ℔ 100 lb	3.15	3.50
Soda, caustic, solid, 98%, drums, ℔ 100 lb	2.65	2.85
Zinc shavings, 850 fine, bbl., ℔ 100 lb	11.50	12.25
Zinc sheet, No. 9—18 by 84, drum, ℔ 100 lb	10.00	11.25

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, ℔ ton	*$20.00	$25.00
Arsenic, white, refined, ℔ lb	0.02¾	0.03¼
Arsenic, red, refined, ℔ lb	0.08	0.09
Asbestos, according to length and quality of fibre, ℔ ton	100.00	350.00
Asbestos, lower grades, ℔ ton	10.00	100.00
Asphaltum, refined, ℔ ton	15.00	20.00
Barium carbonate, precipitated, ℔ ton	42.50	45.00
Barium chloride, commercial, ℔ ton	42.50	45.00
Barium sulphate (barytes), prepared, ℔ ton	20.00	30.00
Bismuth ore, 10% upward, ℔ ton	*75.00	upward
Chrome ore, according to quality, ℔ ton	10.00	12.50
China clay, English, levigated, ℔ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ℔ lb	2.50	
Coke, foundry, ℔ 2240 lb	13.50	15.00
Diamonds:		
Borts, according to size and quality, ℔ carat	2.00	15.00
Carbons, according to size and quality, ℔ carat	75.00	100.00
Feldspar, ℔ ton	5.00	25.00
Firebrick:		
Bauxite, ℔ M	175.00	
Magnesite, ℔ M	190.00	275.00
Silica, ℔ M.	42.50	47.50
Flint pebbles for tube-mills, ℔ 2240 lb	16.50	22.50
Fluorspar, ℔ ton	10.00	15.00
Fullers earth, according to quality, ℔ ton	20.00	30.00
Gilsonite, ℔ ton	35.00	40.00
Graphite:		
Amorphous, ℔ lb	0.01½	0.02½
Crystalline, ℔ lb	0.04	0.13
Gypsum, ℔ ton	7.50	10.00
Infusorial earth, ℔ ton	10.00	15.00
Magnesite, crude, ℔ ton	7.50	10.00
Magnesite, dead calcined, ℔ ton	23.50	27.50
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ℔ ton	10.00	25.00
Manganese, prepared, according to quality, ℔ ton	30.00	70.00
Mica, according to size and quality, ℔ lb	0.05	0.30
Molybdenite, 95% MoS_2, ℔ ton	400.00	500.00
Monazite sand (5% thoria), ℔ ton	150.00	200.00
Nickel metal, refined, ℔ lb	0.45	0.60
Ochre, extra strength, levigated, ℔ 100 lb	2.25	3.25
Platinum, native, crude, ℔ oz	40.00	45.00
Sulphur, crude, ℔ ton	15.00	25.00
Sulphur, powdered, ℔ ton	40.00	45.00
Talc, prepared, according to quality, ℔ ton	20.00	50.00
Tin ore, 60%, ℔ ton	450.00	475.00
Tungsten ore, 65%	455.00	500.00
Vanadium ore, 15%, ℔ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, ℔ ton	*15.00	20.00

Company Reports

ATBASAR COPPER FIELDS, LTD.

This company, which is closely affiliated in management with the Spassky Copper Mine, Ltd., and operates mines and smelters in the Khirgiz steppes of Siberia, 230 miles northeast of Djousalie, on the Orenberg-Tashkent railroad, and 600 miles south of Petropavlovsk, on the Trans-Siberian railroad, was organized in London in 1906 with a capital of £250,000 in £1 shares, and in March 1911 the capital was increased to £500,000. The company is in process of development. R. Gilman Brown has reported upon the property, finding 389,000 tons of ore proved, containing copper of a gross value of £3,000,000. During 1911 W. G. Perkins reported upon the possibility of erecting a smelter, and during 1912 a first unit of 100 tons per day capacity, estimated to cost £50,000, will be erected. H. C. Woolmer, general manager for the Spassky company, has been appointed local director of the company, and the Spassky company has an option upon 200,000 of the unissued shares of the Atbasar company.

GIROUX CONSOLIDATED MINES CO.

This company, with properties adjoining those of the Nevada Consolidated, near Ely, Nevada, was organized in 1903, with a capitalization of $5,000,000, which has since been increased to $7,500,000, all issued with the exception of $496,400 retained to retire an issue of 6% convertible first and second debenture bonds. The company owns 249,575 of the 500,000 shares of the Butte & Ely Copper Co. The property is in the development stage, and the report for the year ended December 31 shows that the company has 10,291,000 tons of fully and partly developed ore of a copper content of 2%, and 6,600,000 tons more of an average content of 1.65%. In the Morris-Bunker Hill mine there are 4,010,000 tons of ore averaging 2.14% copper. During the year the Giroux shaft was damaged by fire, but damage has been repaired at a cost, so far, of $34,521. A contract has been made with the Steptoe Valley Mining & Smelting Co. to ship to the concentrating plant of that company not less than 600 tons, nor more than 1200 tons daily of ore, which will be treated by this company at a rate which it is estimated will correspond to a production cost of 9½c. per pound of copper. This contract goes into effect May 1, 1912, and is for a period of five years.

COROCORO UNITED COPPER MINES, LTD.

This company, which operates mines in the Corocoro district, south of La Paz, Bolivia, was organized in London in 1909 with a capital of £700,000, of which 279,657 shares of £1 each have been issued. During the year ended June 30, 1911, some 67,000 tons of ore was produced by the Santa Rosa, Guallatire-Grande, Vicachani, and Toledo mines. The Toledo mine is now closed. The ore was hand-dressed to 47,481 tons of 3.36% ore, in which the copper appears chiefly in the form of the native metal, with very subordinate amounts of chalcocite and domeykite. The mills, of which there are three, one at each mine, produced 2038 tons of concentrate containing 77.38% copper, which is shipped to Europe. The cost of production of the copper is given as £47 12s. 2d. £47 12s. mining and milling, £1 6s. 9d. export duty, £4 12s. 6d. transport to coast, £2 2s. freight to Europe, £1 18s. selling commissions. The district is arid and without timber, and the remote and inaccessible situation of the mines renders working costs high. It is expected to connect the mines by a branch line to the railway to Arica, when the oxidized ore will be treated. The net profit on the year's operations was £9906, making a balance of £14,982, from which it is intended to write off £6260 for depreciation and £7000 for preliminary expenses of formation of the company. These mines have been productive of copper for a great number of years, and are popularly supposed to have been worked by the Incas.

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

THE ECONOMICS OF MINING FINANCE. By M. H. Burnham. Pp. 26; ill. Reprinted from *The Mining Magazine*. For sale by the *Mining and Scientific Press*. Price 50c.

This is a reprint of a series of articles which, under the title of 'The Finance of a Mine', attracted much attention at the time of their publication in *The Mining Magazine* during 1911. The author's discussion of this topic is profound, and indeed is perhaps, in many instances, above the heads of his readers, who are apt to be appalled by such impressive formulæ. And in putting mine finance upon a sound basis, he is also inclined to be too strict, from a business standpoint. These are the criticisms of excellence, however, and Mr. Burnham's able exposition of a subject too frequently shrouded in profound mystery will be of the greatest service and interest both to engineers and investors.

ENGINEERING AS A VOCATION. By Ernest McCullough. Pp. 201. David Williams & Co., New York, 1911. For sale by the *Mining and Scientific Press*. Price $1.

The author of this interesting volume has written, out of a wide experience, a book which is intended for the high-school student about to choose a vocation, and for his parents. It consists of six chapters upon the engineer, the work of the engineer, the education of the engineer, home-study courses, how to hunt and hold a job, and whether it pays to study engineering. In an appendix to the volume the author admits that the chief reason for the preparation of the book was to secure the publication of the concluding chapter, which had been refused by several civil engineering journals as not sufficiently optimistic in tone. As a matter of fact, the author, while somewhat cynical, is eminently fair and open-minded. A perusal of the book can safely be recommended to all parents and youths, as an antidote to much of the drivel that is published in newspapers and non-technical journals as to the opportunities and rewards of the engineer. To the conclusion that the majority of students should receive a professional training in either engineering, law, or medicine, and then utilize this as the equipment for whatever vocation may open to them, rather than swelling the ranks of those who merely mark time in their profession, many will be inclined to agree.

THE METALLURGY OF IRON AND STEEL. Vol. I and II. By F. W. Harbord and J. W. Hall. Pp. 933; ill. Chas. Griffin & Co., London, 1911. For sale by the *Mining and Scientific Press*. Price $12.

The first edition of this well known work appeared some years since, and was so well received that the present is the fourth edition. With each revision the work has gained in size until it now appears in two volumes, for convenience in use. This is admirable, for the second volume, on the mechanical treatment of steel, by J. W. Hall, is the best presentation of the topic available in any language, and many will wish to possess it, even though not steel metallurgists. This treatise is too well known to need an extended review, and it will suffice, therefore, to mention those features in which the fourth edition differs from the third. In the first volume new drawings illustrate the late modifications in open-hearth furnaces, charging machines, and gas producers, while basic open-hearth practice and electric smelting are rediscussed in the light of recent developments, and plans of new plants in America and Europe are given. The volume on mechanical treatment has been revised throughout, and new chapters on exhaust steam turbines, the generation of steam by solid fuel and waste gases, the production of power by gas-engines using blast-furnace gas, and the electric driving of mills have been added, so that what was already the best is further improved. It is the most readable of all the larger works on steel.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

MINER'S LIEN—WHO ENTITLED TO

A person employed by a mining company as general manager and superintendent, and who has charge of mining operations which require his personal supervision, and require him to perform personal manual labor, and who actually performs manual labor upon the mining claim, for the benefit, development, and operation of the property, is entitled to a lien under the statute of South Dakota which provides that every miner or other person who at the request of the owner of the mine shall perform labor on such mine shall have a first lien thereon prior to other liens. The fact that such person was a stockholder and director of the mining company does not preclude him from being employed by it and from being entitled to the lien, though he had received other moneys from the mining company as payment for commission on the sale of corporate stock made by him, where he claimed no lien on account of such commissions.

Hahn v. Anaconda Gold Mining Co., (South Dakota) 128 Northwestern, 128. October 1910.

DISCRIMINATION IN FACILITIES FOR SHIPMENT OF COAL—DAMAGES

A common carrier is liable for an illegal discrimination for furnishing transportation facilities for shipment of coal, and in an action for such discrimination the measure of damages is what would be a reasonably fair profit on the fairly probable output of the mine discriminated against, less what was actually shipped from the mine. And the fact that coal belonging to the coal company was left in the ground and might be available for future shipment is immaterial on the question of damages, in the absence of proof of what the coal company would realize for such coal if shipped in the future as much as it would have realized if shipped during the period of the alleged illegal discrimination.

Hillside Coal & Coke Co. v. Pennsylvania R. R. Co., (Pennsylvania) 78 Atlantic, 28. July 1910.

OPTION CONTRACT FOR THE PURCHASE OF A VEIN OF COAL—ACCEPTANCE

An option for the sale and purchase of a certain vein of coal and mining right, called for final acceptance by a specified day, and gave the vendee the right thereafter to object arbitrarily to the quality of the coal, the character or location of the surface, or to any title or conveyance, or to the terms of mining rights, and if the vendors were unable or unwilling to remove the same, then either party had the right to rescind the sale. In an action to enforce the contract it was held that after a final acceptance by the vendee, investigation of the coal, coal beds, surface and mining rights, and the final election to take the property agreeably to the terms of the contract, and calling for abstracts of title and deed, the vendee thereby waived the right to interpose such arbitrary objections, and upon tender of abstracts of title and a deed conveying a good title and reasonable and adequate mining rights, the vendors are entitled to specific performance of the contract. And the fact that the vendor was not the actual owner, but was the agent of the owner, and represented the owner as agent, all of which the purchaser well knew, is not such lack of mutuality as will excuse specific performance by the purchaser, where it is shown that the purchaser knew the authority and contract of the vendor had been ratified by the owner.

Armstrong v. Maryland Coal Co., (West Virginia) 69 Southeastern, 195. October 1910.

THE Earle Power Co., of Salt Lake, has filed its articles of incorporation, with a capitalization of $250,000, of which $75,000 has already been subscribed.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends

L. D. HUNTOON is now in Missouri.

F. L. SIZER has gone to Plumas county.

A. C. VEATCH has been in San Francisco.

A. W. PRIOR has returned to Los Angeles.

RALPH ARNOLD was in San Francisco last week.

J. D. HUBBARD is expected in San Francisco next month.

W. S. KEITH has returned to San Francisco from Placer county.

H. W. TURNER was in San Francisco and has returned to London.

T. A. RICKARD is expected in San Francisco at the end of March.

H. W. METCALFE has left England for the Federated Malay States.

R. Y. HANLON expects to return to the United States from Manila shortly.

J. S. WILSON has been elected a director of the Dome Mines Company.

J. W. FINCH is lecturing on economic geology at the University of Chicago.

W. C. DECAMP is in charge of the Creede Trinne Mines Co., of Creede, Colorado.

MALCOLM MACLAREN returned from Cordova to Seattle and has gone to Juneau, Alaska.

E. S. BERRY is on his way to Chile to inspect the properties of the Braden Copper Company.

WILLIAM H. HENDRICKSON is now manager for the Horn Silver Mining Co., at Frisco, Utah.

WALLACE BROAD is on his way to Changsha, Hunan Province, China, by way of Siberia.

W. H. STORMS has returned from Bakersfield, where he has been studying conditions in the oilfields.

B. R. BATES is now with the El Rayo Mining & Developing Co., S. A., at Santa Barbara, Chihuahua.

GEORGE D. JAMES has opened an office as consulting engineer at 1103 Boston building, Salt Lake City.

S. E. BRETHERTON has returned from a professional trip to Winthrop, Shasta county, California.

GEORGE G. VIVIAN is manager of the Pittsmont plant of the East Butte Copper Mining Co., Butte, Montana.

ROSS E. BROWNE is recovering nicely from an operation which he recently underwent at the Adler Sanitarium.

GEORGE J. HOUGH has sold his assay business at Salida, Colorado, and is engaged with a mining company in Zacatecas, Mexico.

H. V. WINCHELL was in San Francisco early in the week and has gone to Toronto to attend the meeting of the Canadian Institute.

H. KENYON BURCH is at Globe, Arizona, on professional business. He has opened offices as mechanical and metallurgical engineer at 503 Union Oil building, Los Angeles, California.

Obituary

WILLIAM ASHLEY WHITLEY, one of the California pioneers, died in San Francisco on February 23 of pneumonia. He was 72 years of age, having come to California from Missouri in 1861. During the years that followed he was prominent in mining on the Comstock and elsewhere in Nevada, California, and Montana. He was a close friend of George Hearst, and was an intrepid explorer and adventurer. During recent years he was engaged in the contracting business in San Francisco, where two sons and two daughters survive him.

Recent Publications

MASSACHUSETTS INSTITUTE OF TECHNOLOGY. CATALOGUE. 500 pp. Boston, 1911.

GEOLOGIE DU CANTON DE FABRE, COMTE DE PONTIAC. By Robert Harvie. Bureau of Mines, Province of Quebec. Pp. 36. Quebec, 1911.

CHINA: SOCIAL AND ECONOMIC CONDITIONS. Annals of the American Academy of Political and Social Science, Vol. XXXIX, No. 128. This volume consists of a series of sixteen articles upon various topics of present interest regarding China, and in view of the widespread attention attracted by recent political changes in that country, is likely to be of much service. The articles are of very unequal value; Arthur H. Smith writes informingly of reconstruction in China and contributes the best of what is new, as the articles by Frederick McCormick and B. Lenox-Simpson (Putnam Weale) have previously appeared. Several articles by Chinese students in American universities derive their chief interest from their authorship, while the articles by Hawkes-Pott, Hinckley, Edwards, Cadbury, and Anderson are excellent discussions of special topics. The article on the geography and resources of China is so poor that it seems remarkable that the author of it could not have done better with the aid of the books of reference which he cites.

Catalogues Received

ALLIS-CHALMERS CO., Milwaukee, Wisconsin. Bulletin No. 1801. 'The Isbell Vanner.' 20 pages. Illustrated. 8 by 10 inches.

ALBERGER PUMP CO., 140 Cedar St., New York. Catalogue D. 'Centrifugal Pumps and Steam Turbines.' 72 pages. Illustrated. 6 by 9 inches.

SEAGER ENGINE WORKS, Lansing, Mich. 1912 Catalogue. Describing the Olds gasoline engines for industrial use, traction engines, and mine hoists. 48 pages. Illustrated. 6 by 9 inches.

RUGGLES MACHINE CO., Poultney, Vermont. Catalogue describing this company's aerial carrier. These carriers will run on an inclination of 15% on a fall of 1 ft. in 15 ft. on short cables. The carrier will lift a load from any depth to the cable, when the carrier is automatically and instantly released and sent on its way to the desired spot where the load is automatically dumped, or lowered to the ground according to the manner in which the dumping hooks are arranged by the men in the pit. One engineer can manipulate three of the carriers on as many cables with a three-drum engine. They are also used for stripping and conveying material of all kinds. This catalogue is well prepared and will be sent on request. 30 pages. Illustrated. 7 by 10 inches.

INTERNATIONAL MOTOR CO., Broadway and 57th street, New York. This company is a consolidation of the Mack Motor Co. and the Saurer Motor Truck Co. Very attractive catalogues have been issued covering the Mack truck as well as the Saurer, showing the extensive field for motor-driven vehicles, particularly for delivery purposes and heavy trucking. The Saurer motor truck during 1911 was given an exceedingly severe test, as a 4½-ton truck carrying 7000 lb. traveled from the Atlantic to the Pacific Coast, over 5263 miles, with no mechanical trouble. This trip was over good roads and bad roads, as well as over miles of desert country. The numerous illustrations in the catalogue cover the use of motor trucks in a great many industries as well as for overland travel and through mountainous country. It is claimed by the International Motor Co. that during the past 10 years, Saurer trucks have won 53 first prizes in European government and automobile club contests and that they have won every event and every contest entered. Motor-truck transportation is rapidly displacing the horse; and anyone interested in this subject will find much of value in these attractive catalogues, which will be sent on request.

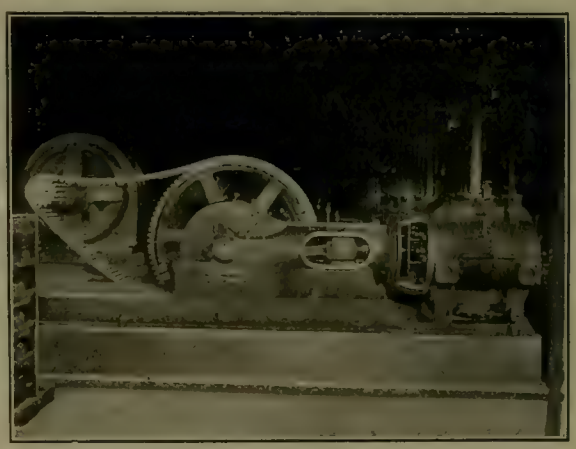
Commercial Paragraphs

The WATT MINING CAR WHEEL CO., Barnesville, Ohio, announces that it is no longer represented by Ira E. Stevens or the Stevens Mine Car Co. of Chicago, Illinois, and that in the future all inquiries and orders will be handled direct from Barnesville.

A. C. VEATCH, having returned from a year's examinations and explorations in the Trinidad and Venezuela oilfields, and having resigned from the United States Geological Survey, where he was geologist and chairman of the Land Classification Board, announces that he will practise as a consulting geologist, specializing in oil, with an office at 3415 Ashley terrace, Washington, D. C.

T. R. BROOKS, for 15 years with the Risdon Iron Works and of late with the Union Iron Works, has resigned from the latter concern and with W. E. MUSHET has formed a partnership under the name of the W. E. MUSHET CO. This firm will have offices in the Hooker & Lent building, San Francisco, and will act as manufacturers' agents for mining machinery, steam-plant equipment, and similar lines.

The accompanying illustration shows one of three 125-hp. maximum silent chain drives recently furnished the Illinois Pacific Glass Co. by the MEESE & GOTTFRIED CO. of San Francisco. The chains are 9 in. wide, 2-in. pitch, and run



at a speed of 1560 ft. per minute, driving Dow double-acting duplex air-compressors for supplying compressed air to the various departments of the factory. Sprocket wheels on air-compressors are 5 ft. diam., those on the motors being 11 in. diameter.

A deal of considerable interest in machinery circles has recently been made whereby the WISCONSIN ENGINE CO., of Corliss, Wisconsin, has acquired the United States rights for the manufacture and sale of the Grine-Nelles crude oil gas producer, formerly owned by the Gas Power Machinery Co., of Los Angeles, California. The negotiations which have extended over a period of some months were conducted by Fred C. Nelles, president of the Gas Power Machinery Co., and E. T. Adams, president of the Wisconsin Engine Co., and were closed in Chicago about two weeks ago. The apparatus was developed and demonstrated in Los Angeles, where it has been in operation successfully for the past year on the low-grade California oils. A carbonaceous fuel bed overcomes the difficulties heretofore encountered in all attempts to develop a producer that would operate continuously on crude oil. Under the Grine-Nelles system regular twenty-four hour a day service is maintained with a single shell, and very remarkable economies have been secured. Edward A. Rumely, of M. Rumely Co., will be associated with the Wisconsin Engine Co. in actively entering the market wherever cheap oil can be obtained, and W. K. Thompson, 705 Union Oil building, Los Angeles, California, is Western sales manager.

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EDITORIAL

PERHAPS that $70,000,000 promoters' fee had nothing to do with the increased cost of living—and perhaps it did.

TESTS made at the experimental mine of the United States Bureau of Mines confirm the suggestion that rock dust may be used to localize the effects of a coal-dust explosion in mines, and point the way to markedly decreasing danger from this source.

REVIEW of the action of the United States Circuit Court of Appeals in the case of the farmers against the smelter at Anaconda, Montana, is promised. The conclusion may not be better founded but it will be final. There is much in the remark of the State House janitor that "the supremeness of the Supreme Court consists mostly of the lastness of its guess."

TRADE between the United States and the Philippine Islands has shown a steady growth during the past decade and has now reached the pleasing sum of over twenty million dollars worth of imports, and exports of equal value. Imports consist chiefly of sugar, manila fibre, copra (cocoanut meat), tobacco, and hats, while exports from the United States are chiefly manufactured articles, supplemented by foodstuffs. Mining shows encouraging growth, as set forth in the letter from our Manila correspondent, who, with true Western spirit, is inclined to regard the doughnut rather than the hole. Development in the Philippines has been hampered by natural conditions, as well as by the operations of those who were more concerned with the advancement of personal fortunes than the development of industry, but the outlook seems to be brightening.

ADVANCE in silver prices will require many readjustments in industrial circles. It has been estimated that the recent rise corresponds to an increase of over $2,000,000 in the income of the leading producers in North America, while exchange between the United States and countries upon a silver basis has risen nearly 15 per cent since last autumn. This operates seriously to the disadvantage of the new Chinese republic, which will have to pay for its loan of 20,000,000 taels almost 15 per cent more than would have been necessary six months earlier. China will require large sums in silver to meet the cost of the recent outbreak, while later industrial expansion, if the hoped-for changes are brought about, will continue the demand. India is expected to be a heavy buyer, so it is not unreasonable to expect that later in the year silver will reach the price it commanded early in 1907.

DURING a discussion, not long since, at one of the meetings of the Institution of Mining and Metallurgy, a distinguished member whose name we will forbear mentioning, in speaking of our knowledge of the genesis of metallic ores said that it "has been illuminated by the geographic [?] work of L. deLaunay, Malcolm Maclaren, and some American workers." This might be humorously cited as an example of extreme British conservatism, were it not that a similar tendency to slur over the work of others is all

too common on this side of the Atlantic as well. It is a remarkable fact that scientific men, even those of the highest attainments who might reasonably be expected to give every fact its due weight, show a deplorable tendency to cite the conclusions of other workers when they can be shown as fallacious, but to ignore the results of those who were correct. In children this would be ascribed to the psychology of adolescence, in grown men of scientific attainment and supposed intellectual honesty it is an unnamable but unfortunate phenomenon. There is credit enough for all; honor is a commodity of which the supply is not decreased by free use. A more generous spirit among scientific workers would lead to better feeling among those with whom *noblesse oblige* should be a guiding principle.

STEALING gold is a pleasant pastime too common among miners. There are few districts in which specimen ore occurs and in which there is no trouble. In Gilpin county, Colorado, operators are now making an effort to stop the illicit traffic. At Grass Valley distinct progress has been made in that Mr. George W. Starr recently secured the conviction of one thief. Juries can seldom be found that will bring in a verdict of guilty, but repeated trials have at last aroused the public conscience of the community. It is one of the distressing features of this traffic that the 'ignorant foreigner' is by no means the worst offender and that the thieves often have connections higher up. There is but one permanent cure, and that is development of a sound public opinion such as is present, even if sometimes latent, in every American community. Keep everlastingly at it, Gentlemen, despite the discouragements that too often follow attempts to secure justice. Thieves have no place in American life, whether in the stope, the counting room of 'high finance,' or on the public highway.

BOLIVIA has long been famous as a producer of silver and gold. The bonanzas of Potosi take second rank only to those of Guanajuato, and it has been estimated that between 1545 and 1800 there was coined from their output over 800,000,000 Spanish dollars, with an equal amount from other sources. More recently its tin resources have become prominent, the Bolivian production of that metal only being surpassed by the output of the Malay peninsula and adjacent islands. Gold mining has been less developed, though *lavaderos* have existed from early times. Recent discoveries have served to largely increase the importance of these, and interest in Bolivia has been greatly stimulated, especially upon the Pacific coast. We are fortunate in being able to present this week an authoritative article by Mr. Carlos Sanjines, Consul for Bolivia at San Francisco. Mr. Sanjines gives useful information as to mining regulations and cost of travel, to which we may add that letters from those already in the field report encouraging results, but urge that prospectors should not make the venture without an ample grubstake. Bolivia is a fine habitable country where large areas are open to prospecting under much less hardship than must be incurred in many parts of the United States. Living is good, the people are friendly, and a number of rivers have already been sufficiently prospected to prove the presence of rich placers.

ABOLITION of discovery as a precedent to location of mineral claims, is suggested in the informing article prepared by Mr. H. V. Winchell for the Canadian Mining Institute that we print this week. Discovery and apex rights were originally linked on the basis that a prospector, having found mineral, should be entitled to the whole of the find, while land not actually mineral in character should be reserved for other use. The principle is good, but in practice both discovery and apex rights introduce complications and are, we believe, likely to be abandoned. In the case of oil, deep placers, and many lode claims, actual discovery is impossible without such expenditure as should be given protection. It has been said that genuine discovery of the Anaconda vein would have required a shaft 200 feet deep. At Ely, on many claims, the orebodies were covered by ten feet or more of solid limestone. Obviously in these cases no real discovery could be made at the surface. In practice it was long common to set up a stake without discovery, and until the Forest Service and Land Office became active and inquisitive, any bit of mineral answered the requirements. The many difficulties incident to rival claims under these conditions have imposed a serious tax on development. It would be much simpler to do away with the requirement of discovery and allow any ground to be staked, and to stiffen the requirements as to regular and continuous working so as to make it unprofitable to hold ground which is really nonmineral in character. Mr. Winchell's paper contains much food for thought. We shall follow it with others bearing on the subject, and hope that all points of view will be presented while the general subject of revision of the mining law is being discussed.

Smelter Fume in Japan

When facing an intricate problem it is always interesting, and often profitable, to learn how your neighbors have met the same difficulties, and in the treatment of smelter-fume help from every source is desirable. In densely settled countries with well developed industries, such as the Eastern part of the United States, and Europe, it is possible, by finding a market for sulphuric acid, to dispose of the sulphur in the fume economically and satisfactorily. In Utah, Montana, and California this is only feasible on a limited scale. There is no present or imminent market for the sulphuric acid that might be made at Anaconda alone, and, if it were economically possible to ship acid from Montana to the Eastern states, this would merely result in disorganization of established industries. It is unnecessary to review here the various attempts made in the Western states to meet the difficulties of an admittedly serious situation. These have been chronicled from time to time in our news pages, and while there is distinct promise of final relief, it is fair to say that at present no entirely satisfactory means of handling smelter fume in the states mentioned has been devised. The final solution must be a process which prevents escape of injurious material from the stack, and which is applicable if not with profit, at least without serious loss to the smelting company.

Pending perfection of existing processes or invention of better ones, and owing to our imperfect methods of legal procedure, it has been customary to close the offending works by injunction. In determining whether such injunction shall be made permanent, the relative measure of damages is not, unfortunately, the principal factor. It should be clear that closing a smelter cuts off the revenue from the only interest having sufficient at stake to warrant the heavy expenditures necessary to perfect a satisfactory technological process. This is aside from the incidental damage to the community in destroying what is often the chief source of income of the particular community. This bears certain analogies to the universally condemned 'cutting off one's nose to spite his face,' and also the killing of the 'goose that lays the golden eggs.' If the smelters are not to perfect the technology in this case, who will? And how are they to do it if their revenue is impaired? In fairness, it must be stated that in several cases the courts have refused to issue or enforce injunctions for a period during which experimental work was being conducted. This, we believe, is a sound policy and may well be extended.

In Japan they do even better. Conditions in that country

are not unlike those in our Western states in main essentials. In particular, there is the same condition of undeveloped industry that prevents the direct utilization, in the form of sulphuric acid, of the sulphur in smelter fume. On the other hand, agriculture is highly developed and every acre of cultivable land is used. Damage to crops is a serious matter where nearly fifty million people must be sustained in an area about equal to that of California and with but 12 per cent of the land suitable for cultivation. Establishment of smelters in such a country, necessary as it is, brings up smelter-fume problems in their most acute form. The smelting industry of Japan is still in an early stage so far as industrial organization is concerned. There is no great 'smelting trust' and custom smelting is not general. Practically each large mine has its own smelter, or, rather, each large mining partnership has at least one smelter. The three leading copper mines of the country each supply a separate plant. The Kosaka mine of the Fujita company is situated in the mountainous country of the far northern provinces where little damage is possible. The Osaruzawa mine of the Mitsu-Bishi company is in the same situation. The Ashio mine of the Furukawa company is in a region where the valleys are devoted to rice farming and great care is therefore necessary to neutralize both the smelter fume and the waste water from concentrating mills. For the first the Asano process of treatment with lime-water has been adopted, and, while not entirely successful, it accomplishes such a degree of neutralization as permits the smelter to continue in operation. In the treatment of the waste water from the mills neutralization with lime-water has been combined with sand filtration so effectively as to produce an actual profit from copper otherwise lost.

At the Besshi mine of the Sumitomo company, perhaps, the experience has been most informing of all. This mine is now producing about 600 tons per day of ore containing 30 to 33 per cent of sulphur. The ore is smelted in blast-furnaces, with pot-roasting of the fine material, in an excellent modern plant built in 1904 on Shisaka island, to which the works were removed from the mainland to prevent further damage to agriculture from fume. The island is in the Inland sea ten miles from the nearest important land. Despite this distance, complaints of damage continued after the erection of the new works. Experiments have accordingly been undertaken to determine methods of preventing damage. These experiments have been made by the engineers of the company under the supervision of a commission of technical men, appointed by the Government. This same commission, it may be noted, has full charge of all matters relating to fume damage, and complaints are made to, and adjusted by, it rather than the courts. In other words, technical matters are judged by technical men, rather than left to decision by judge and jury. The commission includes professors of mining, forestry, and agriculture in the Imperial Universities, and the particular committee handling the experimental work includes Mr. Wataru Watanabe, the director of the Engineering College of Tokyo Imperial University, chairman; Mr. Jisaburo Yokobori, professor of metallurgy at the Kyoto Imperial University; and Mr. Yoshitaro Watanabe, professor of metallurgy in the Kyushu Imperial University. Agricultural experiment stations are maintained on the main islands on three sides of the plant and careful observations are being made of the effect of each change as made. One interesting test was as to the effect of dilution resulting from the height of the chimney, which rises 212 feet above the plant. It was found that the percentage of SO_2 in the air on the mainland was not different when the smoke was released at the base of the stack from what it was when released from the top. In other words, any reasonable height of stack was insignificant in comparison with the horizontal distance within which damage was claimed. Attempts were made to neutralize the SO by mixing coal gas with the furnace gases, and the amount was brought down to one per cent. Interesting experiments are now under way, in the direction of clearing the fume by sucking it through a 2 inch layer of filtering media of various sorts. Many of the lines of research undertaken proved unprofitable, others are promising, none have as yet proved entirely successful and at the same time economical. Under conditions obtaining in the United States probably an injunction would be issued and the works closed. Instead, they are running, and good crops are being regularly harvested. In the agricultural experiment stations conducted as a part of the general investigation it was found that damage was done by the fume in only a certain limited portion of the growing season. In the case of rice, the main crop, the injury occurs almost altogether within 20 days of the year, though danger extends through 40 days. Accordingly the crops are watched by experts, and when the danger season arrives, notice is sent to the smelter. The output then is reduced by one-third, and the plant continues to run at the lower capacity for 40 days, or until notice from the experts indicates that the rice is past danger of damage. The remainder of the year the plant runs at full capacity. This appeals to us as a simple and effective method of meeting present difficulties pending perfection of process such as will permit smelters to run profitably at full capacity and without question of damage to agriculture. We commend it to the attention of state and national authorities in the United States.

The British Language

Certain anecdotes are perennial in nature, and the legend on a shop on the Rue Rivoli, Paris, "English spoken and American understood," is often cited. The content of the jest is not all humorous, for to the foreigner the differences in intonation and accent, added to rhetorical divergences, are quite enough to prevent comprehension of the one by a person who has only a limited acquaintance with the other. Americans not infrequently find difficulty in readily following the conversation of a British friend, especially if he drops into what has not altogether inaptly been termed 'English brogue.' An instance is seen in the quotations, given in our Kalgoorlie letter, from a cablegram sent by an Australian mine manager to his London office, "Lode is disturbed by slide. * * * (The Horse-Shoe and Ivanhoe lodes are frequently disturbed by slides.)" The natural inference from this is that the outcrop of the vein has been carried away by a landslide, though it is far from obvious how this could happen frequently. But a closer scrutiny shows that this cannot be the case, as the context shows that the reference is not to the outcrop, but to the vein on the 2800-foot level. Presumably the idea which it is desired to convey is that the vein is faulted; a not uncommon phenomenon in the Horse-Shoe and Ivanhoe veins. Similarly, a reference to the "strike of the British colliers" does not mean that vessels have collided, but that coal miners have ceased work. Without multiplying instances, it is evident that American slang has its analogue abroad. Slang has the advantage that it is sometimes picturesque and forcible, while the use of common parts of speech in an obscure or colloquial sense is merely confusing, without any compensating advantage. A few colloquial or slang words introduced into speech or writing often serve to give a distinctive flavor; like the shred of garlic in the salad; but in both cases judgment and discrimination are necessary. The purpose of written speech is to convey information, with the possible exception of in some company reports. Good judgment, therefore, dictates the choice and use of language in such a way as will best attain the end desired.

The Mining Law—Its Faults and Suggested Changes

By Horace V. Winchell

*The question of national mining laws is of special interest just now in both Canada and the United States. Attention has been widely called to the many defects and general insufficiency of existing statutes, and wherever the matter has been discussed, the need for revision has been admitted. In the United States during the past decade there has been frequent agitation of the subject. Public officials connected with the administration of our land and mining laws have urged legislation along certain lines; the Director of the Geological Survey and the Secretary of the Interior have discussed it in their annual reports; and the matter has engaged the attention of Presidents, Mr. Roosevelt and Mr. Taft discussing it in messages to the Congress. Associations and societies of various descriptions, after due consideration, have passed resolutions demanding this or that measure of relief, and in some cases committees have been appointed for the purpose of making recommendations as to the principles to be followed in new legislation. Thus, a few years ago a committee of prominent mining engineers, among whom were John Hays Hammond and James Douglas, united in a report upon this subject to the Government at Washington; but nothing came of it, and so far as I can learn, the report was never even published. More recently the matter has again been agitated and committees for its consideration have been appointed by the American Mining Congress and the Mining and Metallurgical Society of America.

Canadian Proposals for Change

The United States might well profit in this matter by the very sensible and systematic method which has been adopted in Canada to facilitate the proper settlement of this most important question. Here, as I am informed, a committee of engineers and attorneys has been selected by the Canadian Mining Institute to draft a bill for a Canada Mines Act, and to present the same for consideration and adoption by the Dominion Parliament. In other words, you Canadians are proceeding in the best way to procure laws framed by experts; and none can doubt that statutes thus prepared are in every way superior to enactments whose subject matter is prepared by theoretical political economists on the one hand or by agitators and professional politicians on the other. I wish therefore at the outset to commend the Canadian Mining Institute for its very wise procedure in this matter and admonish you not to weary in well-doing, nor to be disheartened at slow progress. When you have accomplished what you have set out to do, you will not only have that pleasant sense of satisfaction which succeeds the consciousness of duty worthily performed, but you will have made an investment of time and labor which will return a thousand-fold in actual wealth and prosperity. For that country which is willing to be guided as to the handling and development of its mineral resources by the crystallized policies of its mining engineers is the country whose mining industry will be at once best managed and the most productive of material blessings for all the people.

Systems of Mining Law

The mining laws of a country are those legislative enactments or customs established by precedent which control the acquisition and tenure of mining rights and property, in contradistinction to 'mining regulations' which have to do with the methods and appliances used in operating mines. The principles underlying the mining laws of various countries have been found susceptible of classification into two groups: "(1) The *concession* system under which the state or a private owner of mining property has the right to grant concessions or leases of such mining property to individuals or corporations at discretion, or under certain general restrictions. (2) The *claim* system, under which any individual, under certain general specified restrictions, generally as to nationality and color, has the right to locate on discovery or otherwise certain limited areas of ground, and under certain conditions to hold, work, and dispose of the same."[1]

Under the concession system the right to grant lies with the owner, and it is said that five-sixths of all the mining areas of the world are held under it; under the claim system the right to claim mining ground lies with the locator or discoverer. The latter is the system underlying the laws of Canada and the United States, as well as South Africa and Australia; but there are fundamental differences in these countries as to the nature of the possessory right and the character of title finally obtained.

The Concession System

Originating in the ancient proprietary rights of kings and feudal lords to the minerals in the ground, the concession system still prevails in more or less modified form under all the ancient civilizations of the world. Its chief advantage is in the retention by the state of the right to select and control the operations of its concessionaires, thus assuring proper capitalization and development, good management, economical use of raw material, and the payment of rental or royalty.[2] To this system there have been objections as follows: (1) that it places unduly large property control in the hands of a few men, and takes from the poor working man the chance of sudden wealth; (2) that by destroying competition in the sale of mines it places in the hands of the holders of large concessions the power of unlimited capitalization and speculation; (3) that it leads to the tying up of large areas of mining ground and thus restricts the employment of labor and the mineral production of the country. To these objections it may be answered that a relatively small number of men will always have control of the money with which to buy and develop mining property, no matter how it be granted; that the Government may easily regulate the capitalization of its lessees; and that a large, strong corporation is usually better prepared to thoroughly prospect its territory than the unaided though far more numerous prospector. If diligent prospecting is required as a condition in the concession, the system of preference rights to explore large areas with the further right to take out leases of limited area would seem to present many practical advantages for new and unexplored countries.

The Claim System

The claim system grew out of conditions in early mining days in the United States and Australia. The Argonaut horde who invaded California in 1849 and a few years later rushed to Australia were in many cases allowed to make their own local rules as to size of claim, method of discovery, staking, recording, and obtaining title. In the United States the usages thus established were later sanctioned by Congressional enactment which grew into our present system of mining law, and also served to greater or less extent as a model for Australia and other nations. This system, "however necessary in the peculiar circumstances of its inception, should have been altered as soon as changing circumstances permitted," but instead it has been patched and interpreted by judicial decision until the United States has today the most wretchedly inadequate and antiquated law with which a great country is anywhere afflicted. Instead of fostering the mining industry the law as it stands today and as interpreted by the judicial and

*Presented to the Canadian Mining Institute at the Toronto meeting, March 6.

[1] 'Mining Law of the British Empire,' C. J. Alford, London, 1906, p. 1.

[2] Alford, *loc. cit.*, p. 2.

executive branches of the Government creates confusion, entails unnecessary expense, causes waste, and retards development.

Common Principles

Two fundamental principles are common to the mining laws of all countries: (1) The right of the mine holder to a perfectly secure and indefeasible title to his property so long as he fulfills certain specified conditions entirely within his own control, and (2) the right of the state or other landlord to certain rents, royalties, or taxes on the property or its output, and to the reasonably constant operation of the mine.

In the power of the Government to fix the rate of royalty or taxes lies also the ability to promote or to discourage prospecting and mining. If the chief aim of the Government is the development of national resources and the increase of general prosperity and business, its policy for the disposition and holding of its mineral lands will be most liberal. If there is a desire to enrich the public treasury directly by means of revenues from taxes upon mines, the result may be a rapid decline of the mining business, and a shifting of the population to more favored communities. It is frequently stated, and truly, as I believe, that the principal factor in the growth and development of the United States and Canada has been the liberality of their policy for the distribution of their public domain. Freely, or at a nominal consideration, homesteads and mines have been offered to all who chose to come and settle, to develop and use. If during the past fifty or seventy-five years the policy of conservation as now advocated by its most ardent proponents had been expressed in our statutes North America would be for the most part as little developed as Alaska. There would be a line of settlements along the Atlantic and a few fishing hamlets on the Pacific. The interior of the country would still be to a very large extent bottled up and conserved; and the country would perhaps be still importing the bulk of its copper and iron as it is its supply of tin, platinum, potash, and nitre.

Mineral Wealth of the United States

To speak to an audience of mining men of the importance of a liberal mining law is like carrying silver to Cobalt or copper to Butte, but since these remarks may find a wider audience, a few words upon the extent of our mining industry may not be out of place. First, with reference to the United States. The annual products of the mines of the United States now exceed $2,000,000,000 in value. They contribute 65% of the freight traffic of the country. The industry employs over a million men at the mines and twice that number in handling, transporting, and manufacturing the products.[3] The total value of our metallic products during 1907 was $900,000,000; of mineral fuels, $788,000,000; and of non-metallic mineral products, other than fuels, more than $378,000,000. During the year we imported mineral products to the value of $255,000,000 and exported mineral products to the value of $340,000,000. From the beginning of coal mining in this country in 1814 to the close of 1907, there were mined nearly seven billion (6,865,000,000) tons. Adding to this the one-half additional supposed to have been wasted in mining, gives a total of more than ten billion tons taken from the supplies originally available. The amount of easily accessible and available coal in the United States, exclusive of Alaska, is estimated as 1,400,000,000,000, while the total, including Alaskan reserves of 150,000,000,000 tons and the coal not easily accessible, is perhaps double this amount, and the country is as yet but partly explored. It may be remarked in passing that since the United States is now mining about 500,000,000 tons of coal annually we would appear to have a coal supply sufficient for about 6000 years at the present rate of consumption, even without borrowing or buying from the enormous coal bins of Canada. Can anyone doubt that the provisions of the laws governing the disposition of the fifty million acres of coal land still remaining in the hands of the Government is a matter of importance to a nation with an annual coal consumption of five tons per capita?

[3]Report of the National Conservation Commission, Vol. I, p. 95, Washington, 1909.

Area of Public Lands

Figures are wanting as to the quantity and value of other mineral products estimated to remain within the unappropriated public domain. The land area of the United States, excluding Alaska and the insular possessions, is about 3,000,000 square miles, or 1,920,000,000 acres. Of this area over half is arable, and a little less than half is occupied as farm land. About two-thirds of the land has passed into private holdings. Of the original acreage there remained on July 1, 1908, 387,000,000 acres, or about one fifth open to entry. Nearly all of this is arid or otherwise unsuitable for settlement by families. There are also about 235,000,000 acres in national forests, national parks, and other lands reserved for public use. Of the entire area of 1,920,000,000 acres there remain unalienated about 622,000,000 acres or nearly one-third within which valuable minerals may still be discovered. Is it not a matter of vast importance to provide most carefully for the exploration, disposition, and development of this vast empire? In what direction can the fostering care of government be more profitably and properly extended? And when Alaska, with its undeveloped area of about 360,000,000 acres, and the island possessions with 90,000,000 more acres, are taken into account, is it not clearly one of the largest questions before the public today?

Canadian Conditions

In Canada the percentage of unappropriated public domain is larger than in the older country lying along its southern border, and there is yet ample time to avoid the mistakes of omission and commission of the United States. With a total area of 2,118,814,000 acres, you have still in the hands of your Provincial and Dominion Governments the larger part of your acreage. Your annual production of minerals is valued at about one hundred million dollars. At its present rate of increase it may easily amount to five hundred million dollars by 1950. Can your engineers find any more truly national work than to aid in the framing and adoption of the best possible laws for the protection and encouragement of the mining industry? Is it not apparent that there is a very close connection between mining laws and that conservation idea so dear to the imagination of the majority of our people today? If the true aim of conservation be "maximum use with minimum waste," is it not evident that to be consistent with this theory, mining laws must be liberal as to opportunity and inducement for the individual or corporation, and at the same time as scrupulous and exact in supervision and scientific regulation as the conditions of industry and the laws of political economy will permit? If the terms and conditions for acquiring mining property be so difficult as to materially restrict the number of prospectors or development companies there will be far less than "maximum use"; and if no right of supervisory control is retained by the Government there will seldom be "minimum waste." The best code of mining laws will inevitably aid in the development of natural mineral resources, and at the same time have a tendency toward the right species of conservation, as contradistinguished from that variety of it which seems to aim at disuse, stagnation, and paralysis.

Failure of American Mining Law

In many particulars the present mining law of the United States is admittedly a failure, and in other respects it has both its critics and defenders. I propose to mention briefly some of its defects, and some possible amendments, not because there seems to be any danger that our worst faults will be copied by others, but in the way of general illumination of a question which is not always clearly understood even by our own people.

Briefly stated, the United States mining law, known as the Act of 1872, provides for location by discovery; possession perpetuated by annual assessment work; and title in fee simple to the surface and minerals obtained after the expend-

iture of a certain amount of money by the payment of $5 per acre, and the observance of certain formalities as to survey, etc. The metal-mining laws do not apply to all of the states. They are made applicable to the Western states and territories with the exception of Michigan, Wisconsin, Minnesota, Missouri, Kansas, and Texas. Mining locations are not recognized in the states east of the Mississippi river, nor is there in any state legal authority permitting one man to prospect or mine beneath the surface of ground owned by another without consent of the latter. To this statement there is one important exception, and that lies in what is called the 'apex law' under which the owner of the outcrop of a vein in mining claims has the right to follow and mine the vein on its downward course beneath the surface of a claim owned by another. This law has proved more productive of expensive litigation than of economical mining, and in many of the more recently established and more progressive mining districts has been made inoperative either by common agreement or by compromise between adjoining owners.[4] Placer mines are likewise located by discovery and held by annual work and acquired by purchase in fee-simple forever. Known veins within placer locations must be declared and paid for separately or else they are excepted from the placer patent and can be located by others in 'lode claims.' All veins on placer ground not known to exist at the time of application for patent belong to the grantee, but without extra-lateral or apex rights. If an applicant for a placer patent can be shown to have had knowledge of a valuable lode within his lines prior to the making of his patent application, his title as to that vein may be canceled for fraud at any time upon application of a contesting locator. There is no limit to the time for such contests and they are still being brought in some cases twenty years after placer patent. The law is very defective on this point; for it frequently happens that veins discovered today have a value by reason of improved transportation facilities or metallurgical processes, although these same veins were of no value whatever when the placer claim was located and patented. The owner of such a claim is sometimes put to the expense and annoyance of defending such contests repeatedly, since there is no limit to the number of contestants. The law should be amended so as to make it impossible to attack a placer patent on such charges after a reasonable term of years. Another absurd feature of the placer act is that providing for the location of oil, gas, iron ore, and other deposits in the same manner as auriferous gravel. Coal lands are sold by the Government upon an appraised valuation, and the amount of land that may be legally acquired is limited for an individual to 160 acres and for an association to 640 acres. Tracts of such limited area do not often justify the installation of the most efficient equipment, and economical operation is therefore impossible under the terms of the very law which was expressly designed to promote economy and prevent monopoly.

Absence of Leasing

Under the present United States law there is no general system of separation of surface from mineral rights, no leasing of mines from the Government, no payment of rental or royalty, and no Federal supervision or control after location and patent. Taxes are paid to the state and county, and mining regulation is attempted by many states. Unfortunately there is no uniformity of principle and practice as to these matters, nor any stability, nor assurance of permanence in any state either as to methods of operation required or basis of taxation.

Although it has been successful elsewhere and has much to recommend it, the Government leasing system has never met with much favor in the United States. There is not at present strong opposition to grants in perpetuity by the Government, although the leasing system has been recommended by some organizations and public officials. There is a hesitancy to create more bureaus; for bureaucratic administration is not popular with those who have tried to transact business with many of them.

Requirement of Discovery

Aside from the generally condemned apex law, there are two or three features of our present system which should be speedily remedied. The first is that provision of the law requiring a discovery of valuable mineral before location. There is really no sense in such a requirement. What seems valuable to one man is often worthless to another; and what is of no value today may be worth a million in a year or two. Moreover, it sometimes requires a year's work and a shaft several hundred feet deep before the actual discovery of ore, even though the surface indications give ample promise of its existence below. Every mining engineer and geologist knows that many ore deposits have no value whatever immediately upon the surface of the ground. Why not allow a prospector to stake out his mining claim wherever he chooses on the public domain, and hold it so long as he performs the required amount of development work?

Limit the Number of Locations

Another defect in our present law is that permitting a prospector to locate an indefinite number of mining claims and to hold them without doing his assessment work. Many promising districts are kept from becoming hives of industry and producers of mineral wealth by the tying up of their territory in this way. The prospector should be restricted in the number of his locations, and real development work should be exacted.

Right of Appeal

The last important defect in the United States and Alaskan mining and land law to which I wish to call attention is the lack of any provision for appeal to the courts from the decisions of administrative officers. It is contrary to the general spirit of our institutions and an anomaly in constitutional government to take away from any citizen property rights to which he considers himself justly entitled under the law, by the mere fiat of an appointed government official who is here today and gone tomorrow. To place in the hands of such officials the final dicta in matters involving property valued at hundreds of thousands of dollars, and to provide no method of appeal to any duly constituted non-political judicial tribunal is not only to subject the said officials to great and unnecessary tests of moral courage and fidelity, but to require in them the qualifications of superior judges and experience in the interpretation of the law which many of them cannot be expected to possess. Serious injustice may be done without any remedy at law to the defeated applicant. In the interests of justice, provision should be made for appeals in important cases, and perhaps in all cases, from decisions of the Commissioner of the General Land Office or the Secretary of the Interior to some court of competent standing and jurisdiction, whose decisions could and would be accepted by the public and the interested parties as justified by the law and evidence. I am gratified to notice that this point has been carefully covered in the recommendations of the Canadian committee on this subject.

Comparison of English and American Systems

A comparison of the mining laws of the United States with those of other English speaking countries will disclose a fundamental difference in the underlying theory of the proprietorship of minerals, and hence in the attitude of the courts upon the subject as reflected in their decisions. Recent publications of a report upon the 'Mining Laws of Australia and New Zealand,'[5] has caused considerable discussion because of the fact that its recommendations have been to a certain extent adopted by other government officials in their annual reports and public addresses. This report apparently assumes a similarity between British laws and those of the United States in certain respects where actually a wide difference exists.

[4]Thirty-Second Annual Report, Director U. S. Geol. Sur., p 15, Washington, 1911.

[5]Bull. 505, U. S. Geol. Surv., by A. C. Veatch, with a preface by Walter L. Fisher, Washington, 1911.

Absence of Regalian Right

"Neither regalian right, nor anything similar, has ever existed in or been asserted by the United States. While it has sovereign authority, and the power to enact such statutes as Congress in its wisdom sees fit, within the limits of the Constitution, its right is dependent upon and controlled entirely by statute."[7] Furthermore: "A distinction exists, and should be observed between ultimate ownership and right to govern on the one hand, and the exercise of regalian right, after possession and title is parted with, on the other. The former exists in the United States, the latter does not. The ownership, as well as the manner of exercising control, of mineral lands is regulated in the United States by statute."[8]

"The fundamental principles of the common law of England were to a certain extent ingrafted into our legal system when we separated from the mother country and were and still are the rule of action in the absence of legislation. As a general rule, under the common law minerals were the property of the owner of the land, the property in the surface carrying with it the ownership of everything beneath it." Wherefore the ownership of the surface was the best *prima facie* title to the ownership also of the mines.[9] This *prima facie* ownership continued until rebutted by showing either: (1) that the land contained 'royal mines'; or (2) that it was subject to some particular custom that defeated the *prima facie* ownership, as in the case of the tin mines of Cornwall and Devon and the lead mines of Derbyshire; or (3) that the ownership of the mines and minerals had become in fact, from divers causes several and distinct from the ownership of the soil and surface."[10]

By the term 'royal mines' was meant mines of gold and silver. These belonged exclusively to the Crown, by prerogative, although in lands of subjects. In this respect the rule was the same as under civil law. It was at one time contended that mines or mineral deposits containing the baser metals in combination with either gold or silver were royal mines. This contention, however, was set at rest by statutes enacted during the reign of William and Mary,[11] wherein it was declared that no mine should be deemed royal by reason of its containing tin, copper, iron, or lead in association with gold or silver. Thus, those mines only came to be classed as royal in which were found the precious metals in the pure state. Briefly stated, the regalian right to mines, as recognized in England, was confined to those of the precious metals, gold and silver. The base substances belonged to the owner of the soil, except in certain localities where immemorial custom had modified the rule.[12]

At the present time "England has no general mining laws. Legal questions governing the ownership of mines and minerals have been determined on the general principles of the common law."[13]

As distinguished from the common law the theory of the civil law is thus clearly stated by H. W. Halleck:

"All continental publicists who have written upon the subject lay down the fundamental rule, that mines, from their very nature, are not a dependence of the ownership of the soil; that they ought not to become private property in the same sense as the soil is private property; but that they should be held and worked with the understanding that they are by nature public and that they are to be used and regulated in such a way as to conduce most to the general interest of society."[14]

C. H. Lindley has presented concisely the theory of our leading mining lawyers as to governmental control after patent, as follows:[15]

"The Government of the United States does not concern itself with mining lands or the mining industry after it parts with the title. This title vests in the patentee absolutely to the extent of the property granted. No royalties are reserved; nor is any governmental supervision (except perhaps in the isolated case of hydraulic mines in California) attempted. Upon the issuance of the deed of the Government the mineral land becomes private property, subject to the same rules as other property in the state with reference to the transfer, devolution by descent, and all other incidents of private ownership prescribed by the laws of the state. Briefly stated, property in mines, once vested absolutely in the individual, becomes subject to the same rules of law as other real property within the state."

Did the United States Waive Its Right?

But lately we are told that the United States "has never waived its right to the precious metals,"[16] and that "in all states where the Federal Government has never owned the land, and there are 19 such states, the ownership of the precious metals lies with the state government," and "that in states where the ownership of the land has been vested in the Federal Government the ownership of the precious metals in like manner, lies with the nation, and that as against the Government no person has a right to gold and silver in any lands in the United States unless this right has been specifically granted to him in the deed of conveyance."[17]

Here is a most radical difference of theory. Mr. Veatch would have the Government resume dominion and control of gold and silver and by implication of other metals beneath the surface of all lands except those in which minerals were specifically conveyed. He thinks the Government has the right to grant prospecting permits beneath private property and the power to collect royalties on minerals produced as a result of such explorations. In other words he insists upon it that the United States is in possession of a regalian right, but does not know it or has forgotten it. He would have the people wake up and seize what is theirs from all mine operators who are thus wrongfully removing from the ground valuable minerals never specifically granted to them by the Government. It can readily be seen that it is a matter of no small moment to ascertain whether such a thing is possible. Here is proposed mining law revision with a vengeance. I have not at hand the figures to show the relative proportion of lands patented as mineral lands and in all other classes; but have no doubt that the lands granted under the homestead, preemption, desert land act, private entry, townsite, timber and stone, railroad grants, and all other laws exceed in the aggregate the lands under the mining laws four to one. Now, if the minerals under three-fourths of the privately owned land west of the Mississippi, and practically all the lands east of it, really belong to the Government, it is high time for the Government to assert its right and to exercise some sort of control over its vast possessions. This is either a nebulous and iridescent dream or a very important discovery. If the former the bubbles should be punctured, and the mist dispelled, before arousing too many false hopes; if the latter the work of mining law revision at once assumes paramount importance. Fortunately, we have some illuminating opinions of the United States Supreme Court, as a guide and cloud dispeller.

Opinions of the Supreme Court

In the case of Deffeback *v.* Hawke, 115 U. S., p. 400, Mr. Justice Field, after reviewing at length the various acts of Congress relating to the public lands of the United States, concludes as follows:

It is plain, from this brief statement of the legislation of Congress, that no title from the United States to land known at the time of sale to be valuable for its minerals of gold, silver, cinnabar, or copper, can be obtained under the preemption or homestead laws or the townsite laws, or in any other way than as prescribed by the laws specially authorizing the sale of such lands, except in the states of Michigan,

[7] Snyder on Mines, Vol. I, p. 15.
[8] Lindley on Mines, Vol. I, p. 4, First Edition.
[9] Blackstone's Comm., p. 18; Arundel on Mines, p. 3.
[10] Bainbridge on Mines, 4th Ed., p. 118; MacSwinney on Mines, p. 27; Rogers on Mines, p. 247.
[11] Bainbridge on Mines, 4th Ed., p. 27.
[12] William and Mary C., 30; 5 William and Mary C., 6.
[13] Lindley on Mines, 1st Ed., Vol. I, p. 4.
[14] Lindley on Mines, *loc. cit.*
[15] Introduction to De Fooz on the Law of Mines, p x; Lindley on Mines, 1st Ed., Vol. I, p. 14.
[16] Lindley, *loc. cit.*, p. 29.
[17] Bull. 505, U. S. Geol. Surv., p. 116.
[18] Bull. 505, U. S. Geol. Surv., p. 101.

Wisconsin, Minnesota, Missouri, Kansas. We say 'land *known* at the time to be valuable for its minerals,' as there are vast tracts of public land in which minerals of various kinds are found, but not in such quantity as to justify expenditures in the effort to extract them. It is not to such lands that the term 'mineral' in the sense of the statute is applicable. In the first section of the act of 1866 no designation is given the character of mineral lands which are free and open to exploration. But in the act of 1872, which repealed that section and re-enacted one of broader import, it is '*valuable* mineral deposits' which are declared to be free and open to exploration and purchase. The same term is carried into the Revised Statutes. It is there enacted that 'lands *valuable* for minerals' shall be reserved from the sale except as otherwise expressly directed, and that '*valuable mineral* deposits' in lands belonging to the United States shall be free and open to exploration and purchase. We may also say lands *known* at the time of their sale to be thus valuable, in order to avoid any possible conclusion against the validity of title which may be issued for other kinds of land, in which years afterward, rich deposits of mineral may be discovered. It is quite possible that lands settled upon as suitable only for agricultural purposes, entered by the settler and patented by the Government under the re-emption laws, may be found, years after patent has been issued, to contain valuable minerals. Indeed this has often happened. We, therefore, use the term *known* to be valuable at the time of sale, to prevent any doubt being cast upon titles to lands afterward found to be different in their mineral character from what was supposed when the entry of them was made and the patent issued.

And in the case of the Colorado Coal Co. *v.* the United States, 123, U. S., p. 528, Mr. Justice Matthews uses the following language:

A change in the conditions occurring subsequently to the sale, whereby new discoveries are made or by means whereof it may be profitable to work the veins as mines, cannot affect the title as it passed at the time of the sale. The question must be determined according to the facts in existence at the time of the sale. If upon the premises at the time there were not actual 'known mines' capable of being profitably worked for their profit, so as to make the land more valuable for mining than for agriculture, a title to them acquired under the pre-emption act cannot be successfully assailed.

Since these are the opinions of the highest court in our land it is probable that although the advocates of radical revision of our mining law may be able to change the form of its superstructure they will hardly be able to mine deep enough to disrupt its solid rock foundations. It will continue to present fundamental differences from the mining law of Canada on the north, and from that of Mexico on the south, but rights already granted will not easily be set aside.

General Conclusions

Summarizing these somewhat disjointed remarks, it appears in general that:

1. The development and prosperity of all countries is vitally affected by the provisions of their laws relating to mines.

2. Greater inducements and more liberal rewards should be offered in unsettled countries than in districts of denser population.

3. Continuous development work should be required and rigidly enforced, but

4. No narrow limit should be placed on the amount of property held by an individual or corporation so long as the aggregate amount of work equals the product of the net units of area held multiplied by the amount of development required for each unit area.

5. In case of any contest either between rival claimants or between a locator and the Government full privilege should be given of appeal to the courts as in other matters wherein the title to property is involved.

In addition to the above, and with particular reference to the United States, taking into account the system of mining law there already established by long years of precedent and custom, the following recommendations are tentatively presented:[18]

a. The apex law should be abolished.

b. Mining claims should be locatable regardless of a 'discovery' and held only so long as the specified development work is performed in good faith.

c. Placer locations should be limited to deposits of loose materials above solid bedrock.

d. A statute of limitations should establish a reasonable term of years beyond which placer patents shall be immune from attack on the ground of misrepresentation in the patent application.

e. Special statutes should be enacted providing for the location and working of oil, phosphates, rare earths, haloids, and other mineral substances not specifically mentioned in the present laws.

f. Existing titles should be fully recognized and confirmed and no effort should be made to create retroactive legislation.

I have purposely avoided any discussion of the relative advantages or disadvantages of permanent alienation of title as opposed to the government leasing system. For Canada, I am confident the latter system is to be preferred, and am pleased to find myself upon this point in accord with the majority of Canadian mining men.

[18] It should be clearly understood that for these suggestions the writer is alone responsible. They do not in any sense pretend to reflect the views of the Mining and Metallurgical Society of America, or its Committee on Mining Law.

Hydraulic Equivalents

The U. S. Geological Survey prints in many of its Water-Supply Papers a list of convenient equivalents for use in hydraulic computations. The following form a portion of the list:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).

1 second-foot equals 38.4 Colorado miner's inches.

1 second-foot equals 40 Arizona miner's inches.

1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.

1 second-foot equals about 1 acre-inch per hour.

1 second-foot for one day covers 1 square mile 0.03719 inch deep.

1 second-foot for one day equals 1.983 acre-feet.

1 second-foot for one 28-day month equals 55.54 acre-feet.

1 second-foot for one 29-day month equals 57.52 acre-feet.

1 second-foot for one 30-day month equals 59.50 acre-feet.

1 second-foot for one 31-day month equals 61.49 acre-feet.

100 California miner's inches equals 18.7 United States gallons per second.

100 California miner's inches for one day equals 4.96 acre-feet.

100 Colorado miner's inches equals 2.60 second-feet.

100 Colorado miner's inches equals 19.5 United States gallons per second.

100 Colorado miner's inches for one day equals 5.17 acre-feet.

1,000,000 United States gallons per day equals 1.55 second-feet.

1,000,000 United States gallons equals 3.07 acre-feet.

1,000,000 cubic feet equals 22.95 acre-feet.

1 acre-foot equals 325,850 gallons.

1 cubic foot equals 7.48 gallons.

1 cubic foot of water weighs 62.5 pounds.

1 horse-power equals 1 second-foot falling 8.80 feet.

To calculate water-power quickly:

$$\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11} = \text{net horse-power on water-wheel realizing 80\% of theoretical power.}$$

The Zaruma mining district of Ecuador has long been considered one of the richest and most promising mineral zones of the Republic, but up to the present time the cost of transportation and the difficulties attending a profitable exploitation of the mineral deposits of that region have greatly retarded its development. The railway from Machala to Loja, a concession for the construction of which has been granted, will traverse this rich section of Ecuador, and should greatly stimulate not only the development of the mining industry but of agriculture and stock raising as well

The International Smelter, Utah

The Utah smelting plant of the International Smelting & Refining Co. is 4 miles east of Tooele, in Tooele county, Utah. Construction of the plant, which was designed by C. H. Repath, was started early in 1909, and the copper-smelting equipment was blown in July 1910. Recently two lead furnaces and a bag-house have been added to the plant and will be blown in early this year. These do not appear in the accompanying illustration, which shows only the copper-smelting equipment. The smelter is on the west side of the Oquirrh range of mountains, on the eastern slopes of which are the mining districts of Bingham and Tintic. The Utah Metal Mining Co. is now engaged in driving a tunnel, over 11,000 ft. long, from a point in Pine canyon near the smelter, to a point on Carr Fork, on the Bingham side of the range. This tunnel is 8 by 9 ft., double tracked, and has a grade of 1½%. Besides cutting orebodies in depth, it has developed a considerable flow of water. Pending the completion of the tunnel an aerial tramway, 4 miles long, is employed to transport ore across the range; one end of the terminal is seen at *A* in the illustration. From this point the ore goes to the main receiving bins, *B*, in standard railway cars, as also do the ores from other districts. The shed at *B* covers the bin-spouts, whence the ore is drawn off into charging cars. At *D* is seen the sampling mill, and *C* is the building in which silicious ores for lining are crushed. The crushed and sampled ore then goes to the bins at *E*. The sulphide ore, after crushing, is drawn out upon a series of automatically weighing belt-conveyors, which convey it to the McDougall roasters in the building at *K*. There are 32 of these roasters, but only 15 are in use, as the ore tonnage received while the tunnel is under construction is somewhat restricted. A certain amount of silicious ore is added upon the fifth hearth of the roasters, thus keeping the temperature at the proper elevation and serving to heat the ore. The dust-chamber for the roaster gases is seen at *J*. The sulphides are roasted so that the smelting charges contain about 7% S; this corresponds to a matte-fall of 15 to 18 tons per furnace-day. The furnaces, contained in the building seen at *G*, are of the Anaconda type and smelt about 200 tons each per day, with a fuel consumption of 52 tons of coal per day. The waste-heat boilers furnish power enough for the generation of electricity to supply the plant and the Highland Boy mine. The power-house is seen at *F*. The reverberatory-furnace slag, which is 40 to 42% SiO_2, is tapped off directly at the back of the furnace, and the matte, which runs 20 to 30% Cu, was at first tapped directly into the converters, but is now tapped into a ladle, so that some idea may be obtained of the quantity being used. The converters are ordinary shells which have been supplied with a basic lining, and are only operated on day shift, being kept hot over night by filling them with cinders from the reverberatory furnaces. In this way it is possible to make a slag containing 33% SiO_2; the silica is supplied in the form of silicious lump ore, two 'boats' of ore usually sufficing for an 8-ton charge of matte. The plant is producing about a million pounds of blister per month. The converter building is marked *H* in the illustration. The main stack is at *L*. All parts of the plant are served by a series of interconnecting tracks; those at *b* and *d* are the charge tracks from the crushed-ore bins; *c* is the track to the reverberatory furnaces; and *e* is the track to the converter house; and the tracks to the receiving bins are seen at *f*.

Near the point from which the photograph is taken is the lead-smelting plant of this company. This consists of Dwight-Lloyd roasters, two 50 by 180-in. blast-furnaces, and a bag-house; this equipment is just in process of being put into use. For some time ores have been purchased and placed on the stock piles at the smelter, and contracts have been made with a number of lead mines, among them the Daly-Judge at Park City and mines in the Coeur d'Alene. The lead bullion will be shipped East for refining. An interesting feature of the bag-house construction is the method of removing the collected fume from the bags. This will be done by reversing the direction of the current for a short time in a 'bay' of bags by reversing the direction of rotation of the fan. The accumulated fume is thus drawn into the chamber beneath, where it can be collected and drawn off into cars. This method was devised at the Midvale plant of the United States S. R. & M. Company.

COPPER SMELTING PLANT, INTERNATIONAL S. & R. CO.

The copper-smelting plant, which has a capacity of 1500 tons per day, is at present handling about 800 tons per day. This is due to a shortage of ore-supply, as the mines have been unable to deliver the expected tonnage. When the long tunnel of the Utah Metal Mining Co. is completed it is hoped that a more ample supply will be available. The heading from the Tooele side had advanced 7000 ft. on February 1, while the Bingham heading had only reached a length of 600 ft., leaving approximately 4000 ft. to be done, as the total length of the tunnel is a little over 11,000 ft. At the present rate of advance the work should be completed about September 1.

The possibility of trouble from damage done by fume has been discounted by the securing of easements upon a majority of the farms lying within four miles of the smelter. The company is thus free from danger of being closed by injunction, but is still subject to suits, though no damage has been done as yet.

Mechanical Features of the California Gold-Dredge—III

By Robert E. Cranston

*Wire Rope.—Wire rope is used on the dredges for hoisting the digging and stack ladders, spuds, for all the swinging-lines, and for guying the gantries. On account of the small diameter of sheaves, the necessity for the ropes being under water part of the time, and the general hard service they get, their life is short as compared with ropes used for most other purposes. Some dredge constructors use the regular open and closed sockets for their guy-rope ends, and others think this practice is dangerous and use clips. I have never had any trouble with standard rope-sockets if properly attached to the rope end. This may be done by first spreading the wire strands, treating them with dilute hydrochloric acid, inserting in the socket with the strands spread broom fashion, and then filling with melted zinc. The ends of the wires should not be turned over, but left straight. If turned over some are likely to get more strain than others, and to break and cause trouble. Different makes and types of wire rope are used. My experience points to standard 6 19 plow-steel hoisting rope for ladder, spud, and side lines, and 6 7 crucible cast-steel standing rope for the guys. Hot Stockholm tar makes a good dressing, also many of the rope greases to be had on the market. Whatever dressing is employed, it should be used freely.

Sheaves.—The sheaves used for the various purposes are made of cast steel in preference to cast iron. They are bushed with bronze or cast iron and their hubs made as long as possible. When long hubs cannot well be used, as in multiple blocks, the pins should be made of large diameter, so that the pressure will not be too great on each unit of resisting surface.

Pumps.—Three centrifugal pumps are ordinarily used on a gold-dredge. The high-pressure pump should be designed to have a working head of at least 60 ft.; more is better if the gravel is at all hard to wash. This pump furnishes the water for the spray pipes or jets in the screens and is direct-connected to its motor. The low-pressure pump is likewise driven by a direct-connected motor and should have a head of 20 to 30 ft. This water is piped to the tables where needed, depending on the nature of the gravel and the arrangement of the gold-saving tables. The priming or fire pump is usually a two-step pump with a working head of 100 ft. or more. This pump is used in case of fire, for washing down decks, in cleaning up, for pumping out the bilge, and for priming the larger pumps. All pumps should be fitted with both foot and check valves. By-pass piping, equipped with the requisite valves, should be put in to be used for priming. The foot-valves are provided with a grating, and the suction should be still further protected by a wire-netting box attached to the side of the dredge. If this box be made of ample dimensions, say 8 by 15 ft., a ⅜-in. mesh will work well. If a smaller box be used, ½ or ⅝-in. screen will have to be used, otherwise it is liable to become stopped up.

Motors.—Three-phase induction motors are used on all standard California dredges, variable-speed for the digging and winch motors and constant-speed for the other pieces of machinery. Lately a form of variable-speed motor has been used for the stacker and screen drive, which gives a better starting torque for getting these parts under way and is particularly useful when it is necessary to start under full or overload. Any of the standard types of motor give most excellent results if the proper sizes are provided.

Transformers.—It is customary to bring current to the dredge at 2200 or 4400 volts, then transform down on the dredge with three oil-cooled transformers to 440 volts. Many of the later boats are using 2200-v. motors, thus avoiding the use of transformers altogether. Besides the three main transformers, another small one reduces the current to 110 v. for lighting purposes. All of the transformers are mounted in steel or asbestos-lined compartments opening to the outside of the dredge. They have pipe connections which allow the oil to be drained off and conveyed overboard to a point some distance from the transformers. These precautions are necessary in order to secure the best insurance rates and are to be recommended as a safeguard against fire. Another precaution which might prove useful is to provide the transformer housings with plate-steel doors hung from the top with an automatic latch at the bottom and so constructed as to be readily dropped and latched in case of fire.

Wiring.—The electric current is brought on board the dredge by a three-conductor armored cable on floats at a point near the stern, this part of the hull having the least movement. An oil switch is placed near this point and is often so arranged that it may be instantly thrown out from the pilot-house. From this switch the current is conveyed to the transformers in case low-voltage motors are used, and from there the secondary is distributed to the different switchboards. The latest boats use conduits and condulets for all the wiring. If open wiring is used, the conductors should not be stretched too tightly, and they should all be stranded. The single wires are likely to break under the severe vibration of digging and the movement of the hull and superstructure. I recommend stranded conductors, even with the conduit wiring. Wiring connections for the motors situated on the lower deck can be made through the hold. For the other motors the best method must be determined according to the conditions.

Spuds.—The early California dredges used a head-line to dig on, and even after the spud system was introduced it was a mooted question which was the better. The standard California type dredge uses the spud system exclusively, the head-line being abandoned except in a few cases where the nature of the gravel or other conditions are unusual. At first, wooden spuds were used, then one wooden and one steel, the wooden spud being used to step up with and the steel one to dig on. Now both spuds are often made of steel. This plan is by far the best, since if one breaks, the other may be used to dig on, using the head-line to step up with. If only one steel spud is provided and a break occurs, the dredge must be shut down at once and the broken spud taken out, repaired, and put in again before any digging can be done. Several forms of spud are used, and their make-up can best be understood by referring to the figure, which shows views and cross-sections of an unusual design. An extra cover plate riveted to the tension side of that portion of the spud having the greatest strain adds strength with comparatively little increased weight. The lower ends of the spuds are protected by cast-steel points, which extend far enough into the structural part to give ample riveting area. The later designs are made longer than the older ones. At the bottom they are acorn-shaped and change gradually from a circular to a rectangular cross-section at the point where they enter the structural portion of the spud, and they often extend 8 or 10 ft. below this point. Heavy car springs are often used in the spud frames to reduce the shocks of digging, and those using them think that they lessen the danger of breaking very much. This is doubtless true, but I am of the opinion that it also reduces the digging capacity of the dredge and that the best remedy for broken spuds is to build them stronger.

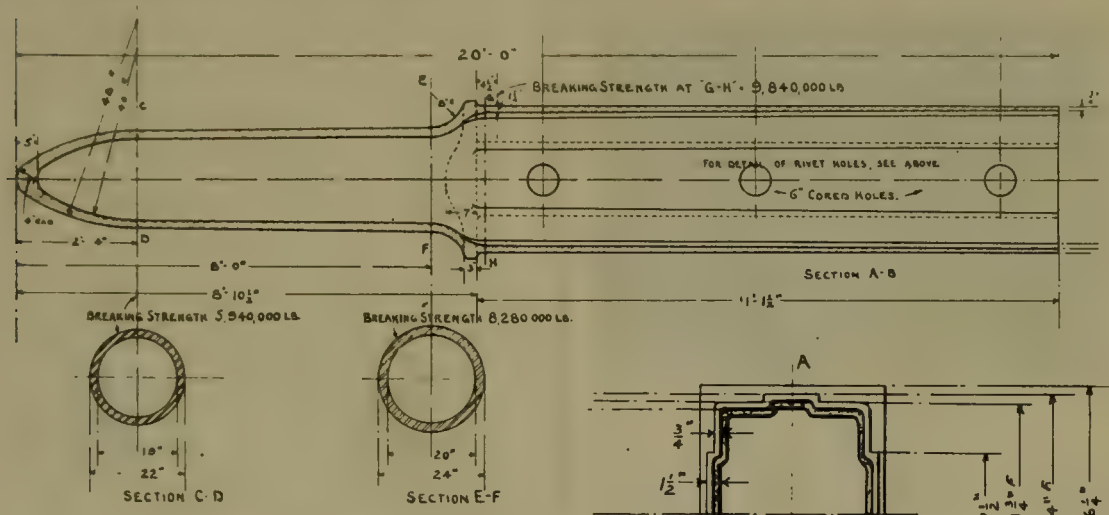
Cranes and Repair Devices.—The modern dredges are provided with traveling or boom cranes covering the heavy machinery, so that repairs and replacements may be made expeditiously and without calling in more men than the

*Abstract from the *Journal* of the American Society of Mechanical Engineers. Continued from *Mining and Scientific Press*, page 338.

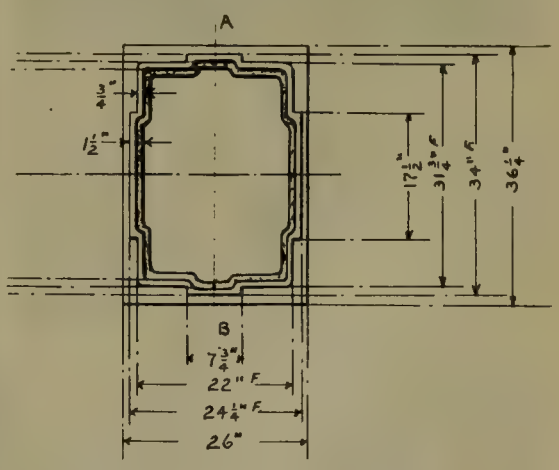
regular dredge crew. A thwart-ship I beam with traveler, or a swinging boom covering the forward portion of the dredge and bucket line, is used for changing buckets. Brackets are riveted to the ladder, into which chains are hooked to hold the bucket line after parting. It is well to have an I beam or at least an eye or hook well secured above the ladder hoist, main winch, pumps, transformers, and screen. Over the bucket line a thwart-ship traveling crane is most useful. It should be of sufficient capacity to lift the upper tumbler, shaft, and gears, and should extend far enough so that these parts may be lowered over the side of the dredge. If a hatchway is provided through the upper deck on each side of the bucket drive, this crane may also prove useful for handling parts on the lower deck.

HULL.—The hull is built of Douglas fir and is proportioned to accommodate properly the machinery which it supports. Before designing the hull, the general dimensions and weights of all machinery should be determined and the hull built accordingly. The depth largely depends on the weight to be supported, the beam on the gold-saving area desired, the length and width of well on the dimensions of the digging ladder, and the digging ladder in turn on the depth of gravel to be dug. The distance from well to stern is determined by the length of screen and the general distribution of machinery fore and aft. The hull rides on an even keel when digging at an average depth and should have a freeboard of not less than one-fourth its total depth. The cross-section is rectangular, with the deck slightly crowned. Thwart-ship frames are used, the bottom planking being spiked to the bottom thwart-ship timbers, the decking to the upper timbers or deck beams, and the side planking bolted to the upright side posts. Besides these, two or more pairs of posts are put in each frame, and to these the well planking and bulkheads or fore-and-aft trusses are bolted. Clamps or fore-and-aft strengthening timbers are bolted inside the frames at the corners where the posts join the deck beams and bottom thwart-ship timbers. The size of these clamps depends on the size of the hull. Drift bolts are driven in the side planking and bulkheads, each bolt passing through 2½-in. planks. They may be put in as thickly as desired, and add considerable strength to the planking and bulkheads. Four-inch deck and bottom and 6-in. side planking is commonly used. The stern is often planked with the same size as the sides, put edgewise instead of flat. At the point where the spuds are placed a short bulkhead or extra bracing is often used. Just aft of the well and below the bucket drive, one or more vertical cross-trusses are often used, likewise horizontal cross-bracing is put in on top of the thwart-ship frame timbers along the compartments adjacent to the well and extending some distance aft from the well throat.

The bow is made narrower than the rest of the barge, the frames being shortened and the side planking steamed and bent around them. How much this portion of the hull should be narrowed down will depend on the width of the cut it is desired to make, together with the distance the digging ladder projects beyond the bow. Using one spud as a centre and drawing the outline of the hull, digging ladder, and cut to scale, will graphically illustrate how much to bring in the bows so that the dredge may dig its way along any desired width of cut. This is a general description of the most common type of hull construction. I have been using what I consider a somewhat stronger construction, but one which is more expensive. Fore-and-aft stringers are laid below the thwart-ship timbers. The posts are bolted to both the fore-and-aft and the thwart-ship timbers, the bottom planking being laid athwart-ships. Clamps are used above the thwart-ship timbers the same as in the other form of construction, the difference being that there is an extra set of fore-and-aft timbers, to which the bottom planking is spiked, this planking running athwart-ships instead of fore and aft. This construction requires more lumber and labor, but is stronger, and by using thwart-ship planking, full lengths can be used, doing away with all butt joints. The tendency of dredge hulls is to sag along the fore-and-aft centre-line. Where fore-and-aft planking is used, this movement of the hull tends to open up the seams, but where the thwart-ship planking is used, the strain is lengthwise of the planking. When a hull is new these weaknesses do not show, but after years of service all such little things count, and since the life of a hull determines the life of a dredge, it pays in the long run to use every precaution possible to add to the stability and length of life of the hull. Solid fore-and-aft bulkheads are recommended, also the use of well plates made up of 6 by 14-in. planking (for the 7 to 9-cu. ft. dredge), laid horizontally below the deck beams and filling the roof of the first compartment on each side of the well for 30 ft. each way fore and aft from the throat of the well. These well plates are particularly useful in dredges having long well holes.

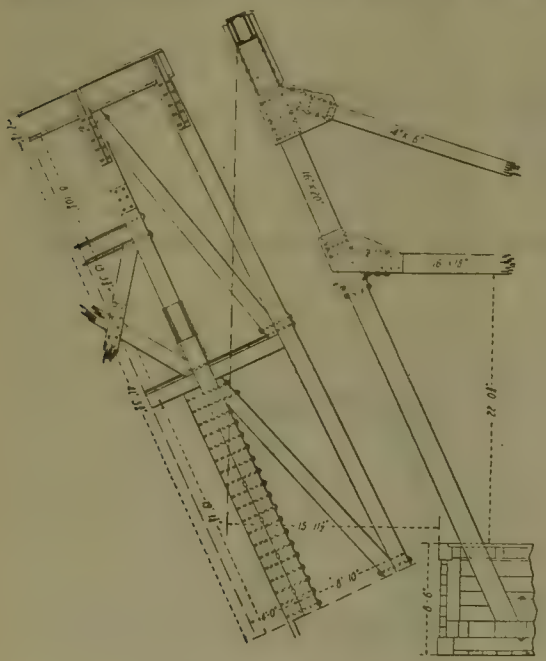


CAST STEEL SPUD-POINT.



FULL END VIEW OF POINT CASTING.

Another plan which will add strength at small cost is to put in diagonal wooden braces from the fore-and-aft timbers near the bottom of the intermediate bulkhead to the clamp near the top of the well hole. This will aid materially in preventing sag toward the well hole. Still another form of strengthening construction being used, particularly on the larger boats, is an overhead thwart-ship truss with heavy hog-rods running diagonally from the upper chord near the sides of the dredge to the bottom of the hull at the well, thus preventing sag at this point. The bottom, sides, bow, stern, and deck are all calked with oakum and the seams pitched or similarly treated. The inside is treated with carbolineum, Stockholm tar, painted, or left without any treatment whatever. On the outside below the water-line the planking may be painted or not as desired. Above the water-line all timber work is thoroughly painted. Before putting timber together, all joints are painted with white lead, mineral paint, or coated with tar or carbolineum. The deck beams are extended

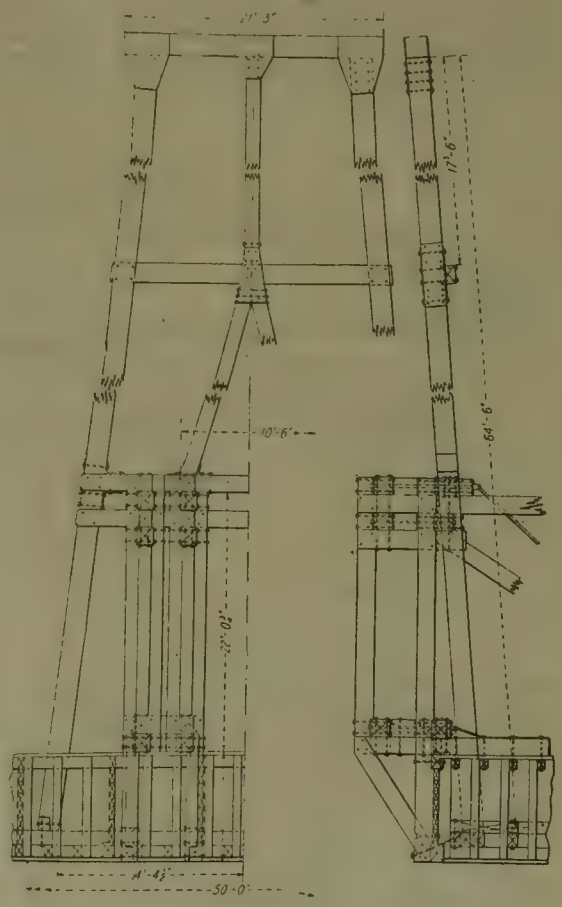


BOW GANTRY, 9-CU. FT. DREDGE.

beyond the sides of the barge at the after portion of the dredge. Braces are put under these in order to support the housing uprights. This gives extra room for gold-saving area or passageways. Hatchways are provided for entrance into each compartment, also a system of ventilation should be installed, using either mechanically driven fans or natural ventilation induced by cowled ventilators. Proper ventilation will do much toward prolonging the life of the hull. Sea-cocks are often installed in order to sink the dredge in case of a fire which has gone beyond hope of being extinguished. If sea-cocks are used they should be placed near the bows, where a hot fire in the housing will not prevent their being approached and quickly opened.

Main Truss.—A large number of the California dredges have a truss along the sides of the well and extending from bow to stern gantry, with wooden chords, posts, and braces, and steel hog-rods. This truss is made 15 to 25 ft. high, the upper chord often being used to support the upper tumbler bearings and the upper end of the digging-ladder. In the earlier dredges there was a tendency for the hulls to go down at bow and stern and hump up near the throat of the well. This truss assists in preventing this condition, strengthens all the gantries and spud frame, and makes an excellent support for the housing, screens, etc. It should be designed as a truss supported at the middle with weights suspended at each end.

Bow Gantry.—At the bow is a gantry which supports the forward end of the digging-ladder, the details varying in the different dredges. A steel cap, of box or I-beam section, on four posts, is a common type. In some dredges the four posts are parallel; others have two posts parallel to the well sides and two sloping inward joining the first at the cap. Still others have the four posts parallel for half their length, the two outside ones being cut at this point, and from here diagonal braces run to the intersection of cap and inside posts. The whole gantry is inclined forward in order that it may have a more direct pull on the digging ladder. In a good many of the California dredges the gantry posts go through the deck and are stepped on heavy foundation timbers or castings near



STERN GANTRY, 9-CU. FT. DREDGE.

the bottom of the hull. A few dredges have rigid foundations for these posts on the deck, and at least one uses a socket casting into which the posts fit loosely. This gantry has thwart-ship bracing and is guyed by ropes or tie-rods to the main gantry, hull timbers, or both. The top chord of the main truss runs to the middle portion of this gantry and is fastened to it by means of steel plates. It is also customary to run a brace diagonally from near the cap to the top of the first truss post. Some form of pin and plate clamp is provided for the bow-gantry cap, to which is attached the ladder-hoist blocks and gantry guys.

Main Gantry.—The main gantry is a support for the bucket-drive and the after end of the digging-ladder. It has a very severe duty to perform and should be built in a most substantial manner. I prefer to place a post under each bearing and use heavy lattice-bracing between the posts. Too many plates should not be used to tie the timbers together, and matters should be arranged, if possible, so that all bolts will be accessible. Where many plates are used it is very difficult to assemble the parts, and in case of repairs the delay is great in taking apart

and reassembling, owing to the difficulty of lining up the holes in the different plates.

Stern Gantry.—The stern gantry supports the spuds and the stacker ladder, and must be made high enough to raise the spuds so that they will nearly clear the bottom of the hull. It is inclined slightly aft so that the spud hoist-blocks will be vertically above the centre of the spuds. The design is simple; two, three, or four posts being used, with a wooden or steel cap. Clamps are used for the spud hoist-blocks, ladder-support, and guy ropes. The posts may rest on foundation timbers or castings placed near the bottom of the hull or on the deck.

Spud Housing.—At the stern of the dredge the two spuds are enclosed in a housing which allows them to slide up and down but holds them in a vertical position. At some point above the deck, usually at the elevation of the upper chord of the main truss, heavy timbers are framed around the spud, with tie-rod connections to the hull or main gantry. This framing, together with the tie-rod connections, resists the tendency of the upper part of the spud to move backward as the buckets engage the gravel and thrust the hull toward the rear. This clamp must be made strong enough to withstand the full digging power of the dredge, increased to some extent by the slight fore-and-aft movement of the hull and the consequent momentum of the full weight of hull and machinery. I do not approve of running the tie-rods to the main gantry, since, no matter how strong this part is made, the constant pulling and jerking on one side will tend after a time to throw the bucket-line shafting out of line. The guy-rods should be run into the hold or to some other part which does not support shafting. Many different spud-housing designs are used, but the present tendency seems to be to use heavy castings covering a large area of the stern to resist the forward pressure of the spud and a structural or cast-steel clamp 20 ft. or so above the deck. In order to keep the spud from moving backward, heavy steel keepers are used which can quickly be removed when it is necessary to change spuds. The timber construction will work well enough, but it is likely to get loose in time, and it is difficult to design a wooden structure so that it will be at the same time strong and easily removable. Whatever form of spud housing is used, it should be so enclosed that small rocks cannot lodge where they will be caught between the spud and its guide.

Housing.—The after portion of the dredge is housed in, this housing covering the gold-saving tables, pumps, main winch, ladder hoist, and transformers. The after central portion is extended up and covers the screen and screen-drive. A covering should also be provided for the bucket-drive, but this is not essential. The roof of the housing is made with a slight crown or slope to the sides, and covered with painted canvas, ship fashion. The roof joists should be made heavy enough to support a considerable weight, since in repairing it is often convenient to lay down one of the big gears or the like, and for this reason the flooring should be at least 1¼ in. thick, or made of two thicknesses of planking. The stern and sides along the gold-saving tables are not usually boarded up. It is thought that an unobstructed view lessens the danger of amalgam stealing.

Pilot-House.—The pilot-house, from which the digging motor and winches are handled, is usually placed on the starboard side of the upper deck, above the main winch and a little forward of the bucket-drive. This is the common position, but the pilot-house on the central line of the dredge above the bucket-line and just forward of the bucket-drive, seems preferable. An objection to this position is that the lever connections to the winches are a little more complicated, but it gives an excellent view in all directions around the dredge and down the bucket-line. By proper arrangement of gratings the main winch may be seen. The bucket-drive, stacker, and spuds are also within sight of the winchman. In my opinion there is no question as to the proper position for the pilot-house, and all my dredge designs have their pilot-houses well up in the centre of the boat.

CONSTRUCTION COSTS.—The construction costs vary greatly, of course, according to the quality of workmanship and material desired, facilities of the builders in the way of properly equipped shops and foundries, and the geographical situation of the ground on which the dredge is to be built. The following may be considered a fair average of many cost records in California, for rough estimating purposes. For all the machinery, including motors, pumps, wire rope, electric supplies, etc., 12½c. per pound, delivered on the ground; for erecting, 1½c.; or a total of 17c. per pound for the machinery erected. The lumber costs about $30 per 1000 ft. at Portland, and this, together with freight, bolts, nails, hog-rods, steel plates, oakum, paint, etc., will make the hull material cost about $50 per 1000 ft. of lumber used; labor of building costs about $40 per 1000 ft., giving $90 per 1000 ft. as a total cost of the completed hull. In addition the direct costs chargeable to hull or machinery, insurance, traveling, superintendence, camp equipment, temporary buildings, shop, derrick, office expense, design, etc., amount to between $10,000 and $25,000, depending on whether new designs have to be made, what construction tools and equipment are on hand, the size of the dredge, and character of the ground on which it is to be built. For a complete dredge, $180 per ton, on a basis of its displacement, is a fair average.

PILOT-HOUSE OF A MODERN DREDGE.

Queensland Gold Yield, 1911

The yield of gold in Queensland for December was 33,873 oz. fine, of the value of £143,883, this being a decrease, when compared with the corresponding month of 1910, of 9910 oz. in quantity and £42,095 in value. This comparative decrease is to some extent accounted for by the fact that the yields from Cloncurry and the Etheridge recorded in the December returns for 1910 were for two and three months respectively. The December yield showed an increase of 940 oz. at Charters Towers, while there were decreases—at Croydon, of 490 oz.; at Gympie, of 2850 oz.; at Mount Morgan, of 2819 oz.; at Ravenswood, of 525 oz.; and the Rockhampton fields, of 376 oz. The record for the twelve months is incomplete, as returns have yet to come in from metallurgical works, but the yield so far recorded for the year is 381,845 fine ounces, of the value of £1,621,973. Comparing these figures with those available for the same period of 1910, a decrease (which, of course, is only approximate) is shown for the year of 56,939 oz. in quantity and £241,862 in value. The published figures for the first nine months of 1911 showed that the increase that had taken place in the production of the industrial metals more than compensated for the decrease in the gold yield; and as the price of copper has since improved, the position should be still better when the year's returns are complete. On the whole, there seems little doubt that the total mineral production for 1911 will show a substantial improvement over that of 1910. The dividends paid by gold mining companies during December totaled £72,337, and for the year £382,729.—*Queensland Government Mining Journal.*

Mineral Resources of Bolivia

By Carlos Sanjines

The Republic of Bolivia, situated in South America, covers an area of 709,000 square miles. This vast territory, which now has a population of 2,500,000, can easily hold 30,000,000 inhabitants. The mineral richness of its soil as well as the fertility of the land offers brilliant prospects to capital and labor. The active construction of railroads going on and the guarantee received by capital are the principal elements making for the rapid progress of the country. A few years ago Bolivia obtained from the Brazilian Government an indemnity of $10,000,000 in exchange for a tract of territory on the Acre river. The amount was not spent in arms and ammunition, because the country loves peace and understands thoroughly that only under peaceful conditions is a nation able to develop its commerce and industries; the money instead was invested, together with some American capital, in railroads, many of which are in actual operation and others under construction.

It is not proposed to give here a detailed review of the variety of products which Bolivia has in abundance in the three kingdoms of nature. This article will be devoted simply to sketching the mineral resources that at the present moment are attracting the attention of the mining people of the United States.

Gold Mining

Before furnishing some data about the gold industry, a general description of the places in which this precious metal is found may be quoted from the 'Bulletin of the International Bureau of the American Republics.'

"The distribution of the metallic belts in Bolivia has always been a matter of wonder to geologists, Raimondi having made the statement that the Bolivian plateau 'is a silver table supported by gold columns.' The gold-bearing belt of the country is divided into three regions. The first extends from the western boundaries of the Republic in the Inambari basin to the eastern frontier on the upper Paraguay. This region embraces the whole mountainous section of the Provinces of Caupolican, Muñecas, Larecaja, Cercado, Yungas, Inquisivi, and Loaiza in the Department of La Paz; thence it continues through the Department of Cochabamba and ends at the Santa Cruz Paraguayan boundary. The second region starts in Lipez, extending south through the Province of Chayanta, Sur Chichas (Department of Potosi), Mendez (Tarija), Cinti, and Acero (Chuquisaca), as far as Santa Cruz plains. The third region, which perhaps is the richest, extends toward the northwest of the Republic as far as Carabaya (Peru) and the head of the rivers Madre de Dios, Acre, and Purus."

Exportation.—The amount of the exportation cannot be determined exactly, because the principal part of the production is smuggled out to avoid the payment of the small tax of 20c. on each ounce exported. In 1902 an estimate was made based on reliable private information, and the amount of the export was figured at more than 1300 lb. per year. Ten years have elapsed since then, and in that period of time more capital has gone into the gold industry and many new mines have been discovered, therefore the production of that metal is at present evidently of great importance.

It can be understood that the results obtained under the primitive methods of gold mining which are still in use at the present time in almost all the mines, should be greatly increased by the introduction of modern methods such as those adopted in Alaska and other mineral regions of the United States. It can be stated without fear of error that any person familiar with the mining industry and with small capital to invest, will be successful working either by himself or associated with natives in Bolivia. Many own rich mines, but are unable to develop them on account of lack of capital, and having but a superficial knowledge of gold mining. The work progresses, therefore, on a very small scale.

For centuries the placers of Tipuani and Suchez have drawn the attention of prospectors, and at present, among the hundreds of mining concessions, are foremost. In them centres the principal interest, according to private reports received in this country by friends of the American miners in the Bolivian goldfields. It will be useful to give the following details about those places.

Tipuani.—Tipuani is situated in the Province of Laracaja, Department of La Paz, about 150 miles north of the city of La Paz. The river of the same name flows from the Mount Illampu, formed by several streams, and empties into the river Mapiri. Both rivers are famous for the presence of gravels containing immense quantities of gold. According to published reports, at a depth of 300 ft. rock bottom could not be found; the proportion of the gold increasing with the depth of the gravel. Though

MAP OF BOLIVIA.

those mines have been worked for more than three centuries and contributed on a large scale to the riches of the Spanish Crown under the Spanish domination, they are far from being exhausted. On the contrary, they offer splendid chances to the prospector. Tipuani gold is from 22 to 23.50 carats fine.

Suchez.—Suchez is in the northwestern part of the Department of La Paz, Province of Larecaja, about 200 miles from the city of La Paz. The river Suchez is as important as the Tipuani, because of the great amount of gold that its waters carry. At the headwaters of the river gold is found in conglomerates and recent gravel. Along its bed gold-bearing gravel exists in paying quantities, there being about 100,000,000 cubic metres of gravel yielding gold at the rate of 40c. per cubic metre, according to the report published by the Bureau of American Republics in 1904.

Other Localities.—Besides Tipuani and Suchez, there are in Bolivia many more placers and mines of no less importance. San Juan del Oro, Los Cajones (river); Chuquiaguillo (river), about three miles from La Paz; and the mines of Araca, Arque, San Jose, Sorotaco de Chiquitos, etc., are all comprised in the first region. Amayapampa, Suipacha, Esmoraca, Chuquichuqui, San Juan, and

tributaries of the river Guapay are comprised in the second region. It must be noted that not all the placers and mines referred to are under actual exploitation, many of them being idle because of lack of capital, and thus affording a good opportunity for new applicants for mining concessions.

Though the following concerns the ancient history of the mining industry in Bolivia, it is of interest in this connection. "According to the data gathered by the General Bureau of Statistics and the estimates of several scientific men as Humboldt, Stobner, and others who made a special study of the matter, the mines of Bolivia have produced, from the year 1540 to 1750, a lapse of 210 years, the enormous amount of £420,000,000, about $2,100,000,000."

Tin Mining

Among the mineral products of Bolivia the most important one is tin, in the development of which large capital is invested. The great value of this metal, which fluctuates around £190 per ton in the markets of London, has led the miners of Bolivia to devote their capital and energies to the working of tin mines in preference to those of silver and other metals. This fact has greatly stimulated the industry. Most of the companies have modern and

CLAVIJO DITCH IN THE SUCHEZ DISTRICT.

well designed plants. The output is large, as will be seen by the following statistics.

In the year 1910 the total exportation of metals from Bolivia reached the amount of 54,732,000 kg., representing a value of $46,716,774. Of this amount, tin occupies the first place, as its exportation was 38,548,441 kg., of a value of $37,006,503. The balance is distributed among the other metals, such as silver, copper, zinc, gold, bismuth, antimony, and tungsten. For 1911, the statistics of the first six months of the year only are available. They show total exports to the amount of:

	Kilograms.	Value.
Tin	19,052,267	$25,149,529
Other metals	7,779,029	5,914,194
Total	26,831,293	$31,063,723

It should be taken into consideration that the value above stated is in Bolivian money, $1 United States currency being the equivalent of 2.50 bolivianos.

Judging by the foregoing figures, it can be asserted that the exportation of metals at the end of the year 1911 reached more than 60,000,000 kilograms.

The probable production of tin in all the world, according to available statistics, is about 100,000 tons annually. The principal output comes from the English possessions in the East Indies, whose contribution is a little more or less than 50,000 tons. Bolivia's output is nearly 40,000, which puts Bolivia in the second place among the tin-producing countries of the world. In some foreign statistics, Bolivia does not appear as a contributor of tin on such a grand scale. Part of its product is classified erroneously as Chilean or Peruvian tin. This happens because Bolivia, being an inland country, has to use for its shipments the ports of Antofagasta (Chile) and Mollendo (Peru).

After the foregoing information about the industry of Bolivia, two more points remain to be explained which may interest the mining people desiring to go there, that is, the substance of the law relating to the adjudication of mines; and the best way to reach the country, as well as the cost of the trip and other details.

Mining Regulations

The mining laws in Bolivia are very liberal, all the foreigners enjoying the same privileges and rights as the natives. Any person having legal capacity to contract may ask as many as thirty (30) mineral concessions (*pertenencias*). The measurement for each concession (*pertenencia*) is fixed at 100 square metres (about 327 sq. ft.) in the

STREET SCENE IN LA PAZ, BOLIVIA.

direction desired by the applicant and extending indefinitely in depth.

The procedure is as follows: Any person finding deposits, placers, veins, etc., has to make his application to the Prefect of the Department in which the claim is situated, accompanying the application with a sketch showing clearly the position in which the mining claim shall be surveyed, and pointing out also its position in regard to adjoining claims. The application must be filed on stamped paper of the value of 10 bolivianos (about $4).

The Prefect, after having published the application in the papers for some time to see if there is any opposition to the claim, shall issue the decree of concession, and the applicant becomes the owner of the mine, paying the annual tax of $5 Bolivian (about $2 U. S. cy.) for each *pertenencia*.

An application is considered abandoned if the survey and setting of landmarks are not made within 70 days from the first publication. Any person may denounce the abandonment of an application, asking to be granted the same, when the owner has failed to comply with the laws relating to the matter.

For prospecting it is not necessary to get special permission. Any person may do that kind of work, giving notice to the authorities of the district in which he intends to prospect.

Machinery and tools for mining purposes may be imported into the country free of duty.

ROUTES OF TRAVEL

It is advisable for all persons interested in mining and other business in Bolivia to go first to the city of La Paz, which, though not the capital, is the largest and most important city of that country, being the place of residence for the Bolivian officials, the seat of government, and the commercial centre of the country.

How to Reach La Paz.—The trip to La Paz may be divided into three stages: (1) from San Francisco to Panama; (2) from Panama to Mollendo; (3) from Mollendo to La Paz.

(1) From San Francisco to Panama the steamers of the direct line established by the Pacific Mail Steamship Co. sail from San Francisco fortnightly and make the journey in 13 days, the cost of the first-class passage being $85. The steamers of the regular service, which make calls at the different ports south of San Francisco, require 25 days and the cost is $125.

(2) From Panama to Mollendo there is a choice of two lines: the Pacific Steam Navigation Co. and the South American Steamship Co., which connect with the steamers of the Pacific Mail. The regular trip from Panama to Mollendo is made in about fourteen days, but the South American Steamship Co., as well as a Peruvian company recently established, have some fast steamers which make the trip in less than eleven days. The price of first-class passage is about $150.

A quick trip from San Francisco to Mollendo, therefore, could be made in 24 days at a rate of $233.

(3) From Mollendo to La Paz the journey is by rail and boat. A railroad connecting the port of Mollendo and the city of Puno (Peru) makes the trip in two days, arriving at the latter point in the evening. At Puno a steamer is taken to cross Lake Titicaca, the highest navigable lake in the world, the journey lasting all night, and on the following day the train is reached at Guaqui (Bolivia). It conveys the passengers to La Paz, taking about three hours. The journey may be summarized as follows: from Mollendo to Puno, 2 days by railroad; Puno to Guaqui, 1 night by steamer; Guaqui to the city of La Paz, Bolivia, 3 hours by railroad. The entire trip from Mollendo to La Paz is made in three days and the cost does not exceed $25.

The information given shows that the journey from San Francisco to La Paz could be made by the Pacific route in less than one month for $260 in round figures. The journey from San Francisco to Panama may be shortened, by way of New York, by three or four days if the traveler makes the exact connection with the steamers of the Panama Railroad Co., which make regular trips twice a week, between New York and Colon, the time being about five or six days. The train from Colon to Panama does not take more than four hours. Time could be saved by this route, but the expense is greater by more than $100.

The Vanadium Industry in France

The Santa Marta company has purchased the factory of Cire les Mello, Department of Oise, for the purpose of carrying out the patents granted to Mr. Perret for the manufacture of vanadic acid. The works are capable of producing six tons of acid monthly, and the company will also make ferro-vanadium and other alloys. In a consignment delivered to the Marine Workshops at Ruelle, the quality was so highly appreciated that other orders speedily followed, and it has been adopted as the market standard. The products of the Santa Marta company were awarded the grand prix at the Turin exhibition. The growing employment of vanadium in the making of steels, in the opinion of the *Echo des Mines*, assures the future success of the company.

Tungsten and Its Uses

By ROBERT P. SKINNER

*Germany offers the largest market for tungsten ore in the world, although the domestic use of the metal is exceedingly limited as contrasted with its uses in England and the United States, which altogether absorb probably two-fifths of the total production. The metal itself is employed chiefly for hardening steel, and its varied applications are increasing rapidly.

Hamburg importers are in a position to sell offerings of ore practically in unlimited quantities. The price is based on the content of tungstic acid (WO_3), the usual content running from 60 to 65%. Ores under 60% are not in demand. The ordinary commercial terms are Hamburg weight, analysis by the state laboratory, shipments in bags of 50 kg. (1 kg. = 2.2046 lb.), price per ton of mineral, and percentage of tungstic acid. One thousand tons of 60% ore should produce about 400 kg. of metal, worth (January 1912) 5.75 marks ($1.37) per kilogram, containing 97% of metal, 0.1% of carbon, and free from impurities.

The total importations of tungsten ore into Germany in 1910 amounted to 2491 tons, against 2520 tons in 1909. The exports of the metal are included with exports of chromium and cadmium, the total shipments under the three heads being 1643 tons in 1910 and 1213 tons in 1909. American manufacturers imported ore and its products from Hamburg alone, as follows:

	1910.	1911.
Tungsten ore	$143,629.43	$53,410.29
Tungsten metal	126,967.05	.....
Tungsten filament lamps	.....	14,938.54

The metal is obtained by reducing the oxides or chlorides in a current of hydrogen, or by means of carbon in an electric oven. According to German patent No. 141811, the raw material is melted at a temperature of 300°C. with sodium bisulphate, after which the temperature is raised to about 800°, and lime or lime salts and alkaline chlorides are added. Sodium bisulphate must always be contained in the mixture in excess of other material. If the method is thoroughly carried out, all tungsten is obtained in the form of tungstic acid, or sodium tungstate. The acid is melted and reduced to metallic tungsten.

Tungsten lamps are incandescent electric lamps consisting in part of threads made of metallic tungsten. Different methods are employed in their manufacture. Bluecher's 'Handbook of the Chemical Trades' thus describes the process:

The metallic tungsten, used in the form of threads in incandescent lamps is obtained from wolframite. Tungstic acid (tungsten trioxide, WO_3) is imported into the United States for the manufacture of these threads. WO_3 is obtained from wolframite by heating together finely ground wolframite and HCl (hydrochloric acid); thus oxide of tungsten and soluble chlorides of Fe (iron) and Mn (manganese) are formed. The three products are carefully washed about a dozen times with water. They are then allowed to settle, when the water is again drawn off and fresh water added. The precipitate of tungsten oxide is dissolved in ammonia, whereby ammonium tungstate is obtained. This is filtered and heated and finally boiled together with HNO_3 (nitric acid) to remove the iron and manganese.

Tungstic acid is obtained from thoroughly washed ammonium tungstate by heating it to a glowing point. This result originated in the manufacture of metallic thread, according to Auer's method (Osram lamp). He removes the oxygen and thus obtains metallic tungsten, which is mixed with an agglutinant and forced through fine diamond matrices. Just and Hananan apply the method of substitution. Kuzel applies the colloid process, according to which the metallic tungsten is alternately treated with strong boiling acids and alkalies. It is, of course, thoroughly

*Abstract from a Consular Report.

washed each time until it is converted into a colloid. The colloid is then precipitated, the liquid drawn off, and the residue, which is gelatinous, is forced through the diamond matrix. Lamps furnished with these threads are called Kuzel lamps.

Another method for the production of colloidal tungsten is to send an electric current under water through two electrodes made of metallic tungsten. In this way small particles of tungsten are thrown off from the electrodes and form colloidal tungsten. The products of the three methods are of equal value. The tungsten thread coming out of the matrix is dried in an oven and then heated in an electric oven up to 2000° C. to drive out the volatile ingredients. Then an electric current is allowed to pass through the thread in an atmosphere of indifferent gas, and the thread for the lamp is thus obtained. The current consumption of the tungsten lamp is from 1 to 1.3 watts per Hefner candle-power, whereas the carbon-thread lamps consume 2.5. The disadvantages are the higher price and greater fragility of the thread. Against this, tungsten thread has a longer life (1000 burning hours against 450 of the carbon-thread lamp), and it is also much less sensitive to current fluctuations. The tungsten lamp also gives a better light.

Water in California Oil Wells

By An Occasional Contributor

The operators of all oilfields become sooner or later familiar with the disastrous result following the appearance of water in the oil wells. To such an alarming extent has water encroached upon most of the oilfields of California that legislation has been enacted to remedy an increasingly serious situation. The state law, however, fails to provide a penalty or to supply an appropriation which will make it possible to apply a remedy. Several efforts have been made in Kern county to take up this matter in a coöperative way, but are thus far only partly successful.

About the middle of February the State Mineralogist, W. H. Storms, was requested to act as a mediator and harmonize conflicting opinions among oil operators. Recently Mr. Storms visited all of the oil districts of Kern county in company with W. N. Forker, County Water Commissioner, and several others interested in the oilfields. The seriousness of the situation is apparent. As an example of what is now taking place there, the fact may be mentioned that at the time of his visit to one of the noted gushers of the Kern field, a production of several thousand barrels of clear oil was being made daily. Only one week later this same well was producing water, the quantity of which is rapidly increasing. All over the fields, wells which a few months or a few weeks ago were profitable producers, are beginning to show signs of water, some of them running as high as 85% water.

There is no doubt but that an industry producing at least fifteen millions of dollars in Kern county, alone, will be completely destroyed unless heroic measures be taken to remedy this unfortunate condition.

As a result of the visit of the State Mineralogist to Bakersfield and the oilfields, a meeting of oil men was held on Thursday, February 29, at which time it was decided to call a meeting of oil operators for Saturday evening, March 9. Invitations to attend this convention have been sent to all operators in Kern county, the large and small interests alike being invited to have representatives at the meeting, at which it is expected to perfect a permanent organization and to appoint a committee on ways and means, legislation, and other important matters.

There appears to be more unanimity than ever before as to the necessity of prompt and effective action on the part of all concerned to control the water, which is steadily encroaching upon the oil sands, and it is believed that there will be no trouble in securing the necessary funds for immediate relief, as the officials of the larger companies say they are willing to share liberally in any movement looking to the desired end.

Tin in Nigeria

London Correspondence.

Progress of the alluvial tin industry of northern Nigeria is being followed closely in London, and the market for the shares of the various companies is the only bright spot in speculative business nowadays. The monthly outputs are scanned eagerly. It goes without saying that most of the companies are absurdly overcapitalized, and that in many cases company-mongering has received more attention than production. It is only fair, however, to point out that several of the companies have started without undue inflation of capital, and have been conducted with the aid of the best possible advice. For instance, the Rayfield Syndicate has a capital of £20,000, in 80,000 shares of 5s., 40,000 of which were issued at 100% premium (or 10s. per share). The results obtained have been highly gratifying to the subscribers, six-penny dividends having been paid monthly since October last, and at Christmas a bonus of 1s. per share was added. The Syndicate originally acquired five properties known as Shen, Lafon, Delimi, Wono, and Kuru. The Kuru was sold to the South Bukeru company for cash and shares. Subsequently the Syndicate secured a property now known as Sabon Geri, and it bids fair to become one of the romances of mining. Situated within a dozen miles of Naraguta, the richness of the tin-bearing streams and banks appears to have escaped the serious notice of the early prospectors. The richness and extent of the deposits has been confirmed by reputable engineers, and further work is to be done in exploring the lodes. Another undertaking is the Nigerian Tin Corporation, which conducts a general mining and finance business; it has four productive properties, securities of the quoted value of £18,000, some £15,000 in cash, loans, and tin in transit, and other share interests. As the subscribed capital is only £45,782, the directors appear to have acted discreetly, and to have had their share of good fortune. A dividend of 10% was paid in February 1911, and 71 tons of tin was produced by calabashing alone to December 31, 1911. The sluicing plant is now ready for operation, and a greatly increased yield is anticipated. A third company, the Northern Nigeria Mining & Exploration Co., has a nominal capital of £10,000, of which £8838 has been issued; £6000 has been repaid in a dividend, and the company now owns areas of approximately 18 square miles. Altogether, six companies are likely to make money: the Bisichi, Rayfield, Naraguta, Kano Tin Areas, Jos Tin Area, and Tin Areas of Nigeria. The total output of northern Nigeria for 1911 is estimated to have been 1700 tons of concentrate assaying 70% metal. While the published returns are defective in being given in terms of a variable concentrate, and not in metal, it is a fact that the average grade of the product shipped to England is high, ranging usually between 70 and 74%. But as some of the so-called tin reported has been a low-grade concentrate, some doubt has been thrown on current statistics. Before long the railway connecting the Bauchi plateau with the coast at Lagos will be completed, and operations will then proceed more rapidly and economically. Northern Nigeria has every promise of coming farther to the front as a mining centre.

Fluorine may be easily detected, according to E. Rupp, by placing the crushed material in a platinum crucible 3 cm. high, or a lead tube, closed at one end, 5 cm. long by 2 cm. diam. Three drops of water and 1 c.c. of H_2SO_4 are added. The vessel is then closed with a rubber stopper through which passes a smooth glass rod, on the tip of which a drop of water is suspended. On heating for a half hour on a water-bath, if fluorine is present a coating of $H_2SiO_3.Na_2SiF_6$ and $CaSiF_6$ appears on the tip of the rod. The etching of the rod may be detected by rubbing it on the teeth. Even traces of fluorine are said to be detectable thus. If a taller crucible is used, the rod should be pushed through far enough so that its tip is only 2 cm. above the mixture within.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Employers' Liability and Accident Insurance

The Editor:

Sir—I have read with interest the articles by A. J. Pillsbury, which recently appeared in the *Pacific Rural Press*, on the Roseberry Liability Act, in which he sets forth reasons why the farmers of California should not object to this act. He emphasizes the fact that this burden will be shifted upon the ultimate consumer. This is the case in every industry except gold mining. The very words 'gold mining' are synonymous with great wealth and enormous profits in the minds of all except the gold-mining fraternity. A good gold mine is a 'gold mine', but how many profitable gold mines are in operation today in California? I believe they can be counted on the fingers. Compared to the number that are in operation, they are few, indeed. Many of the mines are struggling along, and have been, for years, by the help of assessments.

Gold has a fixed value, as everyone knows, and any added expense, caused by increase of wages, shorter hours, increased cost of supplies, and liability for accident damages, cannot be shifted upon the ultimate consumer, as has been, is being, and will be done by all other industries, and which is largely responsible for the increased cost of living. Were all the gold mines in California that are operating but not profitable to close down suddenly, the whole state would suffer from it. The thousands of men employed would either displace workers elsewhere or be idle until new enterprises absorbed them. This is not saying anything about the thousands that are benefited indirectly by the gold-mining industry, and the new liability law may prove the 'last straw' with numbers of them.

I fully agree with Mr. Pillsbury that the shock of accident, with its accompanying pain, suffering, and sorrow, is enough for the unfortunate victim to bear, without the added misery of having the 'wolf' hovering about; but I do not agree with him, that the employer should alone bear the costs. I insist that the state, at large, should share in it, since the whole state is benefited by the gold-mining industry. Professional men, real-estate owners, and those industries in which labor runs little or no accident risk, should share the accident costs. This could be brought about by the compulsory insurance of all labor, the premium costs to be divided into three portions, of which the employee should pay, say, at the rate of one-quarter, the employer one-quarter, and the state one-half, or in such proportions as might be decided upon. In this way, the burden would not be too hard on anyone. If this course were followed, the poor ultimate consumer, already overburdened, will escape this liability burden, except, of course, from the gold-mining industry, which cannot shift it. The burden will come to those fully able to bear it, and without their feeling it. I would suggest that either the older and married men's premiums be less, or else that they carry greater insurance, because old and married men are far more careful than the young ones, with consequent less risk to assume. Another thing I wish to say about this liability law is, that nearly all mining men, especially those who have employed Mexican labor, will agree with me when I say that there are plenty of men who would not hesitate to cut off a hand or foot for $1000, were they sure of collecting it. Of course, they would do it in such a manner as to make it appear an accident, which can readily be done underground. Should a tottering concern bear such expense alone? In gold mining there is always the hope of 'striking it rich' if the struggle can be continued for a while longer. I mention this in answer to those who would say: "Let the concern fail, since it is so near its end." I have heard this remark from a walking delegate who was advising a strike. The concern referred to employed between 400 and 500 men, is still alive, and the remark was made years ago. I have read and heard that in Europe many persons maim and cripple themselves to escape conscription, or for the purpose of begging; why not, then, to collect substantial damages? But this is only a side issue.

I believe in compulsory insurance, with the state sharing a good part of the costs. I am a property holder, willing to pay my proportion, and only sorry I wouldn't be entitled to pay by the thousands.

F. J. MARTIN.

Angels Camp, California, February 21.

Cross-Fractures and Ore-Shoots

The Editor:

Sir—Your issue of September 16, 1911, contains a letter by W. N. Cummings on the importance of vein intersection. Mr. Cummings quotes such authorities as J. F. Kemp, J. E. Spurr, and S. F. Emmons, and he claims that in his opinion the significance of this particular phase of geology in the search for ore is insufficiently appreciated. In respect to veins depending on substitution or metasomatic filling, I agree. By this process a quite narrow intersecting fracture caused by the oscillation resulting from extensive plane faulting may become transformed into a large repository of commercial value.

In my experience I have met such examples, and I have also noted cases where such possibility of intersections has been insufficiently recognized in development program. In this respect, I recently examined a mine in which a branch vein of phenomenal richness was discovered intersecting a main vein which owed its origin to extensive plane faulting. The rocks are andesite, with their characteristic predominance of soda-lime feldspars, together with rhyolites and basalts, the junctions showing considerable brecciation in common with such effusive phenomena. There appears to have been a succession of eruptions, the older being different varieties of andesite, and the younger of rhyolites. It is in the older eruptives, or andesites, that the principal mineralized zones occur. In many places there are indications that some rhyolitic flows had been deposited before the profound shearing which formed the inception of the mineral deposits; as is shown in places by impregnation and fracturing of the rhyolite.

The mineral deposits of the district owe their existence to what appear to be three profound shearing zones. These fracture planes are not continuous, but the mineral zones are all more or less in alignment and there is little doubt that their formation was simultaneous. Diagnosis of the cause of the fracturing is difficult, and it is impossible to state definitely whether the present vein systems are the result of contraction through cooling or profound laccolitic pressure. The surface has all been greatly eroded, destroying much that would be valuable to geological prognosis. To summarize: The country consists of Tertiary eruptives which show a characteristic phenomenon, in that the earlier eruptives consisted in more basic andesites followed by a series gradually becoming more acidic, culminating in basalts.

The cross fracture referred to intersects the main vein at an angle of 50°. The former dips 70° to the west and the latter 70° to the east, the line of contact evidently descending about 50° from south to north. This fracture produced 385 tons of shipping ore of a net smelter return of over $311,000. Together with this there had been extracted, to September last, approximately 12,000 tons of an average assay of $41 per ton. My sampling of the face most remote from the junction was approximately $70 per ton over 18 ft. The value of such a discovery requires no emphasis.

Mines of more or less similarity geologically to this should, in my opinion, be thoroughly prospected on either

side of the master vein or main component of production, as the case may be. Under such conditions horizontal drilling is invaluable. It is both faster and cheaper than cross-cutting. In replacement deposits like Goldfield, Nevada, and Kalgoorlie, Australia, it also affords valuable data on the widths, in respective parts, throughout a mine. In such deposits, where defining walls are practically non-existent in the earlier stages of development, it is generally more expedient to explore for new ore-shoots than to attempt to block out tonnage under the definite conditions as understood by the mining profession, which, in a deposit of this class, is expensive, and, in many cases, financially prohibitive. Horizontal drilling will, therefore, afford valuable data as to probable production and prevent overlooking valuable cross-fractures.

Like most other departures in mining, a policy of horizontal drilling will open the question of costs. The necessity of getting maximum results is a concurrent phase. Data resulting from a large number of misplaced drill holes will cost more and afford less information, if any, than a moderate number placed by an engineer who is familiar with the particular conditions. Each case will afford its own particular data. General statements respecting policy in laying out a horizontal program are impossible beyond that ore-bearing cross-fractures, if existing, may be more prevalent on the one side of the developed vein than on the other. In this respect, I quote from my report on the property referred to. The main vein, which owes its origin to extensive plane shearing, is referred to as the San Francisco and the cross-fracture as the Esperanza.

"The sampling of the San Francisco vein and that of the Esperanza conclusively proves what may be regarded as an interesting phenomenon, inasmuch as the major deposits are invariably found on the foot-wall of the San Francisco vein and on the hanging wall of the Esperanza. My experience, in similar deposits, is that when valuable minerals show an affinity for either the hanging or foot-wall, in the case of parallel veins the same wall will be the more productive in both cases. The deposits under review are, therefore, an exception to this experience, the only thing in common being that in both cases the greater content is found to the west. It, therefore, seems evident that the cause for this selective characteristic must be in the greater reactive properties of the country to the west of the deposit to that of the east. In my judgment the horizontal diamond-drilling recommended should be extended over the San Francisco vein in a somewhat general manner throughout the workings, but the holes should be to the west rather than to the east. The Esperanza vein was evidently a minor fracture, to relieve local strain, incidental to the profound plane fracturing which constitutes the San Francisco deposit, and it is quite possible there may be others that either have or may be missed by exploration work confined to the San Francisco vein. It is also possible that had the Esperanza fracture occurred to the east instead of the west it might not have been so prolific in metallic content."

The subject of why the fracture vein was so abnormally rich is a broad one and entitled to more space than can be here afforded. A theory that it was a blind cavity, deficient in free exit of mineral solutions, causing thereby partial stagnation, is, in my judgment, attractive. Stagnation, under some circumstances, would probably result in a localization and excess of precipitated sulphides. The reactive character of the country rock or its metasomatic attractions at this particular place might also have had a simultaneous effect. The conditions, at all events, are somewhat different from those influencing enrichments in intersecting veins of the true fissure type that depend on direct precipitation and exhibit the characteristic defining walls and possible banded structure. Here the meeting of alkaline sulphides with metallic sulphides or sulphates arising from different sources, and precipitating through cooling or reaction is more feasible. This, together with acute changes in temperature and neutralization, seems, in the latter class, to be the more reasonable explanation of enrichment.

MORTON WEBBER.

New York City, February 9.

Making Mine Models

The Editor:

Sir—As comparatively few mine models are made for mine use, it is interesting to note when one is made for that purpose, and with what success. One made some time ago by myself for the Poderosa Mining Co., Ltd., Collahuasi, Chile, is not of the more elaborate type, on account of the difficulty in obtaining the proper materials, but has served its purpose well, and the idea is an excellent one for any mine; especially if native labor is employed in the capacities of shift bosses or foremen. Most natives of South America cannot read a map, no matter how well prepared. Here the model serves to give perspective, and

A CONVENIENT MINE MODEL.

avoids confusion of levels. It gives them the correct idea of the trend of the orebodies, the dip, strike, and faults, besides educating them to be able to understand a map when they see it afterward.

This particular model is made of sheets of glass, horizontally placed for each level, and supported by brass rods along all sides, with beaten copper straps running around the rods, and extending over the glass about three-eighths of an inch both above and below. This forms a firm support for the glasses. The rods are held in a wooden frame, made after the style of old mission furniture. The whole model can be taken apart in five minutes, by sliding out the glasses at one end, then pulling the pegs of the frame. The top glass is set into the wooden frame in the same manner as the top of a show-case. All levels are shown in black, except where ore-shoots occur, which are shown in green. The top glass contains the coördinates, so that any place can be readily located by its block number and letter, besides the claim lines, title, etc. The scale of the model is 1 to 600; it is 4 ft. 3 in. long, 1 ft. 3 in. wide, and 1 ft. 10 in. high, space being left at the bottom for additional levels as they are opened. The paints used for the work were ordinary artist's oil paints, mixed with Japan size and turpentine to make them flow easily from an ordinary draftsman's pen, and still dry quickly.

C. L. SEVERY.

Collahuasi, Chile, January 12.

A Critic Criticized

The Editor:

Sir—It is not good form for an author to complain of the critic who may review his efforts, and I would not do so but that the reviewer of my book on 'Stamp Milling' in your journal has done me an injustice by misquoting. At the end of the second paragraph he quotes me as writing on page 12: "although the latter factor is influenced by the interior and shape of the mortar", leaving out the word "area" after "interior." He complains that many of the sentences are involved, and no doubt they would be to him if he took equal pains to understand them as he has the one above quoted.

ALGERNON DEL MAR.

South Pasadena, February 20.

[The misquotation referred to was due to a typographical error which unfortunately escaped detection, the more easily since the sentence was quoted as an example of faulty writing. No blame therfore should attach to the reviewer, who quoted the sentence exactly as given in the original text.—EDITOR.]

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

SIERRA NEVADA is a Spanish term, signifying 'snow-clad range.'

BOLIVIANITE is a soft lead-gray mineral, resembling stibnite. According to T. Richter, it is an antimonial silver sulphide, containing 8.5% of silver.

THE Amazon river carries annually to the ocean 618,000,000 metric tons of solution and sediment, and its turbidity can be observed in the ocean waters over 100 miles from the land.

RUBBER packing can be prevented from blowing out by cutting pieces of ordinary wire window screen the size of the packing and placing on each side of it. The wire beds itself into the soft packing and holds it in position.

PATENTING a millsite does not involve meeting any special conditions. Those attached to a lode claim may be entered with the lode claim or subsequently; they may even be located after the lode claim is patented. While no $500 expenditure is required upon a millsite claim, those attached to a lode claim require to be used for some mining and milling purpose in connection with the lode claim, and those unattached to the lode claim, to have an actual reduction works upon them.

DRILLING holes for the foundation bolts of a Cornish pump was done at the Talisman, Karangahake, New Zealand, with a 3⅛-in. piston drill weighing 300 lb., making with ordinary drill steel four hundred 5½-in. strokes per minute with air at 80-lb. pressure. These bolts were 6 in. diam. Hexagonal drill steel 2 in. diam. was used. The starting bit was 6⅝ in. diam. The finishing drill was 6 in. diam., 7 ft. long, and weighed 84 lb. The drilling was done at the rate of 1 ft. per hour in hard andesite.

ACTUAL settlers, residents, individual miners, and prospectors for minerals, not associations or corporations, may take timber from the public lands in Alaska for firewood, fencing, buildings, mining, prospecting, or other domestic purposes, without charge and without application or previous permit, the amount not to exceed a stumpage value of $50 in any one calendar year. No timber may be sold, but an agent may be employed to cut it. Application to purchase timber to be cut for use in Alaska, but not for export, may be made to the receiver of the local land office for the district, to be acted upon similar to applications to cut timber in the United States.

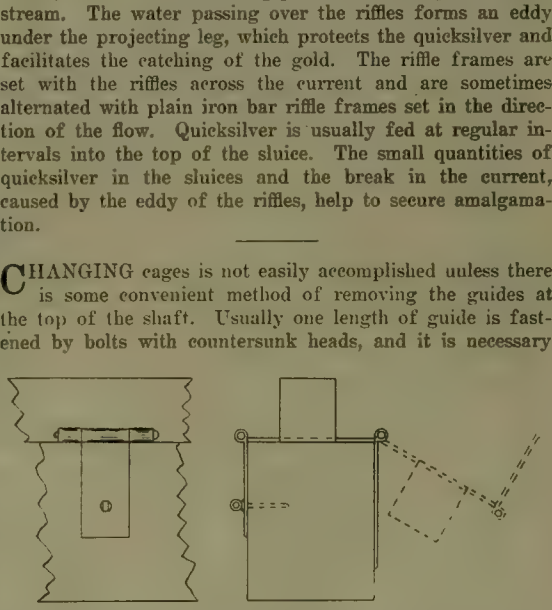
FIRST-AID packets are issued by the sanitary department of the Panama canal, to be placed on all locomotives, steam-shovels, dredges, cranes, and boats of the Commission and the Panama railroad. Each packet is of the type provided for knapsacks in the United States army, and contains, within a waterproof wrapper, 2 compresses of antiseptic gauze, 2 small bandages of antiseptic gauze, 2 safety pins, sterilized, and a triangular bandage by means of which a compress may be held in place on the head or any portion of the trunk or limbs. The weight of the packet is a few ounces and its dimensions are 1½ by 2½ by 4 in., making it pocket-size.

WASTE of natural gas is stated by the United States Geological Survey to be rapidly decreasing. The problem of conserving the natural-gas supply may be considered as having been satisfactorily solved in Pennsylvania, throughout the Appalachian, and the Lima-Indiana fields, and in Kansas. The greatest waste is in Oklahoma and in the Caddo field of Louisiana, owing in Oklahoma to probable looseness in enforcement of the laws and in Louisiana to lack of a market. It is noteworthy that one of the two wild wells in Louisiana that have been sensational examples of waste has been successfully closed and the gas thus conserved for future use.

WATER-POWER sites have been withdrawn from entry by executive order, and of these, during January, 7252 acres previously withdrawn were, on further examination, restored to entry as having no value for the development of power. The original withdrawals of power-site lands, as recommended by the engineers of the U. S. Geological Survey, are invariably made as small as possible, but where more detailed field examination shows that they can be further cut down without endangering the interests of the public such excess areas are immediately restored to the public domain. Thus, of the nearly 2,000,000 acres which have been withdrawn during the past four years for power sites, 184,383 acres have been so restored.

HUNGARIAN riffles of the angle-iron type are considered by many as the most effective for gold working. These consist of a series of angle-irons spaced 2½-in. centre, with the horizontal leg placed so that it points downstream. The water passing over the riffles forms an eddy under the projecting leg, which protects the quicksilver and facilitates the catching of the gold. The riffle frames are set with the riffles across the current and are sometimes alternated with plain iron bar riffle frames set in the direction of the flow. Quicksilver is usually fed at regular intervals into the top of the sluice. The small quantities of quicksilver in the sluices and the break in the current, caused by the eddy of the riffles, help to secure amalgamation.

CHANGING cages is not easily accomplished unless there is some convenient method of removing the guides at the top of the shaft. Usually one length of guide is fastened by bolts with countersunk heads, and it is necessary



to unscrew these bolts in order to take out the guide. A quicker way is to have the guide on one side hinged so that by pulling out a pin it can be swung out of the way. A convenient arrangements of this sort is illustrated in the accompanying figure.

CAUSES for one explosive being safer than another in the presence of explosive mixtures of gas or coal dust have been investigated during the past few years. The many thousands of lives lost in coal-mine disasters have shown the necessity for such investigations, and have stimulated to a marked extent researches in regard to the preparation of explosives suitable for use in coal mining. It has been found that every known explosive, if fired in a sufficiently large charge, will cause the ignition of an explosive gas mixture, but explosives have been found to differ widely in regard to the amount that can be fired without causing such ignition. Ordinary black blasting powder, for example, will cause the ignition of explosive gas mixtures very readily, as little as 25 gm. (somewhat less than an ounce) invariably serving to bring about this result. Certain other explosives, in quantities as great as 1000 gm. (2⅕ lb.), after repeated trials, under conditions exactly similar to those used in testing black powder, have invariably failed to cause ignition of the explosive gas mixtures.

Special Correspondence

MANILA, P. I.

Mineral Industry Prospering. Dredging Results. The Coal Industry. Black Sand in the Philippines. Oil and Asphaltum.

The whole mining industry in the Philippines, which has suffered from so many setbacks in the past, has been given a substantial boost in the past few weeks by the promising returns from the first clean ups of the Colorado mill on the Island of Masbate. This is a 20-stamp Traylor mill which was erected under the superintendence of C. M. Eye. If the present returns are kept up and are increased, as there is every reason to expect that they will be, Masbate will soon lead the other districts. Preparations are being made to install a mill on the Syndicate property (Old Eastern Mining Co.), where a respectable orebody has been uncovered by recent development work. In the Paracale district, materials for the New York Engineering Co. dredge, to be placed on the Gumaus river for the Philippine Exploration Co., are arriving on the ground. The consolidation of all the interests on the Paracale river has been effected, and a large part of that ground is now controlled by a company headed by Mr. McWhae, a prominent mining man of Australia.

The Philippines dredge on the Malaguit river is digging

HEADWATERS MILL.

in good ground and is making good headway. New machinery has been ordered for the old Paracale dredge, for which a pontoon has been completed. There is no operation on the quartz properties in this district, only some assessment and development work. On the Navotas group, especially, from which some high-grade samples have been assayed by the Division of Mines, good progress is being made. Operations in the Benguet district remain at a standstill. The Headwaters company has shut down, and the well known Benguet Consolidated Co. mill on the lower Antimok river was put completely out of commission during the past typhoon season.

Plans for a consolidation of all the properties on the Lower Antimok have not as yet materialized, for the reason that capital, which was expected to finance the undertaking, has not yet been forthcoming from the China coast, due to the financial stringency as a result of the revolution. Recent work and the washing out of some of the streams by the typhoon has shown up more veins and larger orebodies than were before known. It is beyond question in the minds of those who have seen the ground that large and profitable orebodies exist in this district and that some day the Philippine Islands will take high rank among the gold producers of the world.

Some excellent alluvial ground has been discovered on the east coast of Luzon, almost due east from Manila. An Australian company has promised to have a dredge at work on the Umira river in 1913. Above the dredging ground, another company has planned to install hydraulic machinery. Black sand from some of this ground, when tested by the Division of Mines, by grinding in a tube-mill, and cyaniding, showed that after the free gold has been removed high extraction can be obtained. The Division of Mines is now investigating black sand from all over the Philippines, as this promises good returns when the right process has been found.

The coal industry, which came near to succumbing completely a year ago, has been resuscitated by the timely assistance of the Government, and from the last reports, the East Batan coal mine is progressing as satisfactorily as can be expected, considering the quality of the coal and the circumstances under which the operations must necessarily be carried on.

No headway has been made in the development of the Tayabas oilfield, and it is not likely that any material advances will be made until the present methods there have been radically changed. Warren D. Smith, the chief of the Division of Mines, while on leave in the United States, will spend a month in study in one of the California oilfields in preparation for projected work in the Philippine fields. The recent discovery of asphaltum in the mountains of Rizal province of Luzon, a two-days' walk from Manila, promises to be of great importance to the Islands.

NEW YORK

Dividends, Declared and Prospective.—Increased Metal Demand.—Litigation.—San Toy Affairs.—Chance for Speculation in Silver.

While there has been no noticeable improvement in Wall Street conditions during the past week, there are some features in copper that are being pointed to with a measure of pride, as reflecting the increase in prices in the metal market.

Calumet & Hecla has declared a quarterly dividend of $8 per share, as against $6 paid three months ago and one year ago. The Miami Copper Co. has made a semi-official announcement, through J. Parke Channing, that the initial dividend of the Miami is to be 50c. per share, and that in all probability it will be declared as a quarterly payment. Miami will be the first of the new Arizona porphyries to enter the ranks of the dividend payers, although it is expected that Chino, in New Mexico, will announce a dividend some time during the spring, as will also the Ray Consolidated. Miami has started the sixth unit of its concentrator, and expects to produce during the current month 3,000,000 lb. of copper. January earnings were at the rate of $150,000 net, which would be equivalent to something better than $2 per share per year. It is stated that Miami sold some copper at 14½c. recently, getting the top of the market on the present move. The recent dividend paid by the Bonanza group of mines at Kennecott, Alaska, amounted to $1,000,000. The company is capitalized at $2,500,000, but has expended some $23,000,000 in developing the mines and building the Copper River railroad. The railroad is said to be now on a basis where it pays its operating expenses, but it will be a long time before it will return any dividend out of its own earnings on the amount invested in it. The Bonanza mines represent one of the largest high-grade copper deposits recently developed. Engineers estimate that there is about 100,000 tons of 65% ore now ready for extraction; shipments up to the present time total about 16,000 tons. While the railroad was necessary for the operation of the mines, the real return upon this investment was and is expected to come from the opening of the tributary territory, and while Morgan & Co., Kuhn, Loeb & Co., and the Guggenheims, constituting what is known as the Morgan-Guggenheim syndicate, are apparently receiving a large return in taking down a dividend of $1,000,000, the fact remains that this syndicate has a large investment upon which it will never reap its expected profit until other outside capital goes into Alaska to develop its resources. Notwithstanding Alaska's much-talked-of immense coalfields, the Copper River railroad operates its engines with fuel oil, shipped in by tank steamer from California.

Reports from metal brokers in London tell of an increased demand, and it is expected that the amount of

metal exported will be the feature of the coming report of the Producers' Association. The world's visible supply is estimated at a much lower figure than at any time during the past two years. There has been no change in the policy of ignoring the fact that a large percentage of this copper has been purchased by various governments in preparation for possible coming hostilities, and it is possibly owing to this fact, and the belief that commercial requirements have not accounted for the shrinkage in accumulated stocks, that there are stories from time to time of hidden supplies of copper on the Continent that are so held as not to be taken into account statistically. One important financial New York paper, while ignoring the purpose of the market move, states that "the heavy shipments during the last two months made to Havre make it evident that 15,000,000 tons has gone into warehouse which has not been taken account of statistically. The metal has not gone into consumption, American shipments into France being largely in excess of the consumptive capacity of the country. There is reason to believe that similar transfers were also made to Germany and Holland, so that European statistics of stocks are either fragmentary or unreliable." In any event, it is quite evident that there is a much stronger combination existing in copper metal than ever before, and that the recent bull pool operations have been backed by enormous capital. If there has been a corner successfully engineered in copper, it will be well for the public, as well as the operators, to bear in mind the fact that with sufficient capital there is no great degree of difficulty in acquiring control of a commodity. The real test comes when the unloading begins, or, as the market phrase goes, "when the attempt is made to bury the corpse."

The various defendants in the suit brought by the United Copper Securities Co., the organization formed by Arthur P. Heinze, to rehabilitate the United Copper Co., acknowledge themselves to be as much in the dark as any part of the public, in regard to the relief suit by the recently instituted litigation. The suit would appear to be brought rather late in the day, as several of the defendants named, both corporate and individual, have alike gone the way of all things earthly.

The suit of the Government against George Graham Rice and others is apparently developing into something of an endurance contest. It is now in its fifth month, and a well known mining engineer, who was called upon to testify, commenting upon the length of the trial, stated that they had really but just begun. The case bids fair to furnish ground for some of the caustic criticisms made regarding the delays in our criminal procedure.

The management of the San Toy Mining Co. has issued a reply to the charges made by the committee of local stockholders regarding the Quince de Mayo lease, defending the action of D. B. Gillies, general manager for the company, on the ground that the directors did not care to take the risk in developing adjacent territory, but were willing to allow Mr. Gillies to do so, as any favorable developments would be of great benefit to the San Toy company. The use of the San Toy shaft and equipment was not given without compensation, but it was understood that if any ore were produced from the lease, the company should hoist the ore and receive a reasonable charge for so doing. The San Toy operations for January show a deficit of $4260, the mine being shut down during two weeks, on account of a strike among the laborers, and no ore was shipped during February on account of the discontinuance of service by the National Railways of Mexico south of Chihuahua.

Looking on the one hand at the stagnation of business on the New York Stock Exchange, and on the other hand at the results which have been accomplished in the copper-metal market within the past ninety days, and recalling also the active speculation that existed at one time upon the old Gold Exchange, some of the restless spirits in Wall Street have suggested that the position of silver presents some possibilities that might induce the public to indulge in speculation. Just at present the public has its head so pointed in the other direction from Wall Street, and is so apparently deaf to all inducements, that the Street itself would take a chance in making a market in dynamite, if that would bring any customers into the market-place. As to silver, it is argued that China regenerated will soon go on a silver basis with greatly enlarged needs; that India must soon buy silver for Government coinage, and that legitimate conditions are bound to force silver and lead to higher levels than have prevailed for some years. The so-called Indian pool is estimated to hold some 20,000,000 oz. of silver. As this is less than 10% of the world's annual production, and as the pool's operations have resulted in an advance of something like 8c., it is argued that a strong combination of American capital in America could make the pool pay considerably higher prices, in order to maintain its position. The operators in India, and the dealers in bullion in London, have been somewhat antagonistic, but as it has apparently been rather easy for the Indian pool to accomplish what has been done, it is believed that American capitalists could make themselves a decided factor if they entered the field. Details would have to be worked out that would permit certificates being issued against bullion in storage, and it is through the trading on these certificates that the public would be invited to take part in the operation. It is extremely doubtful whether anything more than talk will be developed along this line, but it is true that market operators would vociferously welcome anything that would create general interest and some market activity.

JARBIDGE, NEVADA

DEVELOPMENT OF ALPHA GROUP.—PROSPECTING THE FLAXIE.—DEVELOPING DEEPER LEVELS.—THE PAVLAK AND FLETCHER MILLS.

Chicago capitalists have taken over the Alpha group and have a force of men at work developing. Very little actual development work has been done on this vein, although small open-cuts have been made for 700 ft. along the surface and showing a vein 2 to 7 ft. wide. Average assays are $10 to $40 per ton, with portions of the quartz showing free gold and yielding a long string of colors in the pan.

Across Bourne gulch, to the north from the Alpha, the New York people who are prospecting the Flaxie vein are meeting with excellent results; at a depth of 75 ft. from the surface a drift has been run along the vein in a continuous ore-shoot for 125 ft. This vein has a width of 4 to 6 ft., and numerous samples assay $40 to $152 per ton. At the face is 8 in. of quartz that runs nearly $600 per ton; this is considered to be one of the best bodies of ore opened, and will crowd either the Bluster or Success for first place in the district.

The adit on the Jarbidge Gold Co.'s property, adjoining the Flaxie, has entered the Flaxie vein, which here is about 20 ft. wide and somewhat broken, being very near the surface. The average content is not so great as in the Flaxie workings, but on the whole the future promise of this property can be considered very bright. About a quarter of a mile to the northwest, on the Mother Lode claim, an adit is being run to intersect the Flaxie vein. And on the Cabin claim, near the river, a long adit is projected to cut the Flaxie vein at depth. The Success is pushing work on its four adit-levels, with every indication that the three ore-shoots on the upper levels persist, although the veins are somewhat faulted and irregular. George Wingfield has sent in a new superintendent to take charge; he has made another payment on the Success. Development on the Bluster on the adit or 300-ft. level is opening another ore-shoot to the south of the shaft. Mr. Wingfield is examining and sampling the Pavlak mine.

The expected shut-down of both the Pavlak and Fletcher mills has occurred, not from any lack of ore nor from any lack of gold content, but from the usual troubles that overtake a mine or mining company, no matter how good the mine may be, when inexperienced men are in charge. Capital finally becomes tired of paying for experience, and work is at a standstill until the bills are paid, a reorganization effected, and more money raised to remodel

the mill so that it will not only pulverize the ore, but save the mineral. The Pavlak mill was built on much too large a scale for the size of the orebodies, and its crushing and pulverizing equipment is practically no good. The Fletcher mill handled a little more ore since remodeling, but much too large a percentage of the mineral content was lost. As these errors are only such as can be easily overcome, it is expected that both of these mines will soon be running again and that the experience thus bought will prove of benefit to the other mines now developing. The ores at Jarbidge are not high grade, although they should pay good profits when properly treated; veins of 3 to 10 ft. in width are good workable size, and with ore of from $10 to $20 per ton, there is no reason why they should not be worked at a good profit; but a saving of over 50%, and a running time in mill of over 40%, are certainly necessary. Considerable work has been done this winter to the south of Bonanza ridge, along Gorge gulch, Snowslide gulch, and Dry gulch, and while no startling discoveries have been made, there are indications that lead to the belief that they will be heard from during the coming season.

SILVERTON, COLORADO

Frisco Tunnel Company to Build Mill. Sunnyside Operating. New Zinc Plant.—Kittimac Development.—New Iowa Tiger Lease Ships Excellent Concentrate.—Gold King Sub-Lessees Developing.

The San Juan district is experiencing a very mild winter and the snowfall has been exceedingly light. All necessary trails have been kept open and there has been no delay in receiving supplies and shipping ore. Charles Gagner, manager of the Frisco Tunnel Co., operator of the Bagley adit at Animas Forks, has returned from Pittsburg and announces that all financial arrangements have been completed and that work will begin on a reduction mill at an early date. It is rumored that Otto Mears has secured a bond and lease on the Gold Prince mine and mill, but no announcement of future plans has yet been made. All other properties at Animas Forks are idle, but it is probable that the Sound Democrat, Frank Hough, and Columbus will be active this season.

At Eureka the Sunnyside maintains its usual production and has started its new zinc plant, from which much is expected. The plant is equipped with electric separators and the company hopes to raise the percentage of zinc in the zinc concentrate above 40, which is at present the lowest percentage that can be shipped from this district at a profit. The results obtained in the new plant are not yet available. The Kittimac is being developed and John Joyce, the manager, announces that mine and mill will be in operation this season. The mill will be thoroughly overhauled and a cyanide plant added, and Mr. Joyce expects excellent results from the new milling methods which he plans to introduce. The Silver Lake is running two shifts and employs about one hundred men at mine and mill. The ore is of fair grade and the property is giving good returns under the new management. The Iowa Tiger Mining Co., successor of the Iowa Tiger Leasing Co., has shipped thirty cars of concentrate during February. This concentrate is better grade than any shipped for many months and nets the lessees $800 per car of 20 tons. Most of the crude is coming from the Melville vein, which previous lessees refused to operate, regarding it of no value. Forty sub-lessees are working in the Gold King mine, and report large tonnages of ore available for the mill, which will be started in April.

The Ledge Consolidated closed down February 10, without meeting its pay-roll or other obligations. The available ore in sight had steadily decreased for several months prior to the shut-down, and the company had made little effort to develop new ore, so that the shut-down was not unexpected. The company has about $8000 on hand to cover accounts amounting to $30,000, so that the miners and the local merchants are left, as usual, 'holding the sack.' The company had a bond and lease on the old Silver Ledge mine at Chattanooga, and the stockholders have invested about $150,000 in an effort to rehabilitate this old property. As stated in a previous article, the company's affairs have been woefully mismanaged from the start, and the board of directors, residents of Chicago mostly, have interfered with and handicapped the local managers so that success was almost impossible. The company has been directed by men ignorant of mining and unwilling to leave the local direction in the hands of competent men. During the two years and six months these men have directed its affairs the company has boasted seven general managers, eight mine superintendents, and three mill superintendents. The directors are at present negotiating with R. W. Hollis, trustee for the Ledge M. & M. Co. creditors, for an extension of time on property payments and more liberal terms in general, but success under the present board seems hardly possible, no matter what terms are granted. The Congress lessees report good progress, and the machines are at present in a hard iron pyrite formation, which makes considerable water, and which may be the pyritic casing which has always enclosed the enargite ore-shoot at the Congress.

KALGOORLIE, WESTERN AUSTRALIA

A Camel-back Survey.—Deep-Level Exploration in the Horse-Shoe.—Notes of the District.—Production Records for December and the Year.

The Mines Department has decided to keep one of the Geological Survey parties equipped with camels, employed upon flying surveys of those areas remote from settlement,

TYPICAL SURFACE PLANT ON THE GOLDEN MILE.

with the object of indicating, for the guidance of prospectors, any promising belts of country. The party will also look after water-supplies for these areas. A mill is being erected at Mount Egerton, near Peak Hill. The Department has not decided to build mills at Bamboo creek and Woodgina, in the Pilbarra field; and at Weston's, near Southern Cross. These fields require a little more development yet. Mention has been made of the Associated Northern buying for $110,000 the Gimlet South Extended, at Ora Banda, near Kalgoorlie. During the option 3190 ft. of exploratory work was done at three levels. At present, they are stripping the shaft and getting ready for the mill. This is to cost $125,000. The ore reserves are given as 159,000 tons, worth $950,000. This is all above the sulphide zone.

Last year the Horse-Shoe, boring from the 2800-ft. level of the Great Boulder, cut the boundary lode of its property, it being 18 ft. wide, worth $25 per ton. As the former's main shaft was down only some 2000 ft., it would mean a long time before this ore was reached by sinking and cross-cutting; so an arrangement was made with the Boulder people to cross-cut from their main and Edwards shafts at the 2650 and 2800-ft. levels. In the meantime the Horse-Shoe shaft would be sunk to these levels, and cross-cuts driven, so that early in 1913 it is expected to haul this ore to the mill. The following cables on this subject may be interesting. (1) West cross-cut of south drift, at 2800-ft. level of Boulder main shaft, cut No. 4 lode a few feet from north boundary, and 16 ft. from east boundary. It is well defined, but width and value not determined. (On the north is the Ivanhoe and east the Boulder.) (2) Lode is disturbed by a slide. Disturbed section extends to present face of cross-cut 35 ft. from east boundary. Boring for 4 ft. from face of cross-cut assays give $41.20 per ton. (The Horse-Shoe and Ivanhoe lodes are frequently disturbed by slides.) (3) Through the lode, with $33 over 6-ft. width. Well defined, and showing telluride and free gold. This is an important result, and work at Edwards' shaft is awaited with interest.

The Ivanhoe main shaft is now down 2600 ft. in country. From the Associated, Perseverance, Lake View & Star, and Kalgurli there is very little of note to report. The Holman pneumatic stamps are now at work on the Mountain Queen, near Southern Cross, and may furnish some interesting data from this new type of pulverizer. At the Hainault, a Richards classifier has been installed and is now under trial. The gold yield for December was valued at $2,470,000, making $29,110,000 for 1911, against $31,060,000 for 1910, and a total, to date, of $524,340,000.

The Perth mint received bullion worth $2,400,000 in December, and for the year past a total of $25,710,000; while the total issue of sovereigns and half-sovereigns was valued at $25,655,000. Dividends for the year totaled $4,110,000. The yield during December from the principal mines was as below:

Property.	Tonnage.	Gross Value.	Profit.
Associated	10,252	$ 59,500	$ 4,200*
Associated Northern	1,263	11,000	.....
Burbanks Main Lode	1,394	17,500	.....
Golden Horse-Shoe	22,221	137,000	1,400
Golden Ridge	2,705	26,300	8,700
Great Boulder Perseverance	19,666	102,200	6,200
Great Boulder Proprietary	16,908	242,500	144,800
Great Fingall	6,027	59,000	11,400
Hainault	5,048	35,300	2,000
Ivanhoe	18,641	200,000	90,000
Kalgurli	10,040	104,000	45,000
Lake View & Star	18,009	104,500	18,300
Oroya Black Range	4,580	45,800	17,200
Oroyo Links	10,510	60,600	12,100
Sons of Gwalia	14,020	129,300	48,500
Sons of Gwalia South	2,141	13,500	3,600
South Kalgurli	9,620	60,000	11,000

*Loss.

LONDON

RECORD OF SOUTH CROFTY FOR YEAR.—EAST POOL PROFITS.—RESULTS OF WHEAL KITTY & PENHALLS.—REPORTS FOR THE YEAR.

At this time of year the position of the tin-mining companies in Cornwall come up for review. Perhaps South Crofty is the company which may claim the precedence in receiving notice in this column. The results for the year 1911 are decidedly gratifying. Every item of the accounts shows an advance; the total production of tin, tungsten, and arsenic, the yield per ton of all three products, and the income and profit. Naturally the high price of tin has been in the company's favor, but, on the other hand, the prices realized for tungsten and arsenic have been slightly lower. The mill treated 63,882 tons of ore during the year, and the recovery was 677 tons of black tin which sold for £76,587; 148 tons of tungsten concentrate selling for £14,717, and 1008 tons of arsenic products selling for £9518. The total receipts were £100,822, and the receipts per ton 31s. 6d. The yield per ton of ore was 23.76 lb. black tin, 5.22 lb. wolfram, and 35.36 lb. arsenic products. As compared with 1910, the yield showed an increase of 47 tons black tin, 22 tons tungsten, and 272 tons of arsenic products, and the receipts per ton of ore treated, 6s. The profit for 1911, after allowing for depreciation and all other expenses, was £31,981, out of which £17,500 was distributed as dividend, being at the rate of 35% on the nominal capital, and £10,000 was placed to reserve. This dividend of 35% is of course a handsome one, but it must be remembered that when the present company was started five years ago outsiders paid £4 each for the £1 shares, so that their return is only 8¾% on their money.

One of the old mines, East Pool, that did well formerly, has been in rather low water for the past four years, owing to the fall in the grade of the ore. It is still worked on the cost-book system, and in consequence has been short of capital, and the underground development has been greatly neglected. It is pleasant to be able to report that the accounts for the three months ended December 31 last showed a profit of £749, which enabled the adverse balance of the previous quarter, amounting to £402, to be wiped out, and £347 to be carried forward. This is the first time since 1907 that the company has made a profit. There was a good deal of talk at the shareholders' meeting about dividends in the near future, but any division of profit would be absolute folly, seeing how the development of the property has been neglected for many years past. All the money that is likely to be made for the next few quarters should be devoted to vigorously developing the mine, so as to raise the grade and enable the management to face with equanimity a fall in the price of tin. For the past quarter, the average recovery was 19.25 lb. of tin and tungsten per ton, and the price received for the black tin averaged close to £114 per ton. The development for the past quarter was only 276 ft., and the tonnage milled 17,337, so that the footage was only 1 foot for every 62 tons milled. The receipts were £17,317, or 19s. 11d. per ton milled, while the costs were £16,568, or 19s. 1d. per ton. It is to be hoped that the directors will take courage to turn the company into one of limited liability, and raise adequate funds for conducting development on a proper scale. The treatment plant is thoroughly up to date, containing Holman air-cushion stamps, tube-mills, and magnetic separators. Those who are particularly interested in the subject will find a flow-sheet of the mill given in *The Mining Magazine* for February. The directors have recently gone so far toward publicizing the company as to appoint an outside accountant as auditor and adviser. It seems late in the day to have to record this step.

I reported a few months ago that the Wheal Kitty & Penhalls, an admirably managed little mine in the St. Agnes district, had unfortunately got into poor ground. This fact is reflected in the accounts for the latter half of 1911. After having shown continuous profits since its formation in 1907, this company has had now to report a small loss. The cause is obvious from the report, for it appears that the yield has dropped from 28 lb. per ton for the first half of 1911 to 19.9 lb. for the six months under review. Fortunately, the price of black tin was well maintained, or the position would be serious. The southern section of the Stamps lode has been a great disappointment. When intersected in the south cross-cut from Sara's shaft last July, the lode had a most promising appearance; so much so, that at the shareholders' meeting last August the speakers permitted themselves to paint the discovery in glowing colors. However, these ups and downs are to be expected in the St. Agnes district. It is satisfactory to see that the recovery is again on the up-grade, for at the last ticketing seven tons was offered for sale, which is the best fortnightly return since June last. During July to December 1911, 8384 tons was treated, with recovery of 19.9 lb., worth 20s. 3d. per ton, at a working cost of 21s. 2d.

General Mining News

ALASKA

Copper River

The McKinley Lake M. Co. has intersected a vein of ore of which five tons milled about $14 per ton. The company has about 450 ft. of development work. The Lucky Strike company, which has completed about 140 ft. of development work, has intersected a valuable vein 18 in. to 4 ft. wide.

The Northern Development Co., cooperating with the Copper River & Northwestern railroad, will operate motor cars across the surface of Kennicott glacier for transporting copper ore. Construction of the road will start soon.

Cordova

It is reported that a large deposit of high-grade cinnabar ore has been discovered recently between the Kuskokwim and Yukon rivers. An ore-shoot of metacinnabarite was opened from which assays of 60% cinnabar were obtained. It occurs in sandstone and serpentine, with a little limestone. The conditions are favorable for mining. Allen Chester, of Rebel Creek, Nevada, is interested. Samples of the ore will be placed on exhibition at Room 221, National Bank building, San Francisco.

Juneau

The Alaska Treadwell G. M. Co., during the month of January, made a production of gold and concentrate valued at $133,883, with a realizable value of $132,544. Operating expenses amounted to $97,463, leaving an operating profit of $35,081. Construction expenses were $6939, leaving an estimated net profit of $28,142. The ore milled yielded $2.29 per ton. During the month 992 ft. of development work was done.

Prince William Sound

It is reported that the vein has been intersected on the Mayfield property, 200 ft. below the surface, after a cross-cut had been driven about 180 ft. The vein at that point is said to be about 12 ft. wide. The Mayfield company, through M. M. Reese, is negotiating the purchase of a 20-stamp mill now lying idle near Douglas.

The Tanana

W. B. Mallison has purchased a 50-hp boiler for his claim on 4 Below Goldstream, says a report from Fox City. He intends to do open-cut work. McGillvray & Fisher, lessees on the Cleary extension of the Newsboy vein, have ordered a 5-stamp mill from Brumbaugh & Hamilton, states a Fairbanks report. It is believed the mill will be in operation by April 1. A. J. Smythe recently discovered unusually rich ore near the Jesson property at the head of Chatham creek, near Chatanika.

ARIZONA

Cochise County

The Commonwealth M. & M. Co. is making preparations for the construction of a 300-ton mill and cyanide plant at Pearce. It will be built in units, so that it may be enlarged at any time. At a recent meeting Charles E. Knox was elected president of the company, succeeding A. Y. Smith, and W. B. Alexander was elected secretary-treasurer, succeeding J. H. Snyder.

MAP OF ALASKA.

Advices from Bisbee state that ore assaying as high as 50% copper has been found on the 400-ft. level of the Shattuck mine.

Gila County

The Miami Copper Co.'s concentrator is now in full operation and is handling 3000 tons of ore per day. It is reported running satisfactorily and making a recovery close to 75%. While some changes will be made, especially in the crushing machinery, yet they will be introduced gradually and without interfering with the mill's operation. The mine is easily furnishing all the ore the mill can handle, and considerable development work is being done. Assembling of machinery in the power-house at the town of Miami continues and should be finished in a few weeks. The ground northeast of the orebody is being explored by churn-drilling, there being one drill in use at present, though another may be added later. At the Live Oak mine the erection of equipment at No. 2 shaft, and the enlargement of this shaft from two to three

compartments, is proceeding rapidly. The churn-drill hole on the Barney group is 1070 ft. deep and in granite-porphyry. Another churn-drill was put to work last week near the eastern end of the property near the Live Oak boundary.

GREENLEE COUNTY

The Arizona Celtic Copper Co. has been organized at Clifton, capitalized at $3,000,000. The incorporators are D. F. Lynch, R. T. O'Donnell, and A. G. Shaw.

YAVAPAI COUNTY

Press rumors state that the Bagdad Copper Co. is planning to build a branch from the Santa Fé railroad to its property, formerly the Lawler copper mines, in the Eureka district. It also is reported that a large reduction plant will be built. The Lake Superior & Nevada M. Co. mill, near Harrington, is to be put in operation soon. The United Gold Mines Co.'s mill will resume operation April 1, according to an announcement by D. J. Sullivan.

James Blanchard is reported to have discovered a 5-ft. vein of rich gold ore on his claim a mile from Turkey, a station on the Bradshaw Mountain railroad. The Gold Cliff M. Co. has acquired the Yarnell mine. W. E. Sharps is at the head of the company, which is planning operation on a large scale. According to S. R. McGarvey, the Yavapai Metals M. Co. has intersected unusually rich ore in a cross-cut from the 250-ft. level.

CALIFORNIA

MARIPOSA COUNTY

(Special Correspondence.)—The Clearing House M. Co., operating the Original mine on the Y. V. railroad, one of the successful mines of Mariposa county, is now installing a power-plant to generate power for operating purposes. The Original mine, according to reports by the company, has an adit 275 ft. long, all in good ore, and above the adit is sufficient ore for a year's run. In the winze, down to where the water could not be handled, is considerable high-grade ore. The power-plant has a 5-drill cross-compound compressor, driven by a 108-hp. turbine. The electric hoist, capable of sinking 1000 ft., is driven by a 150-hp. Westinghouse alternating-current 440-volt generator. This generator is driven by a 230-hp. turbine. Water is diverted from the Merced river by a timber crib dam across the river, to a ditch a quarter of a mile in length and into a flume with a carrying capacity of 6000 miner's inches of water. The total mean efficient head on the turbine is 24 ft. H. A. Kuns is consulting engineer and George W. Egenhoff is superintendent of this property. The company is now considering erecting a 10-stamp mill. Stock of the company is owned principally in Merced.

Merced, March 2.

PLUMAS COUNTY

(Special Correspondence.)—The recently incorporated Grellman M. Co. is completing preparations for working the Colonial mine, on Mill creek. The gravel is mined by the drift method. J. G. Steel is manager. A development company is being organized by Llewellyn A. Morrison, of New York, to operate the Elizabethan group of six quartz claims, near Quincy. Morrison recently bonded the group from C. Bayles for $70,000. The Spring Garden channel has been intersected in the Brown Bear mine. Driving has been under way for several months. A washing plant is being erected. A. Dennis is manager. An electric hoist has been installed at the Golden Eagle. In the old workings a fair amount of ore is said to be blocked out. The Frankmont M. Co. is extending a 4500-ft. adit into the Home Ticket mine, by way of the Eldorado estate. The work is rapidly nearing completion, and operation at the Home Ticket will commence shortly. W. S. Keith is superintendent. The property is situated in the Last Chance district. The new gravel deposit, about 50 ft. below the Thistle channel, is being opened by an adit. It is reported some of the gravel runs $40 per cubic yard in gold. About 80 men are employed. R. H. Kingdon is manager. The Eagle Copper Co., owning a group of developed copper claims near Taylorsville, expects to start smelting this summer. The smelter is nearly completed, and ample ore reserves are available. The company is composed principally of San Francisco people.

Quincy, March 1.

SIERRA COUNTY

(Special Correspondence.)—The drift from the Tightner adit toward the Red Star mine has intersected a vein showing in places a width of 10 ft. It has been opened sufficiently to indicate a length of about 200 ft. Arrangements are being made to open it to greater depth. Since the new owning company, composed of San Francisco, Grass Valley, and Nevada City people, took over the Tightner, a large quantity of ore has been opened. Abe Hall, formerly with the North Star Mines Co., is in charge of operations. It is stated the new plant of machinery for the Sixteen-to-One will be immediately shipped in and erected. The company has been delaying shipment for fear that a storm would render freighting practically impossible. Oakland people are interested. W. J. Smart is manager. The Oasis M. & M. Co. reports the intersection of the long-lost King Solomon vein in the Kenton mine. The lode is said to be 12 ft. wide with a good portion carrying milling ore. Arrangements are under way to repair the small mill and commence crushing early in April, if the water-supply proves sufficient. E. S. Polk is manager. Los Angeles people control the company. An 8-ft. vein has been intersected by the 700-ft. adit at the Red Ledge, at Scott's Flat, on lower Kanaka creek. Arrangements are being made to develop the vein and determine its value. Buffalo, New York, people are back of the development. It is reported a mill will be erected the coming summer to replace the one burned several years ago. J. B. Moulton is superintendent. The Rainbow company has purchased additional machinery and plans have been made for further sinking. L. P. Woodbury is manager. The Croesus mill is treating a good quality of ore. This property continues to be the heaviest producer in the Alleghany district. The Sovereign M. Co. has its mill and cyanide plant in action. The latter is reported to be effecting a saving of 90%. A mile line of flumes has been completed to convey the tailing to a point where the domestic water-supply will not be contaminated. F. O. Richardson is superintendent.

Alleghany, March 2.

The old adit and drifts of the North Fork drift gravel mine have been successfully reopened, after several years of work, by J. F. Stone, general manager for the North Fork M. Co. The inclined adit is 1050 ft. long. The property is near Forest.

TUOLUMNE COUNTY

(Special Correspondence.)—A new compressor and electric-power apparatus will be installed at the Bonanza mine. Meanwhile operations have ceased, owing to the failure of the pumps to control the water. New cement mortar-blocks for 30 additional stamps are being installed at the Harvard. This will bring the total number of stamps up to 90. The sinking of the shaft 300 ft. deeper has necessitated the temporary laying off of many men. Rich ore has been found at the Imperial. The Dutch mill, strengthened by the addition of twenty stamps, will be running by the first of April. Development work is being done by a San Francisco company upon the Oak Hill and Mitchell mines, in the southwestern part of the county. John Whitney has uncovered the old gravel bed at the Humbug tunnel. Washings give high results per yard and the outlook is most encouraging. Electricity from the Phoenix Lake power-plant is now used at the Black Oak mine. A large 8-drill compressor is in place and the new roller mill and cyanide plant will soon be finished. By improved methods it is expected to save more than 85% of the gold content. The rich shoot of ore, which was found in the 1400 and 1500-ft. levels, is now being sought for in the 1600-ft. level, where a cross-cut is being run. An increased inflow of water at the Springfield T. & D. Co.'s property has made it necessary to remove the boilers from the Ravich mine in order

to install a steam pumping plant. Some difficulty is experienced at the Saratoga M. & D. Co.'s mine, below Springfield, by the filling of the workings with clay which bursts continually from the face of the adit.

Wayland Avery, of San Francisco, has given R. C. Kennedy of San Francisco, A. Wagner of Alameda, and M. Tucker of Tuolumne, an option to purchase the Starr King and Sherman quartz mines. The purchase price is $16,500, to be paid in installments. The intending purchasers agree to unwater the Starr King mine shaft and to work without interruption, for which $600 will be deducted from the first payment. A force of men will be put on at the Iron Spring group of mines, where a cross-cut will be driven about 700 ft. A new mill has been ordered and will be installed at once.

Tuolumne, March 4.

COLORADO

Clear Creek County

(Special Correspondence.)—Word was received in Georgetown last Tuesday that the Centennial mine, on Leavenworth mountain, had been sold by David Kennedy to Boston capitalists for $125,000. It is stated that a 50-ton mill will be constructed and that a new compressor-plant will be purchased. Work has been resumed on the Big Blue property, situated on Saxon mountain. Driving has been started on the Big Blue vein, cut 600 ft. from the portal of the adit. An 8-in. streak of $30 ore is being followed. A. Santo is manager. The Ontario mine, on Young mountain, is the scene of a rich discovery. A streak of ore 12 in. wide gives assays of 180 oz. silver and 1.10 oz. gold per ton. William Young is manager. The compressor-plant at the Everett mine on Republican mountain will be brought into commission next week. Shipments of 200-oz. silver ore are going out. Otto Shatz is lessee.

Georgetown, March 2.

The Saxon mine, near Georgetown, has been purchased by Poindexter & McDonald of Seattle. It is reported that a development fund amounting to $30,000 will be provided for operation, which will not be started for a month or two.

Ouray County

Press reports assert that enough ore has been blocked out in the newly proved ground of the Camp Bird vein to insure a year's reserve in addition to the ore which will be treated at the mill. The bottom of the winze, now being made to conform from the fourth level to the dimensions of the new shaft which is being sunk from the third level, has shown the vein to be nearly vertical, and about five feet wide. The ore is of profitable grade. It is reported that a sample taken from the Muldoon vein by Frank Beech and Robert Long assayed 1700 oz. silver and 4½ oz. gold per ton. The discovery was made on the road connecting the Camp Bird and Revenue mills. The men have a lease on the property.

San Juan County

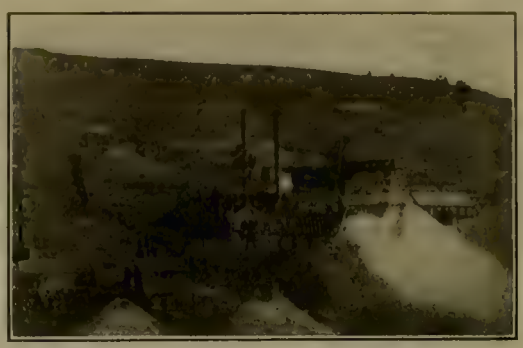
A. A. Brown, representing Eastern capital, has secured a bond and lease on the Columbine group, in Maggie gulch. The property is an extension of the Buffalo Boy. Work will be started early in the spring, says a Silverton report.

Teller County (Cripple Creek)

The Golden Cycle M. Co. has paid its regular dividend for March, at a rate of 1c. per share. The $30,000 required brings the dividend total for the year to $90,000. The Union Leasing Co., operating the Gold Dollar Con. M. Co.'s Husted shaft on Beacon hill, in February shipped 28 cars of ore, which averaged about $30 per ton. Arthur Carnduff and associats, lessees on the Dead Pine-Crown Point property, during last month shipped 15 cars of milling grade ore. The Puritan G. M. Co. has secured its patent on the Holy Terror claim.

During February the main bore of the Roosevelt drainage adit was driven 209 ft. Only one day was lost. T. R. Countryman, engineer for the project, estimates the flow to be over 10,000 gal. per minute. The washing away of the weirs has made accurate measurement of the flow impossible. The driving of the adit was in charge of Charles Fuller, superintendent. The Colorado Mines & Investment Co.'s American Eagle mine in February shipped 17 cars of ore averaging about $60 per ton. The Pride of Cripple Creek shipped 7 cars. The School Section L. Co. during the month shipped 18 cars of ore.

The El Paso mine, Beacon hill, in February shipped 103 cars of ore averaging about $20 per ton. The Marquette Gold M. Co. is considering reorganization. L. J. A. Cockburn, secretary of the company, has addressed a letter containing a plan of reorganization to the stockholders. The Kitty Lane Gold M. Co., a reorganization of the Gould company, has been incorporated, with a capitalization of $2,000,000. Matha & Co., holding a lease



EL PASO MINE, CRIPPLE CREEK.

on the Pharmacist mine, Bull hill, recently shipped five cars of ore.

IDAHO

Idaho County

The Elk City Con. Mines Co., a Spokane company, is about to erect a Chilean mill on its property, which is situated about six miles from Elk City. The adit is in 200 ft. During development, about 300 tons of ore, reported to assay $6 per ton, was removed.

Kootenai County

The Palisade M. & M. Co., capitalized at $1,500,000, has been incorporated. T. W. Schmidt, of Cataldo, is president of the new company, which has a lead-silver mine at the head of Pine creek.

Shoshone County

The Reindeer M. Co. is planning to erect a mill, to be in operation next fall, on its property in the Wallace district of the Coeur d'Alene. The work in hand consists of driving and cross-cutting on the vein from the shaft level. Two large bodies of good milling ore have been developed. The first shoot was 75 ft. long and 15 ft. wide, and the second shoot has been driven on for 125 ft. The cross-cut has shown this to be 22 ft. wide.

It is reported that the 150-ton concentrator at the Alice mine will be put in operation in the near future. Development is to be resumed at the Ray Jefferson property in the Sunset district.

MONTANA

Silverbow County

(Special Correspondence.)—Of the independent producing companies in this district, none is making a better showing than the East Butte, and in the course of a few months the company will be earning a good profit on its operations. For several months improvements looking to the reduction of costs have been in progress, and it is now claimed that the company is in a position to put copper on the New York market in competition with the leading producers of the country. This condition of affairs has been largely brought about by Oscar Rohn, manager for the company. In the next few months the smelter will be in a position to turn out 1,500,000 lb. of copper

per month at a cost of about 9c. per pound. The sintering plant recently finished is one of the most important improvements made in the past few months. With it the flue-dust is carried back to the blast-furnaces for re-treatment, bringing about a saving of at least 5% of what was formerly a complete loss of about 8% of the mineral content of all ores treated. As the process is largely automatic, the cost of operation is comparatively light. This will add considerably to the earning power of the company. The plant has a capacity of treating 100 tons of flue-dust every 24 hours. It is adjoining the smelter and close to the adits beneath the new dust-chamber which was completed a few weeks ago.

An effort is to be made by W. A. Clark to operate the Moulton mine, this time as a silver property. A year ago the shaft was repaired and some work done, but a shipment of ore sent to Salt Lake did not turn out well, as the process under which the ore was treated did not separate the zinc, iron, and silver satisfactorily. It is now claimed that a process has been perfected which will treat the Moulton ore at a profit and that on the strength of this the mine is to be reopened and shipments of ore made to Salt Lake City. It is more than twelve years since the Moulton mine has been a producer. Previous to the silver panic it was a profitable property.

Butte, March 4.

NEVADA

Esmeralda County

(Special Correspondence.) — The estimated February production of the Goldfield Con. Mines Co. was 27,641 tons of ore, with a gross value of about $685,000. Operating expenses amounted to $210,000, leaving a net profit for the month of $475,000.

Goldfield, March 4.

The report of the Florence Goldfield M. Co. for the year ended December 31 shows that the company operated for that period with a deficit of $42,008. The year closed with the company having $44,098 on hand. During the year the management did 11,699 ft. of development work. The production for the year was 48,874 tons of ore, which yielded about $252,821. The loss caused by the burning of the mill last December is estimated at $212,481, after proper deductions were made for depreciation and insurance.

Humboldt County

The shaft now being sunk on the north end of Winnemucca mountain by Bert Shively and associates has intersected a vein of rich ore, according to recent advices. The shaft is down 30 feet.

Lyon County

(Special Correspondence.)—The Mason Valley smelter at Thompson has one blast-furnace in operation and has smelted as high as 560 tons of charge per day. The matte is being shipped to the Garfield smelter. Within the next two months the second furnace will be blown in, as the Nevada-Douglas and Mason Valley mines are expected to be shipping the necessary quantity of ore by that time. These two mines are now shipping 200 to 250 tons per day each, and will gradually work up to a 500-ton per day output. A considerable quantity of custom ore is being bought by the smelter. The Nevada-Douglas is also shipping about 150 tons per day of gypsum from its extensive deposit of that mineral, to the Western Gypsum Co. at Reno. This is 400 ft. thick, of unknown extent, and has the highest quality of any gypsum deposit in the Rocky Mountain region. Quarrying machinery is being erected to aid in its extraction.

Yerington, March 4.

Nye County

The Tonopah Belmont Development Co. has declared a dividend of 25c. per share. A similar dividend was paid January 1. The dividend, which will require $375,000, will bring the company's total dividend disbursements up to $2,843,000.

Press rumors are to the effect that the Rogers-Norton company, of New York, represented at Manhattan by F. H. Mitchell, soon will commence development of the Toro Blanco group, recently purchased.

The Tonopah Mining company last week produced 3500 tons of ore. The production of other properties in the district for the week were the Belmont company, 2200 tons; Montana Tonopah, 1041 tons; Tonopah Extension, 990 tons; West End, 800 tons shipped and 44 tons to the smelter; the MacNamara, 400 tons; making a total of 8975 tons of ore from the district during the week. The gross value of the ore is estimated at $224,375.

Storey County

The Ophir company last week produced 298 tons of ore, estimated, of a gross assay value of about $10,160. The shipments for the week included 356 tons of ore for the Kinkead mill. The Crown Point hoisted 773 cars of ore, and shipped 657 tons to the Yellow Jacket mill. The ore hoisted was valued at about $5800. The Mexican mill, running 72% of the time, crushed 421 tons of ore with a gross assay value of $9388. The Con. Virginia has changed the numbers of its levels to conform with the system used in other north end mines, and each level now has the same number in all of the mines. In addition to other work in the Con. Virginia, 29 cars of ore assaying $23.12 per ton was mined. The preparation for the joint Best & Belcher and Gould & Curry winze has been completed. The United Comstock Pumping Association reported for the week the water-level as being 297 ft. below the 2200-ft. level station measuring point.

Bullion valued at about $6000 was shipped March 2 from the South Brunswick lode by M. C. Murtagh. The bullion, which was the first shipment from the South Brunswick lode, was from ore from the Home claim, the ore having an average assay value of $86 gold and $2 silver. The Home is one of six claims in the Silver Star district owned by Mr. Murtagh. On March 3 the Mexican mill shipped five bars of bullion, valued at over $10,000, to the smelter.

White Pine County

(Special Correspondence.)—The Nevada Con. Copper Co. has five steam-shovels in action at Copper Flat, four on overburden, one on ore. Two are in action at the Liberty pit, one handling overburden, and the second mining ore. Churn-drills and steam-shovels are active on the hill situated between the Copper Flat and Liberty pits. A new 95-ton Bucyrus shovel is being tested and will probably go into commission soon. The company is reported to have recently extracted some high-grade ore from the Liberty workings. From the Veteran mine about 1100 tons of ore per day is being sent to the Steptoe smelter at McGill; 300 men are working at this mine. The Boston-Ely company has suspended operations. It is officially stated the company is planning to conduct prospecting with diamond-drills, this work to be done under contract. If results prove satisfactory, pumps will be erected, lower levels drained, and the Emma shaft sunk deeper. The Ely Con. company is arranging for the sinking of the Zack shaft from the 600 to the 800-ft. level. It is hoped to commence this work within a short time. On the 400, 500, and 600-ft. levels good quantities of ore have been opened. S. M. Levy, president of the company, recently inspected the holdings. The prospecting and development of lead-ore deposits in the Ely district is attracting much attention. The Lead King company reports the uncovering of a vein of steel galena ore averaging three to five feet wide. The ore is said to run about 70% lead, with some silver. Salt Lake people control the property, situated near McGill. The Ely Gibraltar is prospecting for lead on its holdings, several miles north of the Steptoe smelter. An adit has been driven 800 ft. and is being continued. Surface indications are considered to favor success. Other companies are active, and considerable ground is undergoing exploration.

Ely, March 1.

One of the eight units of the McGill concentrator is constantly operating on ore from the Veteran mine. For treating the Veteran ore, which is mined by the caving system, the jigs at the mill are being overhauled. Copper

Flat ores are treated without jigging. The McGill plant in January produced 6,309,228 lb. of copper, the heaviest month since the record established in July 1910 of 6,896,429 pounds.

Advices from Ely state that A. D. Meyers has completed the purchase of the Panamint mine, on the west slope of Panamint range, near Telephone peak. Operation will be resumed under the direction of J. K. Turner.

UTAH

Carbon County

(Special Correspondence.)- W. G. Sharp, president of the U. S. S. R. & M. Co., representing interests connected with that company and with the Davis coal people in West Virginia, has purchased the Blackhawk Coal Co., having 1000 acres of coal land, and a controlling interest in the Castle Valley Coal Co., which owns 4400 acres, together with the Castle Valley Railroad Co., which runs from Mohrland to Price, on the main land of the Denver & Rio Grande railroad. He has also secured an option on the control of the Consolidated Fuel Co., which owns 3600 acres of land in the vicinity. If this option is exercised, which it is stated unquestionably will be done, these transactions in themselves mean the expenditure of $2,740,000. The Utah Coal railroad, owned by the Sharp interests, will be built to connect these mines in Carbon and Emery counties with the San Pedro, Los Angeles & Salt Lake railroad. By the time the railroad is completed, it is stated that the mines mentioned will be brought up to a capacity of 6000 to 8000 tons per day. Options on additional coal land have been secured, in Huntington canyon and elsewhere, which will greatly increase the holdings of the company and make it a powerful rival of Gould's Utah Fuel Company.

Price, March 4.

WASHINGTON

Ferry County

O. B. Hollis, of Spokane, who has just completed an inspection of the Princess Republic property at Republic, reports the discovery of an excellent ore-shoot on the 600-ft. level, 400 ft. below the adit-level. Good shipping ore has been found on all levels. Plans have been completed for the resumption of work in the near future, and it is expected that the property will begin shipping this season. There is a wagon-road from the portal of the property to the Great Northern tracks.

Spokane County

William S. Thyng has been elected secretary of the Northwestern Bureau of Mines, which was organized in Spokane on February 28. William A. Nicholls is president, the secretary-treasurer being Ross Brattain. The Bureau has permanent quarters at 105 South Howard street.

Stevens County

The American Tungsten Consolidated corporation, recently organized, has taken over the Germania mines and other important tungsten properties in the Cedar canyon district, and will work them as a group under one management. The Germania is equipped with modern machinery. The new owners will complete the mill, and plan the installation of an aerial tramway to convey ore to the mill. The corporation plans to open the three lower veins east of the Germania, where there has been little or no development at depth.

Conrad Wolfle and W. G. Collins of Spokane have closed negotiations for a bond for $50,000 extending over a period of two years on the Copper Queen group of seven claims lying just north of the United Copper Co.'s property. Four of the claims are patented. The property will be operated in connection with the United mine.

NICARAGUA

Pis Pis

It is reported from New York that the sale of the Bonanza mine has been effected in Paris. A dredging contract, in the vicinity of the Potosi mine, has been secured by Mr. Aramburu.

Among the Copper Mines

Isle Royale in 1911 made a net profit of $160,000, with a production of 7,500,000 lb. of copper at a cost of 10½c. per pound.

The Mayflower M. Co., it is reported, has proved its vein for a length of 550 ft., the distance between No. 15 and 17 drill-holes, and for a width of 55 ft. The extreme depth was found to be 300 feet.

The Naumkeag Copper Co. will be organized, probably under the laws of Michigan, by the General Development Co., and will be capitalized at 200,000 shares of a par value of $25. The property comprises 1260 acres on the south side of Portage lake, just west of Houghton, Michigan.

The Tuolumne company will show a treasury surplus of about $80,000 after having paid for all the improvements, including the new surface plant and the building of the railroad spur from the mine to the Butte, Anaconda & Pacific railroad connection. In another week the output will be increased to about 400 tons per day. In August next, unless something unusual occurs to retard the present showing, the dividends at the rate of 25c. will be resumed. The showing on the 1800-ft. level has improved in the past week, and ore is being mined which runs as high as 12%. It is intended to ship a large amount of this ore in the next few weeks and keep the ore on the 1400 and 1600-ft. levels in reserve.

The North Butte company is not making any effort to develop the Edith May vein from the 2800-ft. level. Crosscutting is going on in a northerly direction. From the 2800-ft. level the High Ore mine is to be entered, but it will be quite a long time yet before this is accomplished, as some 500 ft. is to be cut through. The purpose of this is to afford an exit from the property in case of necessity, and also for the purpose of affording the North Butte company a chance to take advantage of the High Ore system of drainage. On the various lower levels of the North Butte extensive development work is going on and some fine bodies of ore are being opened up, this being especially true of the Snowball vein on the 2200-ft. level, where the orebody is becoming larger and more valuable. A considerable quantity of the ore now going to the Washoe smelter is from this level, and some of it runs as high as 12% copper.

The Chino Copper Co.'s first quarterly report for the period ended December 31, shows that the steam-shovels handled 1,938,000 cu. yd. of material, of which 377,000 tons went to the stock-pile. The average cost of the steam-shovels, stripping and mining, was a little over 31c. per cubic yard. At present one shovel, working only part of the time, is supplying more ore than the mill can treat. Two units of the mill are in operation and the third will be put in commission in the near future. The two units under construction should be read in a few months, one in May, and the other on or about July 1. Drilling was discontinued at the close of September, and the last estimate of ore reserves, October 1, places the amount at 54,970,646 tons, averaging 2.24% copper, of which about 32,000,000 tons will be mined with steam-shovels. Although the ore has contained a large amount of carbonate, it has been of higher than average grade, and the recovery has been equivalent to high recovery from ore of ordinary grade. The cost of production in December was 8.3c. per pound. The January cost was about 8¼c. per pound. Judging from the amount of ore treated at present, it is believed that the mill will be capable of handling a minimum of 5000 tons of ore per day. The report closes with the statement that with two units operating at full tonnage on the inferior quality of ore now being treated the cost of producing copper would not exceed 7c. per pound. No difficulties have been experienced in the operation of the mill.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

C. H. MUNRO is in New York.

JAMES G. BERRYHILL was in town.

H. W. DUBOIS is in San Francisco.

E. C. DAMIN was in San Francisco.

F. L. LOWELL has returned from Idaho.

H. V. WINCHELL was in San Francisco recently.

PERRY SKILLMAN was in San Francisco recently.

J. WILLIAM SMITH was in San Francisco this week.

LIONEL LINDSAY has returned to San Francisco from London.

B. C. AUSTIN has been at Smartsville and Hammonton, California.

H. S. CHAPMAN has sailed for the Philippine Islands on mining business.

W. W. MEIN has gone to Arizona, and from there will go to Porcupine, Ontario.

JOHN W. GEIGER has returned to Salt Lake City from Humboldt county, Nevada.

A. E. DRUCKER was married to Miss MINNIE BARSTOW, at Seoul, Korea, February 14.

A. C. FRENCH is in charge of development at the Lost Josephine mine, near Provo, Utah.

S. S. ARENTZ, general superintendent for the Nevada Douglas Copper Co. is in San Francisco.

STEPHEN J. LETT is returning shortly from Sumatra, where he has been for the past three years.

CHARLES KIRCHHOFF was married to Miss ERWINA DIEPENBROCK on February 26, in New York City.

EDWARD M. RABE is at Magnolia, Boulder county, Colorado, conducting a series of mill and cyanide tests for the Cash mine.

THEODORE B. COMSTOCK has given up his work on the Board of Public Utilities and resumed general practice at Los Angeles.

M. A. NEWMAN has resigned as manager for the Cia. Minera Jesus Maria y Anexas, at San Jose de Gracia, Sinaloa, Mexico.

F. LYNWOOD GARRISON has been examining a mine in the South, but was at Toronto this week attending the meeting of the Canadian Mining Institute.

THOMAS N. MILLER has sold his engineering office at Nevada City, California, to C. W. WHITWELL, and will sail for Korea from San Francisco on March 12.

PAUL DE MONTCALM is a member of Ben S. Revett's party, which is prospecting in the Choco district, Colombia, for the Consolidated Gold Fields of South Africa.

A. H. PURDUE has been elected State Geologist of Tennessee to succeed George H. ASHLEY, resigned. Mr. Purdue's address is State Geological Survey, Nashville, Tennessee.

A. J. HOSKIN is now Western editor of *Mines and Minerals*, succeeding GEORGE F. DUCK, who is now principal of the School of Coal Mining of the International Correspondence Schools.

JOHN CARSON, the president, and SAMUEL W. COHEN, the general manager for the Crown Reserve Mining Co., Ltd., have gone to Europe for two months on business for the company.

S. W. YOUNG, of Stanford University, will give a talk before the Mining Association of the University of California on the 'Thiogen Process,' Wednesday, March 13, at 8 p.m., in room 200 Mining building. Mr. Young has made some very successful trial runs at Campo Seco with his process, and will have several lantern slides to illustrate his talk. The public is invited.

Market Reports

LOCAL METAL PRICES

San Francisco March 7.

Antimony	11—11½c	Quicksilver (flask)	46.50
Electrolytic Copper	16—17¼c	Tin	47—48½c
Pig Lead	4.25—5.20c	Spelter	8—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

Average daily prices in cents per pound, based on wholesale transactions, standard brands.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Feb. 29	14.33	4.00	6 60	58⅛
Mar. 1	14.33	4.00	6.70	58⅛
" 2	14.33	4.00	6.70	58⅛
" 3	Sunday.	No market.		
" 4	14.40	4.00	6.70	58⅛
" 5	14.40	4.00	6.70	58⅛
" 6	14.40	4.00	6.70	58⅛

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, Mar. 7.		Closing Prices Mar. 7.
Adventure	7¾	Mohawk	$ 57
Allouez	42½	North Butte	27¾
Calumet & Arizona	62½	Old Dominion	49¼
Calumet & Hecla	455	Osceola	114
Centennial	20	Quincy	78½
Copper Range	57	Shannon	12⅜
Daly West	5⅜	Superior & Boston	3½
Franklin	14⅛	Tamarack	30
Granby	86¼	Trinity	6
Greene Cananea, ctf.	7⅛	Utah Con	16¼
Isle-Royale	28⅜	Victoria	4½
La Salle	——	Winona	7
Mass Copper	8	Wolverine	112

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, March 7.

Atlanta	$ .17	Mayflower	$ .02
Belcher	.51	Mexican	3.47
Belmont	10.00	Midway	.28
B. & B.	.14	Montana-Tonopah	1.37
Booth	.06	Nevada Hills	2.27
Chollar	.15	Ophir	1.47
Combination Fraction	.15	Pittsburg Silver Peak	1.32
Con. Virgina	.82	Round Mountain	.46
Florence	.61	Savage	.27
Goldfield Con.	4.50	Tonopah Extension	1.80
Gould & Curry	.05	Tonopah of Nevada	7.40
Jim Butler	.40	Union	1.25
Jumbo Extension	.27	Vernal	.15
MacNamara	.20	West End	1.20

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, March 7.

Associated Oil	$42.25	Peerless	$ 4.60
Brookshire	.80	Pinal	3.75
Caribou (New Stock)	1.35	Premier	.58
Claremont	.65	P. S. Petroleum	.18
Coalinga National	.14	Republic	.37
Con. Midway	.01	Silver Tip	.90
Empire	1.10	Sterling	1.40
Enos	.04	S. W. & B.	.17
Maricopa 36	.40	Turner	1.00
Midway Premier	.29	Union	98.37
Monte Cristo	1.30	United Oil	.35
Palmer	.70	W. K. Oil	2.25

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. Mar. 7.		Closing Prices. Mar. 7.
Amalgamated Copper	$ 68⅜	La Rose	$ 3½
A. S. & R. Co.	73¼	Mason Valley	12¾
Braden Copper	6½	Miami Copper	24½
B. C. Copper Co.	4½	Mines Co. of America	3⅜
Butte Coalition	23	Nevada Con	20
Chino	25½	Nevada Utah	¼c
Davis Daly	⅜	Nipissing	7½
Dobie	⅛	Ohio Copper	1
Dolores	4	Ray Central	2½
First National	2¾	Ray Con	17⅝
Foley O'Brien	⅛	South Utah	⅛
Giroux	4½	Superior & Pittsburg	16½
Goldfield Con.	4½	Tenn. Copper	38⅛
Greene-Cananea	7½	Trinity	6⅜
Guanajuato Con.	⅛	Tuolumne Copper	3⅜
Hollinger	11½	United Copper	1½
Inspiration	19½	Utah Copper	58
Kerr Lake	2⅜	Yukon Gold	3½

Monthly Copper Report

By James Lewis & Son

Under the influence of a fall in the price of securities on the New York Stock Exchange standard copper declined from £61 17s. 6d. for cash on February 1, to £61 on February 6. The very favorable American statistics showing a reduction of 10,346 tons in the stocks at the end of January and an increase of 9047 tons in the home consumption as compared with the same month last year, induced active buying of profits and standard advanced on February 9 to £63 cash and £63 15s. three months. This was followed by a fall to £62 7s. 6d. February 14; but the very material reduction in European stocks and in visible supply announced February 15 caused a sharp reaction to £62 17s. 6d. cash and £63 11s. 3d. three months.

Refined copper has sold only to a moderate extent, manufacturers showing little desire to replenish their stocks, which must now be considerably depleted. American electrolytic was offered at £65 per ton c.i.f. for March and £65 5s. for April delivery, but the quotation has since been raised 25s. per ton. In sulphate of copper more business has been transacted, and with the sale of the second-hand parcels pressed on the market, down to £21 15s. per ton for February delivery was accepted. There has since been a recovery, closing value February 15 being £22 15s. with buyers eager to acquire sulphate for delivery during February, as should a strike of the coal miners take place on March 1, its manufacture will be considerably diminished, if not altogether stopped.

Stocks in England and France have decreased 982 tons and in Germany and Holland 400 tons during the fortnight. American refiners' returns for the month of January show a reduction of 10,346 tons in the stocks, the production being 1590 tons less than for the previous month, and exports 414 tons more. The consumption was 1627 tons less than during December, but 9047 tons more than for January last year. The total reduction in American and European stocks is therefore 12,334 tons, or 65,598 tons less than on February 1, 1911, being 88,359 tons, against 153,957 tons twelve months ago. English and French consumption has increased 76 tons, and the exports of sulphate of copper are 31% larger than the large exports of January 1911.

	1911. Tons.	1912. Tons.
Imports from United States:		
England	7,090	5,066
France	5,834	6,431
Italy, Austria, and Russia	2,430	2,835
	15,354	14,332
Imports from other countries:		
England	10,267	11,405
France	1,795	359
	12,062	11,764

The Board of Trade returns for the month of January show the following results:

	1911. Tons.	1912. Tons.
Imports from United States	7,090	5,066
Imports from other countries	10,267	11,405
	17,357	16,471
Exports from England:		
Manufactured	3,932	3,772
Unmanufactured	2,942	2,404
Sulphate	1,165	1,524
	8,039	7,700
Difference	9,318	8,771
Decrease in stocks	1,045	1,922
Consumption of England	10,363	10,693

Company Reports

TENNESSEE COPPER CO.

This company was organized in 1899 with a capitalization of $5,000,000 in shares of $25. It has outstanding $1,500,000 in first mortgage 6% bonds, issued December 1, 1910, and to be completely retired by December 1, 1917. The mines are at Copperhill, Polk county, Tennessee. The financial report for the year ended December 31, 1911, is as follows:

	1911.	1910.
Total receipts	*$577,926	$547,158
Bond interest and discount	110,877	61,770
Depreciation account	60,000	40,000
Total	$170,877	$101,770
Net	407,049	445,387
Dividend	.....	300,000
Depreciation of special reserve	40,000	.....
Surplus	$367,049	$145,387

*Including $27,200 insurance received.

In his presidential report for the year, F. Lewisohn says: "At the end of 1910 the construction of the acid plant had been practically completed, with the exception of two Gay-Lussac towers, which it was found advisable to build in order to attain the minimum cost of producing acid. Owing to unfavorable weather conditions they were not completed until June. The entire plant was working harmoniously during the first few days, when a serious fire necessitated a complete cessation of operations for over a month, and a serious impairment of efficiency for over two months."

MUREX MAGNETIC COMPANY, LIMITED

This company was organized in London, April 15, 1909, to acquire from the Murex Syndicate, Ltd., its patent rights to a process for the wet concentration of ores by the magnetic method. The consideration was £89,993, payable in 59,993 fully-paid shares, and 60,000 shares credited with 10s. paid. The authorized capital is £120,000 in 120,000 shares of £1 each; all the shares are issued and fully paid; the final call of 2s. 6d. on 60,000 shares was payable October 20, 1909. The accounts to June 30, 1911, submitted December 21, 1911, show general expenditure, £24,244; cash, £163; Broken Hill South Extended debentures, £10,000; debtors, £517; creditors, £1454; loan and interest, £26,366. The price of shares February 15, 1912, was ½ to ¾.

This company controls the A. A. Lockwood process of adding to ore magnetite or other magnetic substance together with some liquid to make the particles agglomerate with the sulphide or other valuable mineral to form granules susceptible to magnetic influence. Lionel Holland, chairman of the annual meeting held in December in London, reported that the test plant formerly at Broken Hill Block 14 mine has been removed, owing to lack of proper facilities for demonstration, to the Amalgamated Zinc (De Bavay's), where it will be observed by certain persons, who, if the process is a success, will acquire the Australian patent rights. To facilitate a thorough test in the district, the South Extended mine has been financed, this step being necessary as the directors of other properties consider the metallurgical problem satisfactorily solved. The company, assisted by friends, is to subscribe for a maximum of £55,000 debentures, to be paid in installments according to the success in development. For this, £30,000 will be spent, and later £25,000 will be provided for the plant. So far the development of the mine has been satisfactory, having proved the existence of large orebodies assaying about 24½% zinc, 11½% lead, and 2.8 oz. silver per ton. The process has given good results at the Cordoba mine in Spain, and the plant at Malines, France, where zinc-lead sulphide in a barite gangue is concentrated, is running continuously. As the ore had too little zinc to be profitable, the plant at St. Christoph, in south Germany, was closed.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

CONVEYANCE OF MINERALS—CONSTRUCTION OF DEED

A deed conveyed to the grantee all the metallic ore and mineral interest of every description, and all ore and mineral of every kind and quality, in or upon a certain described land, "with the exclusive right and privilege of entering upon said premises at any time hereafter to dig and mine for ore and mineral of every description, including stone, wheresoever the same may be found or wheresoever the said grantee may deem proper to excavate for the same, and to take out and remove, ship, sell, have, and dispose of all the mineral and metallic ore of every description found in or upon the aforesaid premises, with the right of ingress and egress to and from the mine in every direction, the water privilege for washing ore and the right for erecting small houses for the accommodation of the hands employed in working the mine and also the right of removing the said buildings or houses and to have the right and privilege of purchasing the said premises at any time within 25 years from the date thereof for the sum of $600, payable in cash on delivery of deed to same." The habendum clause provides that the grantee was to have and hold such metallic ore and mineral interest, with all the rights and privileges granted, to his heirs and assigns for their use, benefit, and behoof forever in fee simple. On the construction by the court it was held that the instrument was not a lease of the mineral interests in the land for the period of 25 years, nor a mere option or right to purchase such within that period for the sum of $600, payable in cash; but it conveyed to the grantee all the minerals described in the land, together with the right of purchasing all the remaining interest at any time within 25 years from the date of the instrument for such cash consideration.

Lanham *v.* Henry, (Georgia) 69 Southeastern, 552. November 1910.

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

PROFITS AND WAGES IN THE BRITISH COAL TRADE. By Thomas Richardson and John A. Walbank. Pp. 96. The N. A. C. C., Newcastle, 1911. For sale by the *Mining and Scientific Press*. Price 35c.

This little pamphlet is a discussion of wages and profit in the Durham coalfield, by a member of Parliament and a chartered accountant. It is divided into three parts; the financial position, the economic aspect of the minimum wage, and the consumer. American students of economic and social problems will find much of interest in this detailed study of conditions under a more highly developed social organization than our own.

HAZELL'S ANNUAL FOR 1912. By Hammond Hall. Pp. 592. Hazell, Watson & Viney, Ltd., London, 1912. For sale by the *Mining and Scientific Press*. Price $1.50.

This well known British Annual, now in its twenty-seventh year of issue, though primarily intended for the subjects of Great Britain, will also be useful and helpful to Americans. The 'almanacs' published in America cover only in part the field of this volume, which gives much fuller details on economic and political questions of the world at large, as well as furnishing a complete dictionary of reference on British affairs. As examples of its up-to-dateness may be mentioned the abstract of the provisions of the Anglo-Russian convention regarding Persia, a summary of Sir Edward Grey's speech on the Morocco question, and the amendments to the insurance bill.

CENTRAL BANK OF THE UNITED STATES. By E. Clyde Robbins. Pp. 182. The H. W. Wilson Co., Minneapolis, 1910. For sale by the *Mining and Scientific Press*. Price $1.

Two characteristic features of modern life are that the average man needs a wide fund of information on industrial, economic, and political questions of the day, and that the amount of literature dealing with these topics is so great that even a specialist can scarcely keep up with it. Daily journals are of little use, for they are notoriously inaccurate and are usually partisan, while discussions in serious magazines spread over such long periods that the interest is lost. To all such this small and inexpensive volume will be of great service. It has been prepared primarily as a syllabus and digest for debating societies, and therefore endeavors to give all shades of opinion. The independent thinker will welcome this, but those who prefer predigested opinions will perhaps end its perusal with a feeling of uncertainty.

MINING MANUAL FOR 1912. By Walter R. Skinner. Pp. 1500. Walter R. Skinner, London, 1912. For sale by the *Mining and Scientific Press*. Price $5.25.

Skinner's 'Manual' is almost as indispensible as a dictionary, in many ways, and it is only to be regretted that it deals only with British companies, or companies having British affiliations. Several feeble imitations of it exist, dealing with American companies, but none are worthy of comparison. Apparently the American volumes are poor because but few are purchased, while but few are purchased because they are so poor. Skinner's 'Manual' finds a most practical and pleasing testimony to its quality in its general use. The form of the volume under review is unchanged from last year, and it differs from its predecessor chiefly in containing the latest incorporations and latest prices, to January 15, 1912. English deliberation and American speed are stock phrases, and it is interesting in this connection to note that the British annuals appear months ahead of their American prototypes.

Commercial Paragraphs

THE AMERICAN AGENCIES, LTD., 608 South Olive street, Los Angeles, California, acting as Pacific Coast Agents for Eastern manufacturers, are making arrangements to open additional offices in San Francisco, Portland, and Seattle. The company is now in a position to take Eastern lines and place them effectively in the hands of both jobbers and retailers on the Pacific Coast, to see that the most effective outlet is found and that sufficient credit is behind houses dealt with.

SMITH, EMERY & CO., assayers and metallurgists, Los Angeles and San Francisco, announce as shortly ready for custom work, one of the best equipped ore testing plants in the country. The heavy machinery is being installed in separate buildings in the rear of the main building on their property in Los Angeles. The machinery now being set up consists of a full-sized stamp-mill, elevators, amalgamation plates, concentrating table, classifiers, pumps, cyanide leaching and agitating plants, filter, tube-mill, large and small crushers and grinders, furnaces, etc. A full equipment of preliminary apparatus has been installed, and other machinery will be added as rapidly as there is a demand and it can be taken care of.

The INGERSOLL-RAND CO., of 11 Broadway, New York, has issued a bulletin, No. 4111, descriptive of its type BC butterfly hammer drills. These drills are equipped with telescope feed and can also be furnished with dust allayers, which are strongly advocated as a safeguard to the health of the miners. Water can be sucked up 6 or 8 ft. from a pail or bucket, no tank or pressure line being necessary. This makes the use of the water spray possible under all conditions, no matter how small the working or how far away from the source of water supply. The butterfly valve consists of two wings and a central stem on which it oscillates. One wing controls the supply to each end of the cylinder, the other wing controlling the exhaust. As the two wings are of the same area, the pressure holding the supply wing on its seat is equalled by the pressure tending to force the exhaust wing off its seat, thus making a balanced valve which requires very little pressure to shift it. The valve closes the ports by advancing to the seat, not by sliding on the seat, thus making a better fit the longer it runs.

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TABLE OF CONTENTS

EDITORIAL

NOW that a Norwegian explorer has reached the south pole, lovers of adventure will sigh for more difficulties to conquer.

ARBITRATION treaties with Great Britain and France have been adopted by the Senate, after subjecting them to emasculation. General arbitration seems to have fared but little better than reciprocity.

POCKETS of high-grade gold ore are not infrequently found in the veins of Nevada county, California. Recently Mr. Murray I. Scott made such a discovery on the Eureka ground near Grass Valley, and now it is announced that the lease that he supposed he held was granted by an unauthorized person; all of which contains interesting suggestions as to titles in the California goldfields.

SPOKANE has won in the contest for the privilege of entertaining the American Mining Congress next November. The last meeting having been held in Chicago, it is appropriate that the next should be in the West. Philadelphia would undoubtedly have proved a generous and attractive host, but as a newcomer among the cities interested in the Congress, may appropriately be asked to wait until another year.

DEMOCRACY is not confined to republics. On Sunday last Mr. George W. Goethals, chief engineer of the Panama canal, lunched with William III, Emperor of Germany, at the palace in Berlin, and two forceful and capable men discussed canals and their construction. The invitation was a pleasing tribute to the notable contribution which the engineer has to make in the control of the forces of national and international life.

PORCUPINE is to celebrate with a banquet the opening of the mill at the Dome Mines. We trust there may be many happy anniversaries of the day. The Dome is a property of demonstrated value and large additional prospects. In planning the underground workings and the mill the owners have profited by the best technical advice, and a long and profitable period of production is safely anticipated. We expect shortly to publish an account of this and other properties at Porcupine, written by Mr. T. A. Rickard, who is now visiting the district.

PRELIMINARY sorting may make the difference between success and failure at a mine, and we are therefore glad to print a description of the plan adopted at El Tigre, written by Mr. J. W. Malcolmson, consulting engineer, and L. R. Budrow, manager, for the company owning that famous and rich mine. The peculiar feature of the plant is the superimposed belts. Coarse rock passing over the grizzly is delivered to the upper short belt and passes before the pickers. They sort out high-grade ore. The rejected material passes on and joins the fine material that has gone through the grizzly and constitutes the mill-feed. Such an arrangement is simple and compact, and clearly

could be used with equal facility in a place where it was desirable to increase the value of the feed by picking out coarse rock. This is a situation that often confronts the manager.

DIVIDENDS for the second half of the year, it is announced, will be passed by the Central Mining & Finance Corporation, the concern that increased its capital stock £1,500,000 last year in order to absorb the properties of H. Eckstein & Company, and Wernher, Beit & Company, on the Rand. Depreciation of investments is given as the cause.

ALASKA and its needs are thoughtfully reviewed in the recently distributed annual report of the Governor, Mr. Walter E. Clark. Unfortunately, the exigencies of politics render it unlikely that any considerable remedial legislation will be exacted at Washington this winter. It is to be hoped that some at least of the excellent suggestions made by the Governor may be adopted. Because there are differences of opinion regarding the leasing of coal lands is no reason why land surveys should be slighted or steamers should be sunk for want of adequate charts and lights.

PETROLEUM prices in the West Side fields of Kern county, California, have advanced five cents per barrel. This is a change in the right direction, since under ruling quotations the producers have not been able to make a fair profit. The new prices range from 35 to 60 cents per barrel, depending on the specific gravity of the oil. It is roughly estimated that in territory where the sands are not more than 3000 feet deep and wells are of the average productivity, operators should make 15 per cent on their investment with oil at 50 cents per barrel. In view of the large number of inevitable failures and the always present risk, this is not an unreasonable return. It should be remembered that if waste in production is to be decreased the actual operators must be allowed a reasonable profit on the business. Invasion of the wells at Bakersfield by water is becoming a serious problem. The operators are in consultation now with Mr. W. H. Storms, State Mineralogist, and some means of protecting the producing wells must be found. Any remedy adopted will involve spending money and must add to the cost of production, however great may be the final economy. Cheap fuel is a great boon to any community, but cheapness may cost too much in waste. As Mr. G. W. Traer has recently shown in regard to coal mining in the Middle West, and Mr. M. L. Requa has argued in the case of California, unregulated competition, while lowering prices, may bring in its train results more serious to the community than the slightly higher price that might be expected to follow a combination exercising a reasonable control over production.

MODIFICATION in the wording of the Foster bill for reorganization of the United States Bureau of Mines, now before the House, and recently also introduced in the Senate by Mr. Miles Poindexter, has removed all valid objection to it from those who feared an incursion by the Bureau of Mines into the field of private testing. Under the terms of the revised bill, neither the Bureau nor any employee will be authorized "to undertake any investigation or operation in behalf of any private party, except for the health and safety of persons employed in the mining, quarrying, metallurgical, or other mineral industries, and with the approval of the Secretary of the Interior." This exception is necessary, as we have already shown, in order to allow testing of powders to determine which it shall be permissible to use in coal mines. When the work is done without any charge there is a tendency on the part of some manufacturers to abuse the privilege of having such tests made. On the other hand, official tests are necessary if the real purpose of the work is to be served. It is further provided that employees of the Bureau shall have no personal or private interest in any mine or the products of any mine under investigation, though outside experts, not subject to this restriction, may be employed temporarily in a consulting capacity. The spirit of economy so prominent in the present Congress, which has been debating whether to add $25,000,000 or $70,000,000 per year to the pension charge, is shown in the provision that no such expert shall receive "to exceed ten dollars per day." This is a brilliant example of economy as understood by Congress and a slap at mining and metallurgical engineers. However, any expert who may serve the Bureau is apt to do so from interest in the work rather than from the hope of monetary reward, and if fair salaries be paid to the men permanently employed, the outsiders will not quarrel over money matters. It is fundamentally absurd to hamper the Director of any technical bureau with such a petty restriction and lends point to the widely current suggestion that what Congress does not want is expert advice, either upon the tariff or any other subject.

Alaska Copper Mines

Payment of $1,000,000, the initial dividend of the Kennicott Mines Company, which owns the Bonanza copper mine in Alaska, has attracted much attention. It is less than a year since shipments from this property began, and in tonnage the output has so far been small. The ore is, however, unusually rich. Cargo shipments have assayed 71 per cent in copper, and there is a content of 8 to 20 ounces of silver as well. This is more like matte than ordinary copper ore, and quick and large returns are to be expected. How many such dividends can be paid is less certain. The Kennicott Mines Company is controlled by the Alaska Syndicate, and we believe no official estimates of the ore reserve have been published. Mr. L. W. Storm is quoted in 'The Copper Handbook' as estimating 80,000 tons of ore containing 50 per cent of copper in the main orebody, and 50,000 tons of 12 per cent ore in the large talus spread on the face of the mountain below the outcrop. In addition, there is an unestimated amount of ore containing 3 to 20 per cent copper and lying in and around the high-grade ore. Another estimate lumps the whole mass at equal to 100,000 tons containing 65 per cent copper. Our own visit to the property was entirely too brief to permit of making even an approximate estimate. The total amount of copper present is evidently large, though not unlimited. When the concentrating plant now being built is completed, much of the low-grade ore can be treated at a profit, and as the orebody is essentially a replacement of the Chitistone limestone by chalcocite, it may be expected to prove extremely irregular. Contrary to the opinion held by many geologists, we believe the Bonanza orebody to be the result of the ordinary processes of secondary enrichment, and find explanation of its preservation in the fact that it occurs in a high ridge which rises above the upper limit of glaciation. Other veins in the same region do not show the same secondary chalcocite because the glaciers have cut deep into the orebody and eroded the secondarily enriched cap. Under this hypothesis the primary orebodies are not likely to be of value comparable to that of the orebody now worked in the Bonanza mine.

The Kennicott Mines Company is capitalized at $3,000,000, and it is said that the final profit on the Bonanza mine was considered likely to be about double the capitalization. To get at the real profit on the transaction, in-

cost and deferred charges would need to be taken into account. The mine has been excellently handled, and every effort has been made to assure a quick return on the investment, the soundest of policies where a rich ore is available. As a mining venture the Bonanza mine shows every promise of brilliant success.

To render available the copper in the Bonanza orebody, it was necessary to build the Copper River & Northwestern railroad, and this was accordingly done, the line being opened for traffic last spring. This road is 195 miles long and cost, according to figures from the engineers' books, $16,500,000 in round numbers, including equipment. The Copper River & Northwestern railway is capitalized at $5,000,000 and has a bonded debt of $50,000,000, secured by a first mortgage on the property and calling for 5 per cent interest. The bonds are dated February 1, 1909, and run till 1959. This capitalization of $55,000,000, it will be remembered, has nothing to do with the mine and is based on a road costing less than one-third of that amount. In addition, the Alaska Syndicate owns the Alaska Steamship Company and has expended money liberally in other directions. Current popular estimates credit the Syndicate with investments totaling $25,000,000, which probably is conservative. The total capitalization would run much beyond this figure. Beatson's Bonanza, an excellent property, is owned by the same people, though whether it is a part of the holdings of the Alaska Syndicate, is not certain. In any event, shipments from it do not enter into the problem of supporting the Copper River & Northwestern road. For that, as yet, ore from the Bonanza mine must be the main source of traffic. It was stated recently that the railroad was now earning its operating expenses. It is difficult to see how much more than that can be expected until more mines are developed, and, while prospecting is active at a number of properties, it is but fair to say that the result is still far from certain. The initial dividend of the Kennicott Mines Company is gratifying, but Alaska still is far from flooding the copper market.

The 'Blue Sky' Law

It is one of the hopeful signs of the times that serious and successful efforts are being made to enact legislation that will minimize, if not entirely prevent, the promotion of 'wild-cat' mining companies such as have brought marked disrepute upon mining in the United States. Both the American Mining Congress and the Mining and Metallurgical Society have done good work in agitation for such a reform. One of the most successful measures yet enacted is the so-called 'Blue Sky' law of Kansas.

The Kansas measure is entitled: 'An Act to Provide for the Regulation and Supervision of Investment Companies.' It requires every corporation or association, foreign or domestic, which proposes to sell stock in Kansas, to file with the bank commissioner a clear and complete statement of the company's affairs, down to the minutest details; to file a written and irrevocable consent to accept service through the Secretary of State; and to pay the expenses of a thorough investigation by the bank commissioner's office. Books must be kept according to the regulations set forth in the act, and the books must be open at all times to any shareholder. The sale of any stock in the state of Kansas without compliance with these regulations subjects the agent to a maximum penalty of $5000 fine, or 90 days in jail, or both. False statements made on applications for a certificate subject the applicants to a fine of from $200 to $10,000, coupled with a jail penalty of from 1 to 10 years. Any company which attempts to conduct its affairs in violation of these regulations is subject to be placed in the hands of a receiver, and its affairs wound up by the state banking department. A similar bill is proposed in Illinois and has been endorsed by the bankers association of that state. Mr. B. F. Harris, the energetic president of that powerful organization, is leading in an active campaign for its enactment. A bill of the same import is now before the New Jersey legislature with excellent prospects for passage, and in other states the matter is being actively discussed. In California promotion of the Mascot Copper Company with inadequate publication of data regarding either the company or its mines, has called attention to the need of compelling complete statements to be made prior to attempts to sell stock to the public. Even in Wall Street the matter is attracting attention and the proposal finds many friends. There is no place where drastic regulations of this nature are so much needed as in that great market, where there have been so many instances of exploitation of the public through misrepresentation, ranging all the way from simple exaggeration to the most flagrant and fraudulent misstatements. The mining industry has suffered for many years from the obloquy placed upon it by the operations of the gentry who have dealt in alluring literature, but who have had little or nothing to do with actual mining operations. The most spectacular effort of the Government to put a stop to manipulation of this nature was the recent prosecution of Mr. George Graham Rice, whose trial was prolonged for a period of nearly six months, finally coming to a lame conclusion last week by the Government accepting pleas of guilty on the part of Mr. Rice and Mr. B. H. Sheftels, the former as the principal defendant receiving a jail sentence of one year, while in the case of the latter, sentence was suspended. The expense to which the Government was put in the matter is estimated at $150,000 or more. The general comment is that the 'mountain labored and brought forth a mouse.'

In addition to the examples against which the Federal law department has exerted its efforts, there have been some final chapters written recently that could hardly have been written had the public had the protection of some such measures as the 'Blue Sky' law mentioned. Recently the Securities Corporation, a holding company that fathered a number of large operations in Guanajuato, Mexico, sold all of its assets in the form of shares in its subsidiary corporation, and proceeded to go out of business with practically a total loss to all its shareholders. The same procedure has just been completed by the Development Company of America, on account of which the trustees sold at auction last week large blocks of stock in its subsidiary corporations, liquidating all of the assets of the holding company. The Development Company of America was interested in a large operation at Tombstone, the Tombstone Consolidated Mines Company, promoted the Imperial Copper Company at Silver Bell, Arizona, and was interested in the London-Arizona Copper Company, the Saddle Mountain Mining Company, and the Look-Out Copper Company. In the case of each of these holding companies and their respective subsidiaries, the shares were sold to the best class of investors—country bankers, professional men, and newspaper men—all of whom are now bitter toward mining enterprises, and in that frame of mind which declares that 'no good can come out of Nazareth.' The aggregate sums invested in the various enterprises under discussion were large. Had they been placed legitimately along conservative lines in properties modestly capitalized, and bought at lowest prices for the stockholders, there would be a regiment of mining enthusiasts throughout the country, instead of a regiment of disgruntled losers unwilling to look at any kind of a mining venture, good, bad, or indifferent. No part of the community is so vitally interested in preventing the recurrence of such collapses as those who are in the mining industry.

Preliminary Handling of Ore at El Tigre

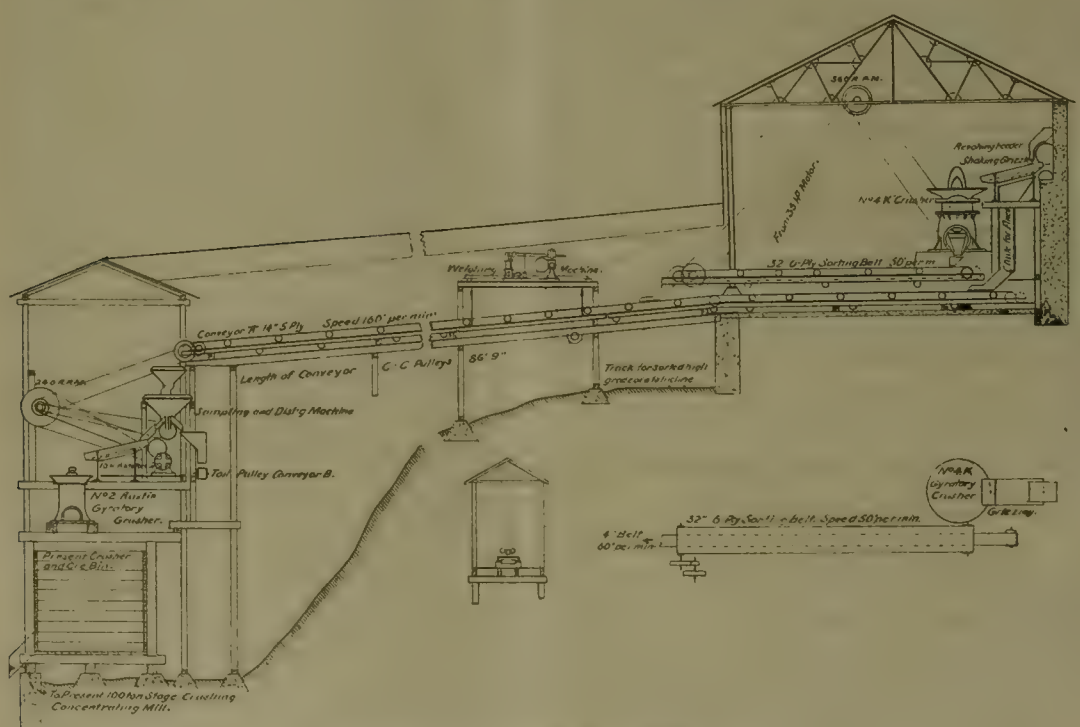
By J. W. Malcolmson and L. R. Budrow

The El Tigre mill, belonging to the Lucky Tiger-Combination G. M. Co., is situated in Sonora, Mexico, 30 miles from any railroad. Power is supplied from Douglas, Arizona, over a line built during the revolutionary troubles of last year, and it is interesting to note that despite the fighting at Agua Prieta, through which the line passes, not a day was lost during the period of construction. The mill, of which a general view is shown opposite, and which was designed and built by D. L. H. Forbes, was put in operation July 1, 1911.

The sorting arrangement here described was designed for a capacity of 600 tons in 24 hr., but at present is used on the day shift only. All second-class or mill ore is trammed from chutes on the lowest adit-level over 3000 ft. to a circular steel bin, of 15-ft. diameter and 30-ft. height, and having 250 tons capacity. A track carried on trestles leaves the main line, passes over the top of the bin, and joins the main track beyond. The loaded cars run over the top of the bin and, without changing direction, are carried forward to the main track, returning on the main line along the hillside to the mine. All underground tramming from the chutes to the bin is done with mules, and the present output of 200 tons per day can easily be handled with three mules during the day's shift. The cost of tramming is 11c. per ton. By changing to electric haulage, the cost would be reduced to 4c. per ton.

The circular steel ore-bin has a flat concrete bottom, 8 in. thick. The bin is made in 5 sections, the lower 2 being of $\frac{3}{8}$-in. steel; the next 2 of $\frac{5}{16}$-in. steel; and the upper section, $\frac{1}{4}$-in. steel. The top and bottom are stiffened with rings of $1\frac{1}{2}$-in. angle-iron. The ore is drawn from the bin by means of a revolving drum of 24-in. diameter and 27-in. width. The mechanism for turning the drum consists of an eccentric with a 1-in. throw operating a friction wheel of 12-in. diam., keyed to the drum shaft. A rack-and-pinion gate above the drum regulates the amount of ore fed at each forward movement of the drum and facilitates the passage of large pieces of ore.

From the drum, the ore falls upon a shaking grizzly, 6 ft. long by 4 ft. wide, with bars, 2 by $\frac{3}{4}$ in., spaced 2 in. apart. The grizzly is operated by a quick-return eccentric drive. The undersize from the screen falls into a short chute or funnel which delivers it upon a $\frac{1}{4}$-in. conveyor-belt, traveling at a speed of 180 ft. per minute. The oversize falls into a Gates type K No. 4 gyratory crusher, which reduces the ore to a size that will pass a 2-in. ring. The crusher feeds on to a 32-in. picking-belt traveling 50 ft. per min. This travels continuously at 50 ft. per min., and 4 men are employed, 2 of them being ore-sorters, who stand on opposite sides of the belt and throw down and to one side. W. W. Mein has suggested as a preferable arrangement an intermittent movement of the belt in order that the sorters may work to better advantage. This is used in South Africa, the belt moving several feet, then stopping for a few seconds and starting again. Such an arrangement permits each ore-picker to handle the same area under equal conditions.

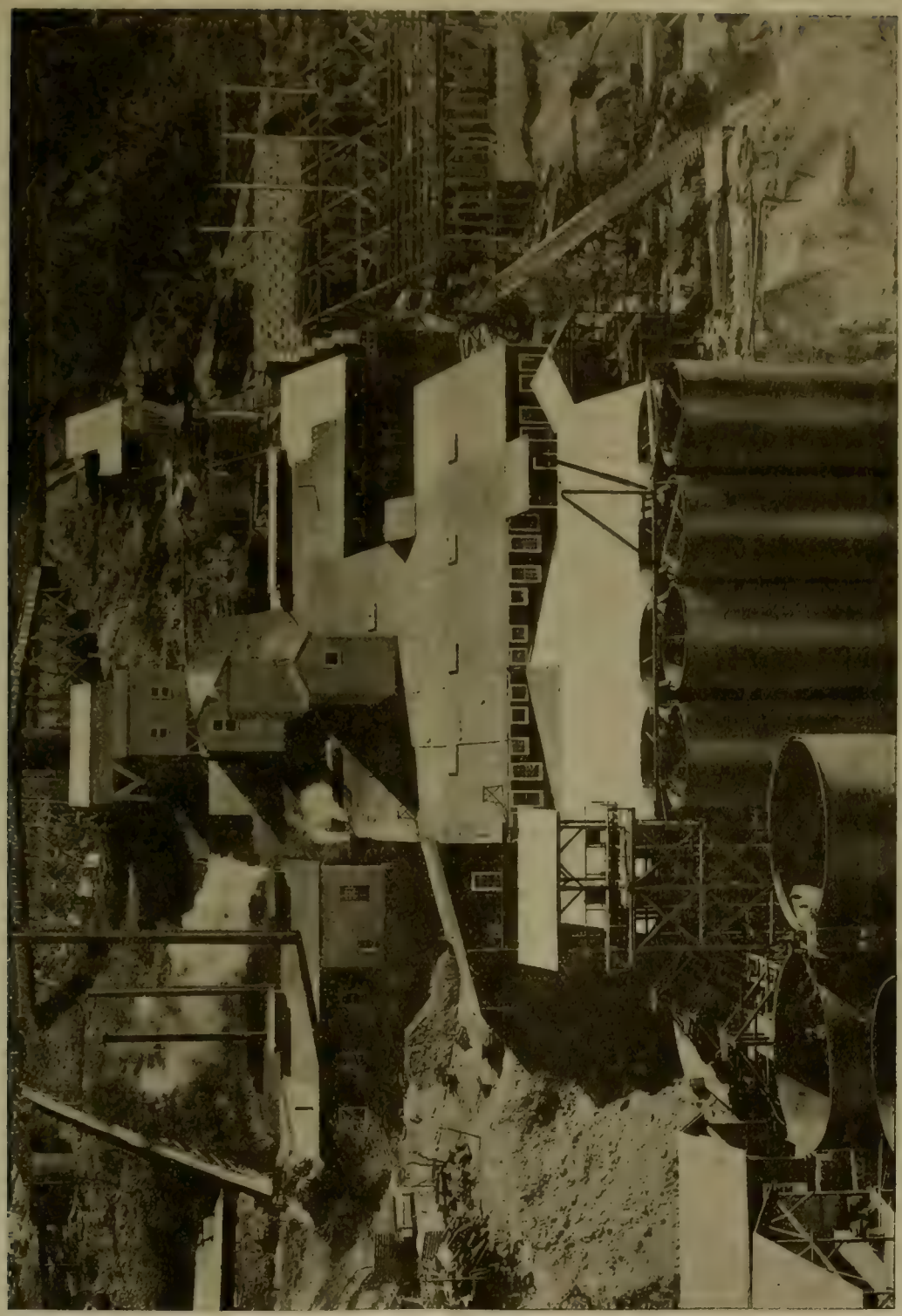


ARRANGEMENT OF CRUSHERS AND SORTING BELT.

The high-grade ore sorted from the belt during December 1911 amounted to $6\frac{1}{2}$ tons, assay value $310 per ton; the waste sorted out was $34\frac{1}{2}$ tons, assay value $1.90 per ton. The ore milled, after deducting 125 tons of high-grade sorted while mining, and the sorted products mentioned, assayed $20.25 per ton. The Gates crusher and picking-belt are housed in a steel-frame building. The arrangement is shown in the accompanying figure.

The ore from the picking-belt falls on the 14-in. conveyor-belt running underneath. It here joins the undersize from the grizzly and is weighed by a Blake-Dennison automatic weigher while in motion. This machine works admirably, recording the weight of the ore with an error of less than 1 per cent.

The ore from the 14-in. conveyor falls into a revolving cone distributer, which in turn discharges on a stationary



EL TIGRE MILL, SHOWING CYANIDE AND STAMP-MILL ADDITION.

cone divided into three segments. This arrangement divides the feed into three portions. One portion, representing 5%, goes to the sampling plant, and the remaining 95% falls into two compartments with an adjustable partition permitting the distribution of ore to the old stage-concentrator or to the new stamp-mill in the proportions desired.

The ore for the old concentrator falls on a second shaking grizzly with bars spaced ¾ in. apart. The undersize falls directly into the old 125-ton ore-bin, and the oversize runs through a No. 2 Austin gyratory crusher and is reduced to pass a ¾-in. ring, falling into the 125-ton bin. The other compartment of the stationary cone discharges on a 12-in. conveyor-belt traveling 200 ft. per min., and delivers the ore by means of a Robins automatic tripper into a 350-ton wooden ore-bin above the new 20-stamp mill.

The 5% sample falls into a 7 by 10 Blake crusher and is reduced to ½-in. size. The crusher discharges into a Snyder disc sampler, eliminating 95% of the sample; the remaining 5% is passed through a 2 by 6 Sturtevant roll jaw crusher and quartered down on a steel plate until the quantity is reduced to 50 lb., when it is sent to the assay office.

The total power consumed in this preliminary crushing, conveying, sorting, and sampling amounts to 14 hp. It requires 4 men to operate this portion of the mill. One is employed at the Austin crusher and sampling plant, and the remaining three on the picking-belt and at the Gates crusher. The total cost, including power, labor, and repairs, amounts to $9.50 per day, or 55c. per ton of ore.

Gold and Silver Production of British Columbia, 1911

The preliminary estimate of the gold and silver production of British Columbia during 1911, by William Fleet Robertson, Provincial Mineralogist, shows a gold output of $5,120,465, a decrease of $952,915 compared with 1910, and a silver production of $972,946, a decrease of $272,070.

GOLD.—There appears to have been a decrease of about $70,000 in the value of placer gold recovered in 1911, and of 42,000 oz. or about $880,000 in lode gold, as compared with the production of 1910.

Placer Gold.—Practically all the placer gold comes from the Cariboo and Cassiar districts, only about one-thirtieth part of the total production coming from the remaining districts of the province. A rough apportionment of decrease places $23,000 against Cariboo and $47,000 against Cassiar. The larger portion of the decrease seems to have been in Atlin division of Cassiar district, about $45,000; next to this is that of Cariboo division, of the district of the same name, about $18,000; while the yield of Omineca, also in Cariboo district, is estimated at $5000 less than in 1910. There is a possibility that Quesnel division of Cariboo did better than in 1910, but this cannot be determined until after the returns shall have been received from the larger operators in that division. The gravel-washing season was shorter than usual in both Cariboo and Cassiar, hence the smaller total recovery of gold. There is encouragement in the fact that in both districts provision has been and is being made for operating on a large scale in the future. Placer mining on a small scale is done in several parts of Fort Steele division of East Kootenay; in Nelson, Revelstoke, and Trout Lake divisions of West Kootenay; in Boundary, Similkameen, and Yale districts; and in Lillooet and Clinton, which last-mentioned divisions yield twice as much placer gold as any other of the smaller producing districts.

Lode Gold.—This preliminary estimate makes it appear that less lode gold was produced last year than in any other year since 1907. About one-half of the decrease resulted from suspension of production at two or three Boundary district mines, though this was in part compensated for by larger production by the British Columbia Copper Co. and Hedley Gold Mining Co. Again, there were several individual decreases in Nelson mining division, though in other instances the reverse was the case. Approximate figures of totals of lode gold from individual districts give an apportionment about as follows: Rossland, 117,000 oz.; Boundary, 51,000 oz.; Similkameen, 30,000 oz.; Nelson, 20,000 oz.; and Coast, 7000 oz. Of Rossland mines (which are in Trail Creek mining division), the Consolidated Mining & Smelting Co.'s Centre Star group produced nearly three-fourths of the total, while the mines of the Le Roi No. 2, Ltd., yielded the greater part of the remainder. Hereafter the production of the Le Roi (not of Le Roi No. 2) will probably be included in that of the Centre Star group, for the Consolidated company last summer added that mine to its other properties in Rossland camp. In the Boundary district the bulk of the gold was from mines of the British Columbia Copper Co. and the Granby company, while in Similkameen the Hedley Gold Mining Co. made a production estimated at the quantity above shown. In Nelson, the Queen, Granite-Poorman, Nugget, Arlington, Second Relief, and Yankee Girl mines together made up the output of lode gold from that division. On the Coast the Marble Bay mine was the chief producer and the mines of the Portland Canal Mining Co. yielded the bulk of the remainder.

SILVER.—Of the estimated total production of 1,920,000 oz., Slocan mines contributed about 875,000 oz.; East Kootenay, 360,000 oz.; Boundary, 310,000 oz.; Nelson and Rossland, 180,000 oz.; Lardeau, 70,000 oz.; and the Coast, 125,000 oz. It is not unlikely the revised returns will show a somewhat larger production than has been estimated, but the foregoing figures represent what at present seems to be the position. The average price of silver for 1911 was a fraction lower than in 1910. The two closing months of 1911, however, saw a rise to an average of 55.312c., with a prospect of a further advance. If a higher average price shall be maintained throughout the ensuing year, and production in the province be increased to the extent it now gives promise of being, the figures, for both quantity and value, should be higher for 1912 than for any other year since 1901, which had a production of 5,151,000 oz., valued at £2,885,000, and was second only to the record year, 1897, with its output of 5,473,000 oz., valued at $3,273,000. The mines that produced the silver in considerable quantity were as follows: In the interior parts of Slocan district, the Rambler-Cariboo, Richmond-Eureka, and Ruth-Hope; and in the Slocan Lake section, the Van Roi, Hewitt (Silverton Mines, Ltd.), and Standard. More than one-half of the production of East Kootenay was from the Sullivan mine, and in excess of one-third from the St. Eugene. In Nelson division the Molly Gibson, and at Rossland the Centre Star group, Le Roi, and Le Roi No. 2 company's group, made the output of those regions respectively. In Boundary district the mines of the Granby and British Columbia Copper companies contributed most of the silver from that part, while in Lardeau the Silver Cup, and on the Coast the Britannia, Marble Bay, and the Portland Canal Mining Co.'s mine each added its share. The Skeena country may be expected to add to the province's production of silver after railway transportation facilities, now being provided, shall be available; meanwhile, in that district a number of mineral claims on which silver-bearing ore has been found are being prospected, and some of them developed. Other Portland canal properties, too, are among the probable producers of the early future.

Quicksilver Production of California

By W. H. STORMS

Contrary to predictions generally made at the end of the year, the quicksilver output for 1911 shows a considerable increase over that of 1910. The production for 1911 was 19,109 flasks, valued at $879,205 (flasks of 75 lb. valued at $46.01 per flask, which was the average price for the year received in the San Francisco market). This is an increase in quantity of 1444 flasks, and in value of $80,203, over 1910. The largest production came from San Benito county, followed by Santa Clara, Lake, San Luis Obispo, Napa, Sonoma, Santa Barbara, Trinity, and Colusa counties, in the order named. The following counties also contain quicksilver deposits, some of which promise to become producers at an early date: Kings, Monterey, Eldorado, Fresno, Shasta, Solano, Stanislaus, and Yolo.

Unusual activity has been apparent among operators and owners of quicksilver mines during the past year, and at the present time the outlook for a further increase in the 1912 production is favorable. During the past twelve months a 15-ton furnace has been built in Lake county; work on a 20-ton furnace in San Benito county has been started, and a 24-ton furnace has been completed in Sonoma county, in addition to the reduction plants already in operation in those counties. New furnaces of 24 to 40 tons capacity, respectively, have also been erected in Monterey and Fresno counties. The value of the 1911 quicksilver production has not been exceeded since 1905, when the product was sold for $886,081. The output was valued at $712,334 in 1906; $663,178 in 1907; $763,520 in 1908; $773,788 in 1909, and $799,002 in 1910.

Magmatic Origin of Ore-Forming Solutions

By C. F. Tolman

The recent review[1] by A. C. Lawson of 'Types of Ore Deposits' is chiefly interesting for the attack it contains on the widely accepted theorem that magmatic waters are important factors in ore genesis. The use of such statements, for instance, as that the author of one of the contributions appearing in the book reviewed, "is smitten with the juvenile water affliction", or that "the doctrine of magmatic waters" is "one of the fashionable vagaries of the present time", does not constitute an effective attack on the theory mentioned, but it is somewhat effective in arousing a reply. The objections, either directly stated or inferred, however, should be promptly met, and the high geological authority of the writer of the review mentioned, justifies a reopening of a discussion of certain points that otherwise might well have been considered to be closed.

Surely a brief suggestion of the varied phenomena that are believed to indicate magmatic origin of ore solutions is demanded by such statements as that "there is as yet no equally clear proof of the deposition of ores by magmatic waters" (equal to the proof that the lead-zinc deposits of the Ozark region and of Wisconsin are deposited from vadose circulation). Further, Mr. Lawson's intimation that the theory of magmatic origin of ores is founded on the evidence present in contact deposits only, is not a statement to be expected from one versed in the literature of ore deposits.

I contemplate presenting, at some future time, a summary of the critical data bearing on ore genesis, but in view of the need of an immediate reply to his review, I have attempted to present here a few of the more important lines of observation and reasoning, the accumulation of which has gradually forced the recognition of the rôle of magmatic waters as metallizing agents. Citation will be confined to ore deposits with which all American students are familiar.

Mr. Lawson's first criticism is inferred from his statement that J. F. Kemp "fails to make any distinction between (1) purely thermal metamorphism wherein the changes in rocks adjacent to an intrusive mass are due to molecular mobility induced by heat alone, and (2) reactionary metamorphism wherein the changes are due to reaction between the encasing rock and the materials emanating from the intruding mass." This is hardly justice to Kemp, for it is difficult to believe that any geologist who has worked on Western contact deposits does not recognize that contact action is erratic; and that at times the intrusive is practically anhydrous (as far as escaping vapors are concerned), and at other contacts these are most abundantly developed. (For further discussion of this, see under Lawson's third objection.) Recrystallization of rock by contact action without addition of material is abundantly proved. The conclusion is evident that either little or no water was present at the time of the intrusion, or that but little mineral matter was dissolved in the water vapors. On the other hand, to one familiar with the change of massive pure limestone into an epidote-garnet-diopside-magnetite-pyrite rock, at its contact with certain granitic intrusions of Arizona and New Mexico, the chemical analyses and calculations of Kemp, proving additions from the magma, appear as but an accurate statement of facts self-evident from field studies.

As a second objection, Lawson finds evidence against ore deposition by magmatic waters in the occurrence of ore later than the intrusive (and contact action). If the contemporaneous intergrowth of the contact minerals with the sulphides, pyrite, chalcopyrite, galena, and blende, proves that the metals are given off with the first vapors, it would indeed be extraordinary if these vapors always ceased with the congelation of the outer crust of the magma. It is abundantly proved, by field evidence mentioned later, that the progressive cooling, solidification, and expulsion of ore solutions is registered in the gradual change in mineral groups deposited by the waters in the overlying rocks.

The third, and greater, difficulty is discovered by Lawson in the fact that only a small proportion of the contacts develop ore. This objection has also been urged by F. L. Ransome[2] in the following words: "If magmatic emanations alone were concerned in the deposition of most ore-bodies, it is difficult to understand why the deposition of ores should not be the regular and invariable accompaniment of the intrusion of certain magmas rather than the somewhat erratic and exceptional occurrences that they actually are." Suggestive evidence regarding this point may be obtained from a discussion of Lawson's idea that the intrusion induces an intensified (both chemically and thermally) circulation of the ground-water, which dissolves the precious and base metals from the rocks through which it passes, and deposits them, first, exactly at the contact between the molten rock and the older strata, and then later, after the adjacent portion of the intrusive is cooled, a more extended circulation mineralizes both the intrusive and intruded rock. Since the ground-water is everywhere present, such an active circulation should be set up around every intrusion. Since iron, magnesium, and the other elements are always present, the intensified circulation should contain these and develop at every contact garnet, diopside, epidote, etc. The rarer metals, such as gold and copper, are more sparingly distributed, and might therefore present some irregularity in their occurrence in the contact zones.

Under the magmatic theory, this difficulty vanishes, for, as already suggested, the intrusives differ greatly in their water content. An intrusion undersaturated with vapors and gases develops a contact action shown by the merest trace of recrystallization of the intruded sediments, while other intrusives, supersaturated with vapors at the time of initial crystallization, produce the profound changes at Morenci and Silverbell, Arizona, and numerous other places. An interesting case has recently been described in detail[3] where the magma was nearly anhydrous on first intrusion, contact action producing only a recrystallization of the rock, but as the recrystallization proceeded, vapors were driven off from below, strongly pneumatolytic in action, and adding to the intruded beds very large amounts of iron and considerable lead, zinc, manganese, chlorine, fluorine, and other elements.

The way the magmatic theory meets the fact that ore deposition is erratically distributed around contacts may be summarized as follows: intrusives, especially acid intrusives, when undersaturated in respect to water and other vapors, develop thermal metamorphism only, accomplishing only a recrystallization of the adjacent rock. Occasionally they are supersaturated at the time of their intrusion, and then produce various effects depending upon the amount of vapor and its chemical composition. During further crystallization of the rock, the water content is driven off, either continuously or at critical points during the recrystallization, and in the majority of cases produces veins in the outer margin of the intrusive and in the adjacent rocks. These are ore veins only when the magma contains valuable metals. Deeply eroded intrusives have lost the outer zone of metallization and vein deposition. Examples of this are known; for instance, the deeply eroded Archean granites are often barren of every kind of vein.

As an introduction to the attempt to present some of the data on which are founded the modern ideas of the rôle of juvenile waters in ore deposition, ore deposition may be

[1] *Mining and Scientific Press*, February 3, 1912.

[2] *Econ. Geol.*, Vol. VI (1911), p. 326.

[3] 'Die Kontactmetamorphose in Kristianiagebiet,' Goldschmidt. See *Econ. Geol.*, Vol. VI, p. 707.

considered briefly as a product of rock differentiation, and since interest here centres chiefly in epigenetic deposits formed by ore solutions, rock differentiates may be classified with special regard to their water content.

Under anhydrous differentiates (this term always being used in a relative sense) may be grouped the recognized segregations of iron ores, chromite, platinum, iron sulphides, and probably other sulphides, at the margin of a basic intrusion. Such a basic differentiation may be termed an *in situ* marginal differentiation. The basic minerals crystallize first, and so any vaporous matter in solution in the magma will tend to concentrate in the still liquid acid portion. Therefore the complement of a basic segregation is an acid rock, enriched in respect to water content. Confining the following discussion, for brevity, to the suggestion of only one example of each type of ore deposit or ore process, I may cite as an example of marginal, *in situ*, basic differentiation, the corundum-bearing deposits of Corundum Hill, North Carolina.

Satellitic dikes, the extruded products of an underlying differentiation reservoir, may be ore bearing, and, if this ore is original, it may be classified as a direct differentiation product. The basic ore dikes are generally anhydrous, while the acid dikes often show evidence of containing both water-vapors and mineralizers. The ilmenite-hypersthene-labradorite dikes, in places largely ilmenite with spinel and apatite, of Ekersund-Sogndal, Norway, also accompanied by purer lenses of ilmenite and both occurring in a 1200 square kilometre intrusive *massif* of norite and anorthosite, is a proved example of later dike differentiation of the basic type. Basic rocks may not, however, be entirely free from vapors. A gabbro may, for instance, develop scapolite-magnetite-apatite-specularite veins along its margin, the mineralogy of the veins showing the presence of water and chlorine vapors. If, therefore, a basic rock undergoes further differentiation, it may produce a small portion of acid rock, and finally expel a mineralized water solution. I believe that the evidence now collected is sufficient to prove that the silver veins at Cobalt, Ontario, are the final product of such a process, the intermediate product being the veins, lenses, and bunches of soda pegmatite, which have segregated out from the extensive Keweenawan diabase.

The acid series from pegmatites to quartz veins illustrates especially magmatic ore processes. I believe that geologists are generally agreed that pegmatite is a mixed rock-and-water solution, and that it is the product of acid differentiation of a magma. The minerals, such as tourmaline, topaz, apatite, fluorite, etc., suggest that such gases as boron, fluorine, and chlorine are generally present. Further, the fact that these minerals of the pegmatites are widely distributed throughout the granites, although in small amounts, indicates that all the vapors are not expelled by the crystallization of such a mass. Numerous substantiated instances of pegmatites grading into quartz veins by the failure of the feldspar, link these deposits together genetically. To cite one of many, take the noted pegmatites of the Black Hills, South Dakota. The list of minerals in these pegmatites includes: spodumene in gigantic crystals, albite, microcline, quartz, black and white micas, beryl, tantalite, columbite, ilmenite, amblygonite, lithiophyllite, tourmaline, garnet, apatite, dufrenite, and graphite, with the following sulphides: pyrite, chalcopyrite, leucopyrite; and the oxides, cassiterite and wolframite. The related quartz lenses and veins present a simpler mineralogical group, namely: quartz, tourmaline, garnet, cassiterite, wolframite, some scheelite, and pyrite. Here there is no question as to the genetic relation between the pegmatites and quartz lenses and veins.

Pegmatites occasionally develop the same intense alteration of adjacent country rock as is found along the tin-tourmaline-topaz, etc., veins, an alteration almost certainly due to the attack of the wall rock by the heated vapors from the veins.[4] I have seen samples showing intense greissenization along the wolframite-bearing pegmatites of Mohave county, Arizona; and the wolframite deposits of the Whetstone mountains, Cochise county, Arizona, may be cited as a connecting link between pegmatites and quartz veins in greissen zones. In this locality an acid granite fingers out into pegmatite dikes intruding a fragment of Pinal schist. These dikes lose feldspar gradually, and become massive quartz veinlets. Along each veinlet the country rock is altered into greissen which contains the disseminated wolframite, the latter only occasionally appearing in the quartz veins and pegmatites. The cassiterite-tourmaline-topaz-quartz-fluorite veins, although they can thus be traced back directly to pegmatites, show independent evidence of direct magmatic origin, in their position only at or near the margins of granitic intrusives. Accepting this interpretation of magmatic origin, it may be extended to a continuous series of deposits in regions of granitic intrusion. The phases around the granitic bosses of Cornwall and Devonshire, Great Britain, are classified according to Findlay, as follows (the numbers show the order in which the minerals are deposited in the veins, suggesting a progressive and continuous change in the character of the ore-depositing solutions):

A. Tin-tungsten phase: (1) Apatite, (2) magnetite, (3) cassiterite and tourmaline, (4) wolframite, (5) arsenopyrite, scheelite, and fluorspar.

B. Copper phase: (1) Pyrite, (2) pyrrhotite, (3) chalcopyrite, (4) arsenopyrite.

C. Zinc-lead phase: (1) Chalcopyrite, (2) fluorite, (3) blende, (4) galena (barite with both the last).

More complicated series containing bismuth, cobalt, nickel, arsenic, uranium, radium, copper, zinc, lead, manganese, etc., minerals, are developed as later products of tourmaline granite intrusions of Bohemia and Austria.

With these series of deposits so well described and understood, it is difficult to understand the reluctance to assign ore deposits of a single phase to the neighboring granite intrusive. The Mother Lode-Alaska Treadwell type of deposits are characterized by an intense alteration along the walls, developing sericite, pyrite, calcite, dolomite, and in basic rock, epidote. The vein material is chiefly quartz with fluid inclusions, and albite, and tourmaline and zircon are present in both gangue and walls more occasionally. The presence in many veins of molybdenite, arsenopyrite, pyrite, chalcopyrite, sphalerite, and galena, line them up with certain phases of European veins. Other evidence fully as important as that shown by mineral association will be considered later.

A brief review of ore deposits formed around Mesozoic-early Tertiary granite, quartz-monzonite, and quartz diorite intrusions of Arizona and New Mexico furnishes proof from petrographical, geological, and structural relations. Much of the evidence to be summarized should be public property, as it has been presented in the detailed studies of the U. S. Geological Survey regarding Arizona and Utah deposits, and in the general description of New Mexico deposits. A belt of structural weakness, characterized by faulting, intrusion, and metallization extends diagonally across Arizona, from northwest to southeast, margining the massive great plateau of Arizona and New Mexico, and swinging around the southern point of the plateau near the Arizona-New Mexico line, it trends first northeasterly and then nearly northerly into Colorado. Excluding the later ore deposits in effusive rocks, which are considered below, the copper, lead, zinc, and gold deposits are grouped around or in small laccolitic or boss-like intrusions of acid or intermediate rock, intruded during the latter part of the Mesozoic or the early part of the Tertiary. Only two hypotheses are applicable to these deposits. Either (1) they are formed by metallizing vapors and water circulation direct from the magma, or (2) by the ground-water incited to unusual activity by the intrusions of the laccoliths, or of course by a combination of the two. The important data exhibited in this metallo-genetic province will be tabulated, although it involves some repetition of the points already mentioned.

(1) Many areas had suffered repeated intrusion before the entrance of the Mesozoic-Tertiary granitic rocks. For

[4] On this subject see Spurr, 'Theory of Ore Deposition,' *Econ. Geol.*, March, 1908.

instance, in the Globe region, repeated pre-Cambrian intrusions similar in mineralogical composition to the later granite rocks, were not able to develop mineralizing action, and the ground-water in their neighborhood remained inactive in respect to mineralizing action. In other cases a relatively feeble metallization, of different type from that about the later intrusives, was induced. In certain areas, especially around Globe, Ray, and in the Catalina mountains, an early Mesozoic intrusion of diabase (former observations to the contrary notwithstanding) developed no metallization, although these became, in cases, the locus of mineralization, after the granites were intruded.

(2) Many of the Mesozoic-early Tertiary intrusives themselves were unaccompanied by metallization.

(3) The mineralily active intrusives, as a rule, develop metallization only in certain restricted areas, and not along their entire periphery. For instance, ore deposits are especially localized at two places around the Morenci laccolith, at Morenci and at Metcalf. It is further noteworthy that at these two points the rock is more acid than in the rest of the laccolith. A still more curious concentration of ore solutions occurs at Globe. In the Globe hills all the deposits of proved economic worth are developed along the Old Dominion complex fault-zone of adjacent parallel faults. Hundreds of other faults were developed at the same time, but the Old Dominion system caught practically all the metallizing waters. I believe that the ore solutions were furnished by the Schultze granite of Mesozoic or early Tertiary age, which also developed the Miami-Inspiration ore zone along its southwest contact with the Pinal schists. On the northeast, however, the ore solutions were drained by this one complex fault-zone. A curious distribution of the ground-water, indeed, must be assumed to account for its great concentration along this one fissure zone.

Four phases of deposition can be recognized, binding the induced products of ore deposition into one related family. (For brevity, attention is confined to copper deposits, and in order to use only better known examples, Utah and California examples of this same group will be mentioned.)

PHASES OF CUPRIFEROUS METALLIZATION AROUND ACID AND INTERMEDIATE INTRUSIVES OF SOUTHWESTERN UNITED STATES, OF LATE MESOZOIC AND EARLY TERTIARY AGE.

Phase I. Developed during the solidification of the outer portion of the magma. Contact zones.

The mineralization is developed directly at the contact of the intrusive with calcareous rocks. Ores are pyrite, cupriferous pyrite, chalcopyrite, blende, and galena, intergrown with the iron oxides, magnetite and specularite, and the lime silicates, such as garnet, epidote, diopside, tremolite, actinolite, wollastonite, etc. A continuation of the process often develops later veinlets of sulphides in the contact rock. The Morenci garnet zones in the margin of fractured limestone blocks at the contact with the laccolith or the network of dikes from the same, has received the best description, but many more extensive examples are known.

Phase II. Developed during or shortly after the solidification of the outer portion of the magma.

Veins and lenses carrying contact minerals close to the intrusive, but not at the contact.

Examples of veins: Twin Buttes, Pima county, Arizona. The veins extend several hundred feet from the contact, carrying garnet, magnetite, hematite, and pyroxene (hedenbergite?) intergrown with pyrite and chalcopyrite.

Example of lenses: Yerington, Nevada. These develop lenses of typical contact ore at considerable distance from the intrusive.

Phase III. Developed shortly after the solidification of the outer portion of the intrusive.

These are pyritic lenses in the outer fractured portion of the intrusive. Example: Shasta county, California, copper deposits.

Phase IV. Hydrothermal 'after-effect' deposits: (A) in the intrusive; (B) in the adjacent rock.

(A) (1) Veins with pneumatolytic characteristics. Example, Cactus vein, Nevada. This is in a shear zone in a monzonite intrusive which also develops metallization at its margin. The veins show successive cooling of the solutions, the order of mineral deposition being (1) tourmaline, (2) quartz, (3) anhydrite, specularite, and siderite.

(2) Quartz magnetite with lenses of chalcopyrite. Example, Old Baldy veins, Santa Rita mountains, Arizona.

(3) Deposits accompanied by sericitization and silicification of the country rock. Examples, Morenci, Arizona, veins, and Bingham, Utah, disseminations.

(B) (In the adjacent rock.)

(1) Lenses in the limestone, unaccompanied by intergrowth of contact minerals, and at some distance from the intrusive. Example, Bisbee, Arizona.

(2) Cupriferous dissemination in schists. Example, Ray, Arizona.

(3) Quartz chalcopyrite veins at some distance from the intrusive. Example, Gibson lodes south of Globe, Arizona.

The above list is, of course, not complete, but is suggestive, and indicates a 'consanguinity' of the deposits developed around these intrusive masses of this age. The mere enumeration of the phases is not a proof of their magmatic origin, but emphasizes that ore deposition of this type is a continuous and complex process. Around any intrusion certain of the phases may be suppressed, and we may get, for instance, a two-phase deposition of, say, contact deposits and veins accompanied by sericitization. In no one case known are all the phases mentioned present.

In cases where the igneous forces found relief by one intrusion, and the later dikes are lacking, we can conclude that ore deposition was started immediately after the intrusion (if contact deposits are present), and continued during an unknown time thereafter. More definite evidence is available when satellitic dikes are present. Detailed study of certain areas has brought out the more definite evidence as to age and genesis desired. Take, for example, the Shasta county copper deposits. According to L. C. Graton, the history has been one of intrusion from a magma reservoir below, differentiation, and metallization the order of which is given as follows:

(1) The intrusion of an alaskite porphyry and the brecciation of its marginal portions shortly after the intrusion.

(2) Intrusion of a quartz-diorite mass.

(3) Intrusion of basic dikes.

(4) The deposition of great masses of pyrite carrying copper.

(5) Cutting of the pyrite lenses by quartz-chalcopyrite gold veins.

The important point is that the quartz veins are closely related to pegmatite dikes, and as these are undoubtedly the last phases of igneous intrusion, ore deposition is confined to the period of igneous activity.

It is the working out of the details of individual cases of intrusion, differentiation, and metallization that has brought forward the magmatic theory of ore deposition and proved it to the satisfaction of many field geologists who have worked in these areas.

The more important deposits of this class in Arizona have had a simple history, and although examples are known in this region to me, where progressive differentiation has taken place, the last products of which already cut the ores, a better known example is the complicated ore deposits of Rossland, British Columbia. Here the critical history of intrusion, differentiation, and metallization is as follows:

(1) Carboniferous strata were shattered by a large laccolitic intrusion of monzonite, accompanied by a complex of related dikes.

(2) Ore deposition followed in the following three phases: (a) as typical contact deposits; (b) in veins under high

temperature, the group of minerals including biotite, hornblende, tourmaline, quartz, calcite, pyrrhotite, pyrite, chalcopyrite, gold, with the alteration minerals chlorite, epidote, and titanite; (c) hydrothermal disseminations in the monzonite.

(3) Satellitic lamprophyric dikes cut the ore deposits.

A second great group of ore deposits of Western America is designated as metallization induced within and by superficial volcanic extravasations of late Tertiary or Quaternary age, or by intrusives into these surface flows, under conditions of light load. A consideration of the various field relations that prove the close connection between metallization and vulcanism would extend this paper further than desired. It is difficult to understand how anyone who has read the report by Waldemar Lindgren and F. L. Ransome on Cripple Creek, Colorado, can fail to appreciate that here ore deposition is a late phase of vulcanism. J. E. Spurr's work proves that a series of vein formations often occur in this class of deposits that differ from each other widely in mineral content, and follow definite periods of volcanic eruption. It seems probable that detailed field work will permit defining accurately many of these strikingly different veins in the volcanic history of the region. (Such, for example, as the early massive calcite veins, and the later quartz-adularia-gold mineralization that replaces the calcite and sometimes invades separate fissures, of the River range, Mojave county, Arizona.) Finally, Le Croix has shown that almost all of the minerals found in ore deposits are formed by fumarolic action in volcanic vents. It follows that the theory that these veins were formed by waters furnished by volcanic outburst is as well established as the magmatic source of the ore deposits in the case of the earlier granitic intrusions.

As a final example, and a suggestion of the accumulation of evidence gradually gathered during the progress of the examination of a great metallo-genetic province, I will cite the extensive group of sericitic-pyritic gold quartz veins extending more or less continuously from California to Alaska. In the early studies, little evidence was recognized that metallization was the result of igneous intrusion. The veins were found to be either in the granitic batholith, in the greenstone or their equivalent schists, or in the slates and other sedimentary rocks at considerable distance from the granite. The 'Bed Rock Complex' is here composed of two series of rocks, interstratified with immense amounts of basic and andesitic effusives and probably basic intrusives. The gold veins can by no means be connected with the volcanic activity that produced the greenstones, although often found in them, nor with the metamorphism of these volcanics into schists, for both these (extrusion and metamorphism) took place before the intrusion of the granite batholith, while the veins followed the latter.

The subsequent intrusion of the batholithic complex of granite, quartz diorite, and quartz monzonite, may be described as a slow pulsating advance of molten rock, the intrusion of which may have occupied an entire geological period or more. The earlier members were solidified and in places transformed into gneisses before the last of the igneous masses were intruded. In some areas (the Mother Lode region, for instance) differentiation split off basic diorites and gabbros. Contemporaneous and later dikes, both of like composition to the batholith, and of acid and basic differentiates, were intruded. The composite batholith and later dikes are oriented in accordance with the structure produced by pressure antedating the intrusion and expressed by close folding of the earlier rocks and by schistosity. The ore deposits occupy a similar oriented series of fractures, often following the dikes.[5] More accurate dating of the metallization is possible as later basic dikes are occasionally found cutting the veins (Juneau peninsula), showing that the final rock solutions were extruded after some of the ore solutions.

Not less remarkable than the continental extent and homogeneous composition of this linear intrusion, is the fact that the composition of the solutions forming the gold ores was practically the same along the entire length of the batholith. This raises difficulties for those who would explain the deposits as the result of a diffuse descending and concentrated ascending meteoric circulation. They must explain how the solutions traversing the various belts of rocks, and depositing their load in rocks of different composition, attained such a uniform chemical composition. The mineralogy of the deposits has been mentioned before. The intense sericitization and pyritization of the wall rock with the development of carbonates and epidote, indicate an unusual reactivity of the alkaline bicarbonate solutions that caused this action, and tourmaline, albite, rutile, and molybdenite indicate granitic origin, if the evidence of other regions is accepted regarding the genesis of these minerals.

In the foregoing discussion, the evidence for magmatic origin of ore deposits has been drawn from field evidence and mineralogical association. The data that have gradually driven out the idea of the importance of meteoric circulations in ore formation are not theoretical. The hypothesis has, however, not yet reached its proper position, as it has had a severe fight to replace the theory intrenched by Van Hise's masterly presentation. Here only those deposits where the intrusive is directly at hand have been assigned a magmatic origin. Even where the mineral association in the ore deposit suggests the presence of an underlying intrusive, the field geologist has rarely had the courage of his conviction to suggest the presence of such.

From the theoretical side, however, the magmatic idea has the advantage over the hypothetical concentration by meteoric waters. The established cases of concentration by the latter rarely attain a concentration of more than 10 to 1. In disseminated copper ores the enrichment may be taken as raising the value of an original ½ to 1½% ore to a 2 to 5% ore. In Butte, where the action has been long continued, under favorable conditions, we may take 2% as the average of the original ore, enriched in places to a 60% ore, but on the average to about a 5% ore. The concentration by vadose circulation of the Lake Superior iron ores is probably less than this on the average. Further, the chemical action involved in this well known process consists of oxidation, solution, and immediate precipitation at the water-level by pyrite or other reducers. The chemistry of a dispersed deep-seated meteoric circulation is not understood, and the very existence of such circulations, except under artesian conditions, is doubtful. Further, active precipitants are everywhere present, and even kaolin and crushed rock are effective precipitating agents in zones below the level of oxidation, so that doubt is raised as to whether the metals could remain in solution long enough, in a dispersed circulation, to raise the concentration of the ore solutions to the degree demanded by the deposits of the precious metals.

On the other hand, in a cooling magma the crystallization of the common minerals takes with them chiefly those less common bases that can form mixed crystals, double salts, or chemically replace the more common elements of the rock minerals. When crystallization reaches the point of forcing out the residual water, it will contain the less common substances, especially those soluble in the water or volatile at the temperature of the solidification of the magma. Crystallization and melting may take place a number of times. The process seems competent to produce the degree of concentration (more than a million to one in the precious-metal deposits) demanded. The exceptional and erratic distribution of such deposits is explained by the exceptional and erratic concentration of such solutions, and the chance of their reaching the channels of escape.

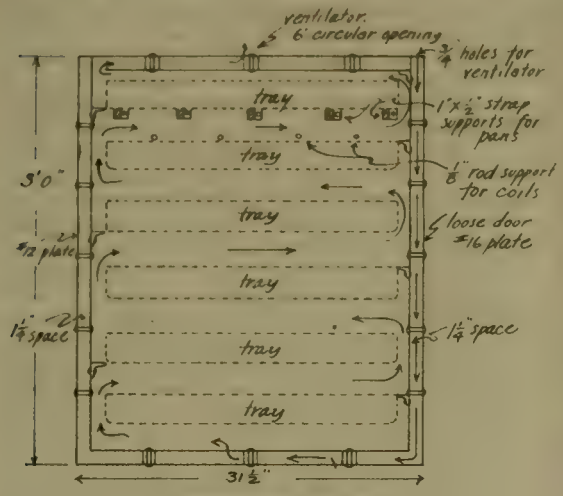
It is hoped that the above discussion, incomplete as it is, suggestive rather than detailed, is sufficient to show that the theory of the magmatic source of ore solutions is now firmly founded on field evidence. That, though it now dominates speculation regarding ore genesis, it is not a "prevailing obsession," and not to be set aside in such a summary manner; nor is it founded on such slender ground of geological fact as Lawson would have us believe.

[5] Field proof that these dikes belong to the intrusive cycle, and not to recent basaltic effusive cycle, is to be desired.

An Electrical Drier for Zinc Precipitate

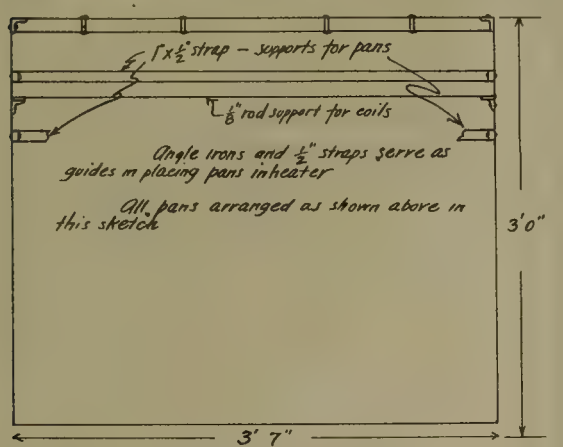
By Donald F. Irvin

The preparation of zinc precipitate for smelting involves a preliminary drying, although if roasting is not desired, it is customary to charge the precipitate into the crucible with a higher moisture content than formerly practised. Drying is done in various ways by direct heating, as in a coal-fired oven; or in a steam-bottom pan; or electrically. Some



TRANSVERSE SECTION.

features of the last method are that drying may be carried on without the dirt caused by stoking a furnace, and also with the minimum attention in the way of regulating the heat. Furthermore, heating can be carried on safely at night, when attendants are usually off duty, a consideration of some value when melting is done on day-shift only.



LONGITUDINAL SECTION.

Thus, a small drying device does the work of one of twice the capacity, requiring constant watching.

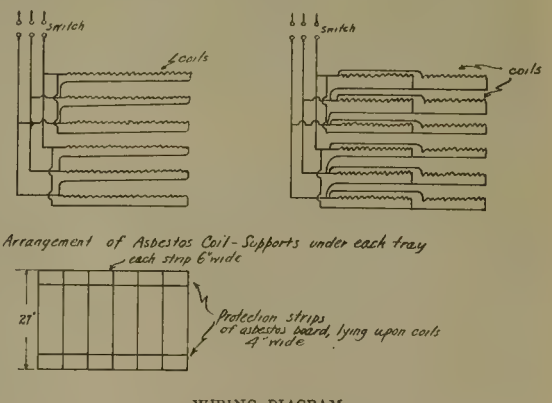
A most satisfactory electric drier is that installed for the El Tigre Mining Co. by D. L. H. Forbes. It consists of a series of sheet-iron trays, enclosed in a ventilated sheet-iron cage, the whole mounted upon wheels for ease of movement. The accompanying illustration and sketches show the construction and wiring of the heater, which is simple and effective. This drier is used for the precipitate gotten from Merrill zinc-dust precipitation presses, and no especial care is required in manipulation, save that time is gained by partly air-drying the precipitate before removing from the presses. Condensation of the rising steam occurs on the inner side of top, making contents of top tray damp through dripping. The remedy for this is more ventilation, which must be balanced against undue loss of heat thereby.

The heating current is supplied from the regular 110 volt electric lighting circuit, and the resistance is furnished by coils of No. 18 hard drawn iron wire. There are 1620 ft. of wire per phase, and in all, 4860 ft. is used. Each phase serves two trays, and each tray has 8 coils. Thus, each coil is wound with a little more than 100 ft. of resistance wire. This requires 30 to 35 amperes current at 110 volts. The capacity of this drier is about 175 kg. of precipitate, dried

ELECTRIC PRECIPITATE DRIER.

from the usual damp condition of fresh air-dried precipitate to absolute dryness in 24 hours.

Short-circuiting, resulting from the moist, dripping condition of the interior of the cage, is one feature to be guarded against. This may be prevented by smearing the coils with



WIRING DIAGRAM.

plaster of paris, thus protecting them from moisture. These wire coils are wound upon strips of asbestos board, 6 in. wide by 27 in. long, and ¼ in. thick, being supported by small longitudinal rods of ⅛-in. iron, as shown in the sketches. When first built, this drier had glass tubing wound with asbestos wicking instead, but was soon changed to the present plan.

This is a very handy machine and saves considerable in first cost over the construction and maintenance of a brick oven drier. A steam bottom pan is not feasible at El Tigre, as all motive power is now electric, and the former boiler room is several hundred yards from the melting house. Also, steam losses in operation would be high. Comparisons of operating cost with other methods of drying cannot include the highly desirable features of the electric drier making for convenience, cleanliness, and safety; all of which incline millmen in its favor, especially after having used one.

Cyanide Regeneration

By B. George Nicholl

*With the introduction of the cyanide process it appeared that finality in gold-extraction processes had nearly been achieved, but the early application of the process to many ores was accompanied by such unsatisfactory results that eventually only those which contained no refractory elements were selected for cyanidation. In accumulated dumps the difficulty lies chiefly in the high consumption of cyanide, owing to the fact that other metals than gold generally go into solution readily, and the baser metals have sometimes to be fairly well leached out before the gold is attacked. This is particularly the case where copper is present in small quantities, and in the cyanidation of auro-cupriferous ores many variations of the cyanide process have been tried, mainly aiming at effecting a reduction in the chemical consumption. No plant operating on auro-cupriferous ores has yet overcome copper troubles, and so long as copper is readily soluble in a cyanide solution, in no such case will the initial consumption of cyanide be very materially reduced. The presence of copper in solution gives rise to precipitation difficulties, and these have so effectually resisted correction that precipitation on zinc-shavings had to be abandoned in favor of other methods. In the early operation of the process the only other form of precipitation practised was the Siemens & Halske electrical process, with precipitation-boxes about 4 by 8 by 30 ft., consisting of about six compartments, each 4 by 8 by 5 ft., and each compartment containing anodes of iron enclosed in hessian cloth and cathodes of lead-foil. The distance between anodes and cathodes was about 6 in., and a current density of 0.02 amperes per square foot of anode surface was generally employed. As low as this current density was, it was sufficient to cause the anodes to decompose rapidly, with consequent formation of ferro-cyanides and ultimate loss of cyanide during the passage of the solutions through the precipitation plant. The only advantage that the process offered over zinc precipitation was that more metal was recovered, and the solutions were returned to the vats in a fairly clean state. The chief difficulty, the high consumption of cyanide, had not been remedied; on the contrary, the cyanide consumption had slightly increased, and the advantages obtained scarcely compensated for the increase.

In 1903 a great improvement in electrical precipitation was effected by Charles Butters, of California. Butters used anodes of lead sheets peroxidized by electrolysis in a solution of permanganate of potassium, and sulphuric acid. These anodes resisted oxidation to a much greater degree than iron anodes, and withstood a current density of 0.5 amperes per square foot without apparent decomposition, and, owing to the use of a greater current density, the size of the precipitation plant was greatly reduced. Butters erected at Virginia City an electrical precipitation plant consisting of boxes 29 ft. long, 10 ft. wide, and 4 ft. deep, and with V-shaped bottoms. Each box had 12 compartments, and each compartment contained 18 anodes and 17 cathodes, spaced 1 in. apart. The anodes consisted of 0.185-in. lead plates, covered with lead peroxide, and not enclosed in any way. The cathodes were plates of ordinary commercial tinned steel, and fitted with an iron strip along the tops to keep them rigid and to connect them together. In using such a high-current density, the gold is precipitated as a pulverulent deposit on the tin, and is periodically wiped off, falling to the bottom of the box, where it remains until cleaned up. In the operation of the Butters plant a regeneration of cyanide was observed, and this was increased as the decomposition of anodes was reduced. It also increased with the increased precipitation of copper and the consequent liberation of cyanogen, which, in the presence of excessive alkali, reformed active gold solvents.

*Abstract from *The Mining and Engineering Review.*

It was not, however, until this plant had been in operation for some time that the possibility of a recovery of much cyanide was fully appreciated, and, by carefully regulating current density, alkalinity, and other conditions, Butters was able to regenerate sufficient cyanide to defray the cost of running the precipitation plant.

In September 1905 a patent, entitled 'Method for recovering precious metals from solution,' was granted to Isaac Anderson and Michael Scanlan, metallurgical chemists, of Arizona. In this process it was claimed that the silver and gold could be precipitated in such a manner that the solution could be readily restored to its original activity with but little loss of the original solution and at a small cost for regeneration. This process is based upon the fact that when sulphuric acid is added to a cyanide solution of the precious metals in which sulphides and chlorides are present, the sulphuric acid so added will combine with the potassium of the potassium cyanide to decompose the double cyanides formed by the action of the potassium cyanide on the precious metals, and the metals freed from combination with the potassium cyanide will then combine the sulphur and chlorine present to form insoluble sulphides and chlorides, which will be precipitated, leaving the cyanogen in the liquid in the form of hydrocyanic acid, or in combination with the radicals with which the sulphur and chloride have been combined. The precious metals having been precipitated as chlorides or sulphides, the superabundant liquor can be decanted off, and the potassium cyanide may be regenerated by decomposing the potassium sulphate formed by the action of the sulphuric acid from the solution. The decomposition of the potassium sulphate and the removal of the sulphuric acid may be readily accomplished by introducing lime into the solution and decanting off the precipitated gold and silver, the lime so added causing the decomposition of the potassium sulphate with the formation of insoluble calcium sulphate and simultaneous regeneration of potassium cyanide. In the operation of this process it was claimed that a regeneration of 90% of cyanide could be effected. At the time of the introduction of this process there was little demand for the advantages which it offered, and there is no record of its operation on a working scale, except on the works controlled by the inventor, where, apparently, it was satisfactory.

In 1908 W. H. Wheelock, an American chemist, in experimenting with the action of sulphuric acid on cyanide solutions, practically rediscovered the process previously operated by Anderson, and contributed an article to the *Mining and Scientific Press* (December 18, 1909) setting forth the results of his experiments. After perusing Wheelock's article I then conducted a number of experiments at the works of the Mitchell's Creek Gold Recovery Co., Bodangora, N. S. W., on the lines laid down by Wheelock, and the following are the particulars of one of these tests: 160 lb. KCN solution containing 0.23% free cyanide, 1.5 lb. lime, and about 5 lb. copper per ton of solution was taken from the tops of the precipitation-boxes and put into a clean cyanide case for treatment. Sulphuric acid was then added (the solution being gently stirred during the addition of the acid) till a precipitate ceased to form. It took 2 lb. of acid to complete the reaction. After standing for two hours, a solution from 5 lb. of lime was added (the portion of lime that did not dissolve in water being discarded); lime solution was added only until the acidity was neutralized. After stirring and allowing the precipitate to settle, the solution was again tested for KCN and it was found to have risen to 0.695% or a gain in KCN of 10 lb. per ton of solution.

These results indicate that under careful manipulation the process of precipitation by sulphuric acid and regeneration of the cyanide is commercially possible when the following general conditions are observed: The solution to be treated should contain very little free cyanide, because if free cyanide be present a fair amount of acid will be consumed in neutralizing it before precipitation actually commences. This cyanide would be totally lost, and so would the acid used to neutralize it. The solution should be as nearly saturated with copper as possible; this can be ob-

tained by passing the solution through successive vats until it will pick up no more metal. Acid should be added until the further addition of acid ceases to make the solution turbid. An excess of acid will prevent a good regeneration and cause a subsequently greater consumption of lime to restore alkalinity and regenerate the KCN. The precipitate formed on the addition of acid should be removed as quickly as possible from the solution and lime added before much HCN could have had time to escape.

Anderson claims that a regeneration of over 80% of the original cyanide can be obtained in the treatment of solutions carrying 0.5% of copper, and that the precipitate will contain 50% of copper; but, of course, the results must depend upon other conditions than only the amount of copper present.

At the Mitchell's Creek works several hundred tons of solution was profitably treated by acid regeneration, but lack of vat accommodation, the large amount of precipitate to handle, and the absence of conveniences to systematically continue this method placed it at a disadvantage when compared to improved electrical precipitation. The latter plant will operate continuously with very little attention, and with only a small power-cost; while facilities for acid regeneration would require large storage capacity for solutions and a special smelting plant to deal with the precipitate. On the same works an experimental electrical precipitation plant on the Butters principle was installed, and this plant consisted of a box 10 ft. long by 12 in. wide and 12 in. deep at the sides, and tapering to 18 in. deep in the middle, and containing eight compartments. About 120 sq. ft. of cathode surface was employed, and from 3 to 8 tons of solution passed through the box in 24 hours. The current density rate of flow and other conditions were occasionally varied, but the average of daily returns of this plant during about three months' run is given below:

Rate of Flow: Tons per 24 hr., 3.5.	Top of box.	Tail of box.
Au (dwt.)	1.6	0.4
Cu (lb. per ton)	4.68	3.83
KCN (%)	0.05	0.125

Current Density: Amperes per sq. ft. of anode surface, 0.5.

This average is from the total returns recorded. During the trials two samples were taken daily, each sample being from a continuous siphon, and included in the returns are a number of samples taken while the current was off, and during which period a loss of cyanide was recorded. As a result of these experiments a large electrical precipitation plant was installed, but this has not been long enough in operation to furnish any valuable data. Since this plant started it has effected a regeneration of from ½ to 2 lb. KCN per ton of solution treated, but better results than these are expected when the most suitable condition of the solutions for precipitation has been determined.

Since the installation of the above plant a patent has been granted for a method of electrical precipitation wherein rods of Acheson graphite, each ½ in. by 24 in., are placed side by side to form a plate, and cathodes of corrugated or waterproofed felt or cardboard, which has been made superficially electrically conductive by treatment with an adhesive compound and Acheson graphite powder. Acheson graphite, by reason of its purity and high conductivity, will withstand a very high current density as an anode without injury, and the fine graphite is found to impart a highly conductive surface to the treated cardboard. Cathodes treated in this way cost about £10 per 5000 sq. ft., and this area is sufficient to obtain good precipitation from 200 tons of solution per 24 hours. The arrangement of electrodes in this plant is such that the greatest possible number of AuCN and CuCN molecules will be brought into contact with the cathodes during the passage of the solutions through the box. In electrical precipitation more depends on diffusion of the molecules than on variations of other conditions, and increasing the cathode area increases the percentage of precipitation more than does increased current density, as decomposition of the metal bearing molecules only occurs when they actually make contact with the cathode. By the use of anodes, consisting of round rods placed side by side to form a plate, and cathodes of finely corrugated, electrically conductive cardboard or waterproofed felt, the area of electrode surface in a box of given size is more than 100% greater, and the solutions in passing between the uneven surfaces of the electrodes will be more diffused and less liable to track than is the case where the electrodes are ordinary flat sheets. The cathodes require to be made sufficiently strong to prevent warping, and this can be done by running a wire around the sides and bottom, the ends of the wire being bent over so as to dip into the mercury grooves to make electrical contact. An additional advantage in having the cathodes corrugated is that the precipitated metal will not peel off and touch the anodes, causing short circuits. If the cathodes are quite rigid the distance between anodes and cathodes can be reduced to about ⅜ in., the clearance required being only enough to prevent the accumulation of precipitate between the plates. The rods composing the anodes are fixed together firmly. Kerosene is poured into the box to form a layer about ½ in. deep on the top of the solution, to prevent the accumulation of froth and the escape of hydrocyanic acid.

Precipitation and subsequent regeneration of KCN depends upon the fact that when the metal-bearing molecules in their passage through the box come in contact with the cathode they are immediately decomposed, the metal adhering to the cathode or falling to the bottom of the box, where it remains until the clean-up. The energy imparted to the liberated cyanogen is expended partly in forming compounds with free alkali, and partly in the decomposition of water and formation of hydrocyanic acid. Where the anode used has not a high resistance to oxidation, most of the liberated cyanogen would be lost in the formation of compounds with the anode material.

The total cost of a plant to treat 300 tons of solution per 24 hours would be about £500, the attention required would be negligible, and about 12 b.hp. would be required to furnish the necessary current. A small recovery in cyanide and the higher extraction possible from cleaned solutions would soon return the cost of the plant. Attendance, power costs, and cathode renewals would not be as great as the cost of attendance, zinc, etc., in a zinc precipitation plant. In the former plant the copper also would be recovered.

In some cases it would appear to be an advantage to use a combination of zinc and electrical precipitation, the solutions passing first through the zinc-boxes, where the gold would be saved, the function of the electrical boxes being to purify and regenerate the solutions before returning them to the vats. On account of the difficulty in getting complete precipitation of the metals without excessive cathode surface in an electrical precipitation plant, a judicious combination of zinc and electrical precipitation in the cyanidation of auro-cupriferous ores is almost certain to show greater economy than either method alone.

The latest process claiming to effect a saving in cyanide and a good extraction from raw sulphide or sulpho-telluride ores has recently been patented by J. C. Clancy and is now in operation at the 100-ton plant of the Ajax Gold Mining Co. at Victor, Colorado. This process depends upon the constant formation by electrolytic action of cyanogen iodide in the pulp during agitation. Mr. Clancy claims to have reduced the consumption of cyanide to mechanical loss only. I have conducted a number of experiments in accordance with Clancy's directions, but up to the present time the results have not been uniform, and trials of the process on a larger scale are now being carried out. In Australian mining at the present time more depends on the discovery of some process which will profitably extract the metals from poor sulphide ores than on the discovery of new mining fields, and the success of the Clancy process is greatly to be desired. Coöperation between metallurgists exploiting the electro-chemical processes would probably bring success where isolated experiments are certain to fail.

Combination Methods for Smelter Assays

By A. T. French

*The smelter chemist is called upon to do daily analyses of one or more ores or products which form the furnace charge, and also of the slag. The chief constituents commonly determined are, for the furnace charge: Insoluble (SiO_2), Fe, Al_2O_3, CaO, Zn, Pb, S, and Cu; and for slags: Insoluble, Fe, Al_2O_3, CaO, Zn, and Cu.

Many methods of determining the separate elements are given in text-books and in technical literature. It is my object to present a scheme for the combination of these methods which has been worked out by experiment, and which seems of sufficiently general application to merit the attention of others interested in similar work. The problem, then, is the separation of these elements and oxides from each other and their estimation in the presence of such usual constituents of ore as As, Sb, Mn, MgO, and others. A standard of accuracy of 0.5% is required (for example, iron, if reported 20%, must be within 19.75 and 20.25), except in the case of copper, which should be within 0.1 or 0.2% on ores and 0.025% on slags.

Method 'A' for Ores.—Weigh out two ½-gm. portions for the analysis and ½ or 1 gm. for sulphur. The two ½-gm. portions for analysis are moistened with water, 5 to 10 c.c. of strong HNO_3 is added, and taken to dryness on the hot plate; 5 c.c. of HCl is added to each, and, after a few minutes' digestion at a moderate temperature, 20 c.c. of dilute H_2SO_4 (1:3), and the assays are rapidly boiled down to white fumes. After cooling and dilution with water to about 100 c.c., to (1) 5 c.c. of HCl is added, and to (2) 10 c.c. of dilute H_2SO_4, and both are boiled a few minutes. In (1) insoluble, SiO_2, Fe, CaO, and Zn are to be estimated. In (2) Pb, Cu, and Al_2O_3.

(1) *Insoluble.*—The hot solution is filtered through an ashless paper and washed thoroughly with hot water, the filtrate is removed and the residue washed with a hot solution of ammonium acetate (if much lead is present it is better to wash back into the beaker, add ammonium acetate and digest for a few minutes on the hot plate, finally throwing back on the same filter); the washings are thrown away and the filter with contents is placed in a roasting dish, dried, ignited in the muffle, and, after cooling, weighed as insoluble.

The filtrate in a 600-c.c. beaker is diluted with hot water to 300 to 400 c.c., about 10 gm. of pure ammonium chloride added, and if manganese is present 10 to 20 c.c. of strong bromine water, then an excess of $NH_4.HO$. The solution is brought to a boil, the precipitate allowed to settle, and then filtered, washing with hot water, or, better, if much zinc is present, with a hot dilute ammoniacal solution of ammonium chloride. The filtrate and washings are received in a litre beaker and the hydrate precipitated is re-dissolved in HCl and re-precipitated as before (not forgetting the bromine water, if necessary) in a rather smaller bulk, combining the two filtrates.

Iron.—The hydrate precipitate is either re-dissolved in dilute H_2SO_4, the iron reduced and titrated cold with standard potassium permanganate, or the precipitate is dissolved in HCl, reduced, and titrated with standard potassium bichromate.

Lime.—To the combined filtrates 20 to 30 c.c. of a 2% solution of ammonium oxalate is added, the solution is brought to a boil and allowed to stand in a warm place for half-an-hour, by which time the calcium oxalate is filtered off, washed thoroughly, dissolved in warm dilute sulphuric acid, diluted with hot water, and titrated hot with standard potassium permanganate.

Zinc.—The filtrate from the calcium oxalate is acidified with HCl, adding 5 c.c. in excess. A current of H_2S is passed through it for 5 or 10 minutes, the solution is then boiled for five minutes, filtered if necessary (usually this is not the case), cooled to about 30°C., and titrated with standard potassium ferrocyanide.

(2) This portion is allowed to stand until quite cold in order that the lead sulphate may separate out and settle. It is then filtered, washing by decantation with cold water, and adding a little dilute H_2SO_4 to the wash-water from time to time.

Lead.—To the residue in the beaker is added 5 to 10 gm. of ammonium acetate, a little acetic acid, and 100 c.c. of hot water. The filter paper is dropped into it and the beaker placed on the hot plate, brought to a boil, and, when all the lead sulphate is dissolved, about another 100 c.c. of hot water is added, and the solution is titrated hot with standard ammonium molybdate.

The filtrate, to which a little strong HCl may be added, is heated to near boiling and a current of H_2S is passed for ten minutes. The sulphides are filtered off, using a rapid filter and washed with hot water (H_2S water should be used if the filtrate comes through at all cloudy, but this is rarely the case).

Copper.—The sulphides are washed back into the beaker, opening out the filter paper and placing it on the side of the beaker; a few drops of bromine water are poured over it to oxidize the traces of sulphides retained in the pores of the paper; then 5 c.c. of HNO_3 and a little hot water, and the paper is removed. A small quantity of iron is added, about 0.05 gm., the beaker is placed on the hot plate and boiled down to dryness. After cooling, 2 or 3 c.c. of HCl is added, and the copper estimated by the permanganate method.

Alumina.—A filtrate from the sulphides is boiled to expel H_2S, oxidized with 2 or 3 c.c. of HNO_3, a slight excess of $NH_4.OH$ is added, and the solution boiled until it no longer smells of $NH_4.OH$. After standing a minute or two to settle, the hydrates are filtered off, washed slightly, washed back into the beaker, and re-dissolved in a little HCl, pouring the acid first over the filter paper. The solution is just neutralized with $NH_4.OH$, 2½ to 2 c.c. of HCl is added, and the alumina is estimated by the phosphate method.

Sulphur.—On silicious and roasted ores, 1 gm. is taken, on pyritic ores ½ gm., moistened with water, and about 5 gm. $KClO_3$ and 10 c.c. HNO_3 added. The assay is taken to near dryness on the hot plate, avoiding baking, taken up with 5 to 10 c.c. acetic acid (1:1) and 150 to 200 c.c. of hot water; about 10 gm. of ammonium acetate is added, the solution is brought to a boil, and titrated, boiling, with standard barium chloride.

Examination of insoluble silica.—(1) When the insoluble is white, as in treating most raw ores and others easily attacked by acids, the residue obtained in the first part of the analysis is fused in a platinum dish or crucible with ten times its weight of fusion mixture (K_2CO_3 and Na_2CO_3). The melt is dissolved in HCl, transferred to a porcelain capsule or casserole, taken to dryness on the hot plate, taken up with 5 to 10 c.c. HCl, diluted, and the silica filtered off, dried, and ignited. After cooling in a desiccator the SiO_2 is weighed and an addition made for the SiO_2 still left in solution. The filtrate from the SiO_2 is rendered slightly ammoniacal, the solution boiled until it no more smells of $NH_4.OH$ and, after standing a few minutes, the hydrates are filtered off, washing thoroughly with hot water. The filter and contents are dried, ignited, and weighed, reporting as Al_2O_3 and Fe_2O_3.

(2) When the insoluble is black or red, as in treating roasted ores and substances not easily attacked by acids, the residue is fused as in (1) and the SiO_2 filtered off, ignited, and weighed.

The filtrate is tested for Cu and Pb by passing H_2S. If any is found, the sulphides should be filtered off, dissolved in HNO_3, taken to fumes with H_2SO_4, diluted, and cooled; the $PbSO_4$ is filtered off and added to the main portion and the copper in solution also added to the main portion obtained in the first part of the analysis, before precipitation with ammonium sulphocyanide. (The free sulphuric acid should be just neutralized with $NH_4.OH$.)

The filtrate from the sulphides, or from the silica in

*Abstract from *Bulletin* of the Institution of Mining and Metallurgy.

absence of Cu and Pb, is boiled to expel H_2S, oxidized with HNO_3 or $KClO_3$, and NH_4OH is added until the solution darkens, or, in absence of much iron, until the solution is only faintly acid, and 5 to 10 gm. of sodium acetate is added. The solution is brought to a boil, allowed to stand, and the precipitated basic acetates of iron and alumina are filtered off.

After washing with hot water the acetates are washed into a porcelain dish, about 1 in. of caustic soda or potash added, and digested at a gentle heat for a quarter of an hour. The Al_2O_3 goes into solution, the iron precipitate is filtered off, re-dissolved, reduced, and titrated as in the first part of the analysis.

The filtrate is acidified with HCl and the Al_2O_3 either estimated by the phosphate method or a slight excess of NH_4OH is added, boiled off, the precipitate filtered off, dried, ignited, and weighed as Al_2O_3. (If the quantity of iron and alumina is large, the acetates should be dissolved in HCl and re-precipitated with NH_4OH, boiling off excess before extracting with caustic, but usually this can be omitted.)

Lime. To the filtrate from the acetates about 10 c.c. of NH_4OH and 20 c.c. of a 2% solution of ammonium oxalate are added, and the calcium oxalate precipitated and filtered off. This precipitate is dried and ignited, weighing as CaO; it should be tested for iron, and, if any is found, the weight of Fe_2O_3 is subtracted from the CaO, and the calculated amount of Fe added to that previously found.

Zinc.—The filtrate from the lime is acidified, gassed, boiled, cooled, and titrated with standard potassium ferrocyanide.

Method 'B' for Slags.—The sample should be chilled; this is usually done at the furnace, the molten sample of slag being poured into a bucket of water. Or the slag in lump form may be heated to redness in the muffle and thrown into water before grinding, the effect being to make the slag easily attacked by acids, anything up to 50% SiO_2 giving a white insoluble containing not more than 1 or 2% of substances other than silica. For the analysis, two ½-gm. portions are weighed into 300-c.c. beakers or casseroles. The slag is moistened with 2 or 3 c.c. of water, the beaker is held over a bunsen burner, keeping the contents in motion, and when near boiling, 3 c.c. of strong HCl is added and a few drops of HNO_3. The heating is continued for 2 or 3 minutes, when gelatinous silica separates out and the beaker may be placed on the hot plate and taken to complete dryness.

Insoluble.—The two portions are taken up with 5 c.c. HCl diluted to about 100 c.c. with hot water, and the insoluble filtered off (use of the filter pump is unnecessary if the SiO_2 has been properly de-hydrated), dried, ignited in the muffle, and weighed.

Filtrate (1) is diluted to about 300 c.c. with hot water, about 10 gm. of NH_4Cl is added, and bromine water if manganese is present, and then NH_4OH in excess. The solution is boiled, the precipitate allowed to settle, then filtered into a litre beaker, washing with hot water, the hydrates are re-dissolved in HCl, NH_4Cl and bromine water (if necessary) added, re-precipitated with NH_4OH, and filtered off, combining the two filtrates.

Iron.—The hydrate precipitate is re-dissolved in dilute H_2SO_4, reduced, and titrated with standard permanganate, or HCl may be used, and the solution, after reduction, titrated with bichromate.

Lime.—To the combined filtrates, which should be strongly ammoniacal, 20 c.c. of a 2% solution of ammonium oxalate is added, the solution brought to a boil, and allowed to stand in a warm place until the calcium oxalate settles. This is then filtered off, washed, dissolved in dilute H_2SO_4, and titrated hot with standard permanganate.

Zinc.—The filtrate from the lime is acidified with HCl, adding 5 c.c. in excess, a current of H_2S is passed for 5 to 10 minutes, and the solution is boiled, cooled to about 30° C., and titrated with standard potassium ferrocyanide.

Alumina.—Filtrate (2) is just neutralized with NH_4OH, 2 or 3 c.c. of HCl is added, and the alumina estimated by the phosphate method. If much Cu and Pb are present the filtrate should be gassed, filtered, H_2S boiled off, and the solution oxidized before proceeding as above; but I have not found this to be commonly necessary in dealing with ordinary slags.

Copper. For copper, 5 gm. portions are weighed into a 600 c.c. beaker, about 250 c.c. of hot water added, and the beaker placed on the hot plate. When boiling, 30 c.c. of strong HCl is carefully added and the solution stirred until decomposition is complete. If pure acid has been used the sulphides which are not attacked can be filtered off, but it is safer to pass H_2S for a few minutes before filtering. The sulphides are washed back into the same beaker, cleaning the paper with bromine water, and dissolving in HNO_3. The copper is then usually estimated by titration with cyanide or colorimetrically. A more accurate, though rather longer, method is to take to complete dryness, take up with HCl, and estimate the copper by the permanganate method.

The National Bureau of Standards

The work of the national Bureau of Standards is apparently only partly understood by the chemists of this country. Probably all are familiar with the fact that the Bureau of Standards prepares analyzed samples of various metallurgical products and calibrates thermometers and glass measuring apparatus. It is probably true, however, that the broader and perhaps more important work of the Bureau is little understood by the person who has not been brought in actual contact with its operations in various lines of industry. This broader field of work covers a line of operations in keeping with its name, and which will be of fundamental importance to scientists, particularly to the chemists and chemical engineers of this country. The ideal of this Bureau is to make it in practice what its name implies: a bureau of standards. This does not mean a bureau of standards for weights, measures, electrical units, and units of time alone, but while meaning this, also has a much broader meaning which is now being emphasized by the labors of the men in the department, and as an illustration of this, their work on paper may be cited.

The Government is a very large purchaser of paper of various kinds, weights, and qualities. It was a matter of fundamental importance to draw up specifications which would properly cover the purchase of grades of paper satisfactory for the various purposes desired. So little information was available along these lines that a small paper machine has been installed and experiments will be made to determine just what composition and method of treatment will be required to obtain a paper such as is desired for the various purposes. Such information will then be embodied in a specification drawn to cover the purchase of this material.

Work is also being done along other lines which are interesting to the chemical engineer, such as the development of standard methods for testing rubber and rubber goods; standard methods and standard apparatus for testing lubricating oils, particularly in the determination of their viscosities. Much work is also being done in comparing types of calorimeters, both for solid and liquid fuels. Suggestions will be ultimately made indicating types of calorimeters most suitable for various purposes. A large amount of work has already been done in the study of various pyrometers of all kinds. This work is being continued, and has done much toward evolving typical pyrometers which are satisfactory for all kinds of heat measurements.

The Bureau also has under consideration and in time will probably take up the definitions and specifications covering the composition of various industrial products, such as alloys. In fact, it seems to be the desire of the responsible heads of the Bureau to act in fact as well as in name as a bureau of standards, to which will be referred many industrial questions, which at present are only vaguely understood because the conception of them has been limited to that loosely formulated in trade practice or trade custom.—*The Chemical Engineer.*

Stripping Coal in Illinois

By J. W. Ijams

*Stripping coal deposits has been done with teams on a small scale for several years. Five years ago stripping had started at Danville, Illinois, with an ordinary type of steam-shovel, loading dirt into a hopper from which it was carried by a belt-conveyor to the spoil bank. This was rather a crude method, but stripping coal at a depth of 25 ft. was done at a price that enabled the coal to be worked at a good profit.

Next a drag-line excavator was placed on the market. This operates successfully to a depth of 40 ft. or more, but will not handle hard shales such as are found in overlying coal deposits.

The early part of 1911, both the Browning Manufacturing Co. and the Marion Steam Shovel Co. brought out long boom, revolving, steam-shovels that deposit material 68 ft. from the centre of the machine and 48 ft. above the wheel base. With this machine it is possible to handle 4000 cu. yd. per day, working a double shift of 24 hr. per day. The Marion company has brought out 8 of these machines, which are now in operation. One of the first was placed at the mine of the Harrisburg-Franklin Coal Co. at Missionfield, Illinois. This is stripping coal lying at a depth of 18 to 27 ft., and is handling 1800 cu. yd. of stripping per day, working only 8 hr. per day, and is uncovering about 400 tons of coal per day. Three other machines of this type are working in the Kansas field and are doing about the same amount of work. A machine of this type will operate successfully in 35 ft. of stripping, although lately both the shovel companies have brought out a larger type of machine which is designed to operate in 45 ft. of stripping. The larger type of machine, however, is heavy, and naturally does not operate as fast as the smaller type. The stripping can be contracted on a price varying from 7¾ to 11c. per cu. yd. In an average case where the stripping lies at a depth of 25 to 30 ft. over a vein of coal 5 to 6 ft. thick, the amount of stripping to be removed for each ton of coal mined would be 4 yd., which at a price of 9c. would amount to 36c. per ton of coal.

The cost of mining coal by the stripping method, where the depth is approximately thirty feet, would be about as follows:

Stripping 4 yd. at 8½c.	$0.34
Mining coal	0.25
Running over screens, general, and all other expenses.	0.10
Total	$0.69

The first cost of a plant as described above, including pumps, water connections, etc., amounts to about $27,500. The depreciation on a shovel plant amounts to about 30% the first year and about 20% for each successive year. The cost of operating the plant is also comparatively high, as experienced shovel-men command a salary of $150 to $175 per month. However, ordinary labor can be used on the ground, making the cost of operating the shovel on a double shift about $4000 per month. Taking into consideration the large depreciation and the large operating expense and general office and other overhead expenses, stripping can be contracted at a reasonable profit at a figure of 7¾ to 11c. per yard. The cost of operating shovels now in service fully substantiate this statement, as do also the figures on operating an ordinary type of steam-shovel, as there is little difference in the cost of operating a revolving shovel suitable for stripping coal-lands and the ordinary type of large steam-shovel such as is used every day in railroad and heavy construction work. Another argument in favor of stripping is that it does away entirely with the cost of sinking shafts, the cost of entry driving, of timbering roof, the cost of air supply and piping, and damages paid to injured miners, and from probable explosions. It also does away with delays caused by strikes, as the mining is in an entirely open pit with ordinary labor.

The average cost of mining coal by sinking shafts and using ordinary methods is approximately 93c. per ton, showing a saving in favor of stripping of 24c., or nearly 40% saving in favor of the stripping method. Where the stripping is less than 30 ft., the price would be even lower, and where it went over 30 ft. it would increase somewhat. I think the maximum depth at which stripping can be operated successfully is about 35 ft. The only question arising is whether there are large areas of coal suitable to the stripping method, and whether they are close enough to railroads to be successfully operated.

*Abstract from *Black Diamond*.

Australasian Gold Output in 1911

A heavy decline in the amount of gold produced, both in Australia and in New Zealand, must again be recorded, according to the *Australian Mining Standard*. For several years past there has been a diminished production, and, although the shrinkage was reduced four years ago, the figures of later years show an increasing falling off, which is not pleasant reading. Not to go back beyond 1907, there was in that year a deficit of 323,329 fine oz.; in 1908 this was reduced to 112,548 fine oz.; in 1909, however, there was an increased deficit, the total being 115,507 fine oz., and this was followed by 266,819 fine oz. in 1910. Last year the Australasian deficiency was 270,713 fine oz., of a value of £1,149,915; the Commonwealth's share of the deficiency being 235,676 fine oz., the value of which would be well over a million sterling. The following table shows the authentic figures for each of the states, and for the Dominion of New Zealand, with the exception that, as the Tasmanian returns are not yet available, an estimate had to be made. At first sight it may appear that this estimate is unduly low; but it must be remembered that from before the end of September the Mt. Lyell company's mines and works were idle and remained so until the end of the year. Three months' supply of gold from the company's copper ore was therefore cut off, and when the actual gold yield of the island state is made available, it is believed that the estimate will not be far out. The total production for the past two years was as follows:

	1910. Fine oz.	1911. Fine oz.	Decrease. Fine oz.
New South Wales	189,214	181,121	8,093
Victoria	570,363	503,541	66,822
Queensland	438,784	381,845	56,939
West Australia	1,470,633	1,370,867	99,766
Tasmania	37,048	32,992	4,056
Total Commonwealth	2,706,042	2,470,366	235,676
New Zealand	446,433	411,390	35,043
Total Australasia	3,152,475	2,881,756	270,713

The Chilean Nitrate Industry

The nitrate industry, according to A. A. Winslow, U. S. Consul at Valparaiso, enjoyed a prosperous year during 1911, the exports being about 2,000,000 Spanish quintals,* or 101,400 tons above that of the previous year, with an advance in prices of from 5 to 10%. Several new nitrate works were opened during the year and others enlarged. The outlook for the industry in 1912 is very bright, which means increased prosperity for the country in general. The nitrate company entitled El Loa, consisting of the nitrate establishments denominated María, Curicó, Anganos, and Anita, has acquired by purchase the Luisis and Candelaria nitrate properties, valued at £700,000. The Loa company will now be able to produce about 5,000,000 quintals of nitrate annually in adddition to its yield of iodine. Steps have been taken in Antofagasta and Taltal to organize a joint-stock company, known as the Taltal Coöperative Nitrate Society, with a capital of $2,000,000.

*1 quintal = 220.46 lb.

Russian Platinum Production in 1911

ST. PETERSBURG CORRESPONDENCE

The platinum business in the Urals during 1911, thanks to the high price of the metal, continued to develop and the production increased. The leading position is held by the Southern Verchotur district, including the platinum mines of the Nizhni-Tagil factories and the mines of the Platinum Company, Ltd. It is stated in a report just issued that the production in this district amounted to 230 poods,* 13 funts, 89 zolotniks, 47 dolyas. This marks an improvement, that is, compared with the production in the year 1910, of 19p. 18f. 26z. 62d.

In the neighboring Northern Verchotur district the quantity of platinum produced, although in itself important, is negligible compared with the large quantity accounted for by the Southern Verchotur district, namely, 21p. 23f. 27z. 6d., and, in contrast to the production of the southern district, the northern shows a decrease as compared with 1910, the decrease amounting to 37f. 25z. 38d. It is stated, however, that this insignificant decrease in the production is explained by purely temporary causes because of the reduction in the work consequent on the scarcity of labor in the mines of the Southern Zaozersk estate belonging to the Trans-Ural Mining Co., where the production was 2p. 8f. less as compared with 1910, which was 2p. 13f., while on the private mines on the Dyalinsk estate the production of platinum, on the other hand, showed a marked increase, amounting to 4p. 23f., or an increase of 1p. 10f. There is also to be added an increase in the production on the Nikolaieff Pavdinsk territories, the property of Vorobieff, which amounted to 14p. 9f. 78z. 79d., or a matter of 9f. 73d. more, as compared with the preceding year.

In the Perm mining district, which may be called the next in importance to the Southern Verchotur, the production of platinum amounted to 89p. 57z. 71d., or 1p. 21f. 54z. 89d. more than was won on that particular ground in the year 1910. In the Southern Ekaterinburg district there was a production of 1p. 38f. 95z. 43d., which marked an increase of 5f. 1z. 86d. on the preceding year's production. It may be observed that at this particular spot the production of platinum is carried on exclusively in the mines of the Systersk factories. In the Northern Ekaterinburg district the production of platinum is not important, being only 13z. 39d. Thus we have for the year 1911 a platinum production in the Urals of:

Districts.	p.	f.	z.	d.	p.	f.	z.	d.
Southern Verchotur	230	13	89	47	+ 19	18	26	62
Northern Verchotur	21	23	27	6	— ..	37	25	38
Perm	89	..	57	71	+ 1	21	54	89
Southern Ekaterinburg	1	38	95	43	+ ..	5	1	86
Northern Ekaterinburg	..	..	13	39	+ ..	..	..	23
Teherdinsk	Returns not yet known.							
Total for the Urals	342	36	91	14	— ..	..	..	..

The following table shows production since and including 1902:

	Poods.	Funts.
1902	374	23
1903	366	35
1904	306	9
1905	319	32
1906	352	29
1907	328	33
1908	298	4
1909	312	21
1910	334	23
1911 (exclusive of Teherdinsk)	342	36
Total for 10 years	3,337	5

*1 pood = 40 funts = 526.64 oz.
1 funt = 96 zolotniks = 13.16 oz.
1 zolotnik = 96 doli = 0.137 oz.
1 dolya = 0.0014 oz. = 3c. in pure gold.

Copper Producers' Association Report

The report of the Copper Producers' Association for February shows a decrease of 3,340,645 lb. in stocks on hand. This reduces supplies this year by more than 26,514,000 lb. and establishes a record for the smallest surplus in the history of the Association. Production for February was 116,035,809 lb., compared with 119,337,753 in January. Domestic deliveries fell off by 6,115,534 lb. and exports by over 17,000,000, making a loss in total deliveries of 23,135,341 lb. The following table shows the conditions of the supply and production of copper as compared with January:

	Pounds.
Production, February	116,035,809
" January	119,337,753
Decrease	3,301,944
Domestic deliveries, February	56,228,367
" " January	62,343,901
Decrease	6,115,534
Foreign deliveries, February	63,148,096
" " January	80,167,904
Decrease	17,019,808
Total deliveries, February	119,376,463
" " January	142,511,805
Decrease	23,135,342

Transvaal 1911 Gold Output

The Chamber of Mines statistics for 1911 show that the gold production of the Transvaal for that period amounted to 8,237,723 fine ounces, valued at £34,991,620, of which the Rand was responsible for £33,543,479 and the outside districts £1,448,141 of the total value. This is a record production to date, the yield during 1910 (also a record) being 7,280,542 fine ounces, valued at £32,001,735. The Transvaal dividends for 1911 were:

Gold:		
Rand	£7,719,610	
Outside districts	303,351	
		£ 8,022,961
Diamonds		300,000
Coal		250,000
Tin		163,250
		£ 8,736,813
Financial, industrial, and land		2,397,650
Total		£11,134,463

An agreement has been signed by the Amalgamated Zinc (De Bavay's), Ltd., and the Potter's Sulphide Ore Treatment Co., under which the option of the former over the patent rights of the Potter's company has been extended for a period of six months. The conditions are: (1) A cash payment of £5000, which is to be regarded as part payment of the purchase money if the option be exercised, or forfeited to the Potter's company if the option be not exercised; (2) if the option be exercised, the balance of the purchase money, namely, £30,000, to carry 5% so long as it remains unpaid; (3) the hearing of all pending law proceedings to be stayed during the option period. It is generally considered likely that this extension, particularly in view of the condition last mentioned, may perhaps indicate an early abandonment of the voluminous and complicated litigation now pending between various owners of flotation process patents. This is the second extension of its option which the De Bavay company has obtained, at a cost of £11,000, so that apparently the directors mean business, though it must be stated that in the event of the option being exercised £10,000 of this amount will form part of the purchase money.

Discussion

Readers of the Mining and Scientific Press are invited to use this department for the discussion of technical and economic matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any communication is determined by its probable interest to the readers of this journal.

How Can Alaska Be Developed?

The Editor:

Sir—The letter from Judge Thompson, and the comment thereon by H. Foster Bain, both appearing in your issue of February 17, have aroused a desire on my part to add some remarks to the discussion of the contemplated change of the national mining laws from the viewpoint of a prospector.

Mr. Thompson contends that, in order to promote the further development of Alaska, the prospector must be given the utmost facilities for acquiring mineral lands, and that if he cannot obtain title to them, and if he should be forced to lease from the Government, he will cease to prospect and move to Alaska. I do not agree with many of these contentions. I have some personal knowledge of the special conditions existing generally in that country, gained during a six years' residence there, beginning in the days preceding the Klondike boom, when all the disadvantages of that remote region existed to a considerably greater extent than at the present time. 'Miner's Law' ruled the land then, and it may be safely assumed that regulations adopted by a small body of men for their own government express with essential accuracy the dominant ideas and wants of the individuals. They invariably imposed provisional holdings by cutting down the size of claims, by allowing only one claim to a district to each person (except the discoverer of new deposits, who might hold two claims), by not tolerating locations by proxy, and in a number of other ways. If prospectors were here everything so entirely their own way as these Alaskan pioneers had it, do not become land-grabbers, it would appear extremely unlikely that they would at any time make much of an outcry for more land. Whoever knows the real prospector in his haunts knows also that he is usually too **busy trying to develop his discovery to bother about adjoining land**, and that he always welcomes neighbors who will go in and dig and by their additional finds enhance the value of his own. It he could eliminate those other 'prospectors' who will surround his discovery locations and, without making the slightest effort to contribute to the development of the country, await an unearned increment accruing from the prospector's labors, he would be quite content with a minimum acreage, so long as it included his orebody.

Leasing was in vogue on every creek along the Yukon that was enough 'rich' to justify it, and it is astonishing to learn from Mr. Thompson that 90% of the present population of Alaska endorses the practice as un-American. The natural inference is that now only 10% of the residents of Alaska are prospectors and miners, as these take kindly to leasing wherever they go, and, providing the terms are otherwise fair enough, it is readily conceivable that they would develop a prejudice against leasing from the Government. Of course, now where a great majority of an American community do not want should not be forced on them, but on the other hand, a general objection to the passage of new laws should not be accepted merely on the ground of a few assertions which are emphatically contradicted by the best portion of the persons about whom they are made. In my opinion, the statement is also quite unwarranted that nothing but only to the good will enjoy the prospector. He very rarely operates a United States patent, and the possessory title prior which he usually holds his claim does not give such absolute security of **tenure that it could not easily be improved upon under a leasing system.**

It appears to be generally conceded that the development of the country's resources must be encouraged by all means, and although the present conservation movement seems to be a step in the opposite direction, its sole aim undoubtedly is the prevention of wasteful exploitation. The enforcement of such a policy does not preclude a simultaneous encouragement of diligent search for new deposits. It should be quite practicable to so frame the proposed new **enactments that they would offer as great inducements to** the prospector as do the present laws, and to reward in an adequate manner the discoverer of mineral resources which add to the present or the future wealth of the Nation, and to abolish at the same time existing abuses. The principle of discovery, upon which our present mining code is based, seems to be sound and should be retained, although it has in the past been honored in the breach rather than in the observance. The trouble was probably caused largely by the difficulty of arriving at a satisfactory definition of what constituted a discovery, and instead of attempting a solution of this problem, a number of makeshifts have been provided to regulate the evasion of the first requisite of a legal entry. The next principle involved, that of use or occupancy, has been nominally adhered to by requiring a certain minimum performance of labor. In practice this has been quite futile in its effect, and has never prevented the holding of mineral ground for purely speculative purposes. The advance of scientific and practical knowledge since the enactment of the present mining laws should make it possible to define the word 'discovery' in such positive terms as would leave little or no doubt of its interpretation. Then it should be possible to provide liberally for the recognition of the discoverer's service, perhaps by giving him an equity in future royalties and, of course, a preferred right to a mining lease, but it seems to me that, under a leasing system, rights acquired through **a duly verified discovery should not be made contingent** upon use or occupancy. The idea is obsolete and does not fit well with modern mining conditions. Its present en**forcement results largely in a waste of time and labor and** tends to retard rather than to advance development, especially in the case of those types of deposits which are not immediately productive but which are of great potential value, as judged by geological evidence.

I can see no reason why the proposed change to a leasing system should be condemned in advance, although I realize also that the new laws might be made extremely distasteful **to the prospector.**

ANTHONY ELFVERS.

Sulphur, Nevada, March 1.

Diamonds in China

The Editor:

Sir—In your issue of November 25, 1911, under 'Concentrates' you have, "Black diamonds are harder than white ones, their color varies from dark gray and brownish opaque to black. They are found only in Brazil." I would like to add that black diamonds, weighing two or three carats, are also found in two provinces in North China. They are superior in hardness to ordinary diamonds, have a fairly good brilliancy, and are used as ornaments by the natives. They are picked up in the rice and *kaoliang* fields shortly after the rainy season. It is curious that the diamonds are never found in the same fields two years in succession. I think that some years ago the Germans had permission or a concession to search for diamonds in the Province of Shantung. This, however, proved unsuccessful, as the natives kept all the diamonds they found, so that the concession was allowed to lapse.

EDWARD DE VILLE.

Tientsin, China, January 4.

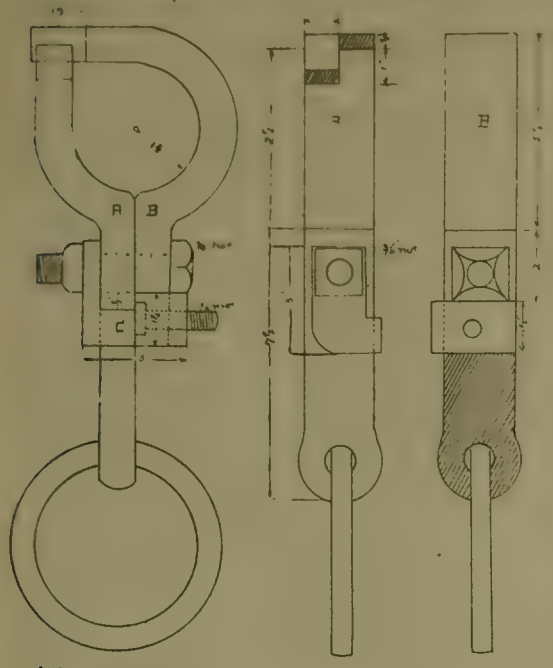
[The story among the natives in regard to these diamonds is that they become lodged in the meshes of the straw sandals used by the farmers while working in the fields, and are thus recovered. There seems to be no reliable estimate of the number found annually, but it is certainly small. Mr. de Ville is apparently the first to call attention to the fact of these diamonds being of the black variety.—EDITOR.]

Clamps for Stamp-Milling

The Editor:

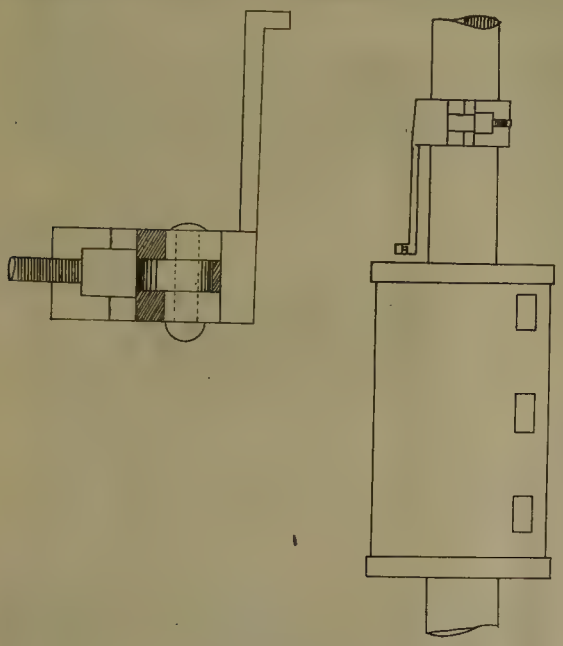
Sir—I enclose drawings of two devices used at the Lightner mill, Angels Camp, which may be of interest to readers of the *Mining and Scientific Press*.

The first one is a clamp used for raising stems. In the



STEM CLAMP.

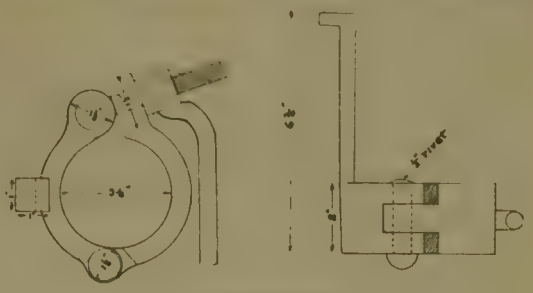
turning of stems end for end, after being broken in the boss, the broken end is often so battered that the ordinary ring type of clamp will not go over the battered top. This difficulty is obviated by use of the clamp shown in drawing,



TAPPET GAUGE.

as it can be quickly and securely placed around the stem below the battered end. The clamp fits firmly and will not slip when stem is twisted.

The second shows the tappet gauge employed at this mill for resetting tappets up on the stamp stems. The wearing of shoes and dies of a stamp battery necessitates the constant resetting of tappets in order to maintain a uniform drop. The tappet gauge shown not only renders easier the setting of tappets but shortens the time usually spent in this operation. With this clamp the stem cannot drop below



TAPPET GAUGE.

the set distance, consequently the use of a chain block is never required. In operation the clamp is placed around the stem the distance above the tappet which the stamp is required to be dropped. The keys are then loosened and the stem allowed to drop until projection *A* rests on the tappet. The keys are then set, the clamp loosened, and the gauge removed, when all is ready to start again.

A. W. MacNichol.

Angels Camp, California, February 28.

Iron as a Cyanicide

The Editor:

Sir—There is nothing new in the statement that small fragments of iron in the ore will consume cyanide during lixiviation. However, a word regarding such a common cyanicide may not be amiss. Julian and Smart make the statement that iron dissolves in KCN, yielding potassium ferrocyanide; one part of iron consuming 7 parts of KCN, the reaction also consuming oxygen, which is required for the dissolution of the precious metals. In a recent cyanide test this cyanide occurred in such a way that it made its presence known. The table concentrate from an ore carrying a small amount of sulphide, after standing a few hours, showed rusty streaks which gave the concentrate the appearance of an oxide rather than a sulphide.

One gram of this rusty material was withdrawn by means of a magnet and treated 16 hours in a cyanide solution, with a resulting consumption of 34 lb. KCN per ton of material. Investigation before cyanidation showed that only about 10% of this rusty material was metallic iron; the rest was simply discolored gangue clinging to the iron. The rust gave this pulp the appearance of containing limonite and, as nearly as could be determined by intensity of discoloration, none of the rust was dissolved. A consumption of 34 lb. KCN per ton of solids treated is 1.7% of 1000 mg. or 17 mg. KCN.

Since the entire consumption is chargeable to metallic iron, which amounted to 100 mg., and iron consumes cyanide at the rate of 1 to 7, it can be seen that no appreciable amount of iron was dissolved, though the cyanide consumption due to its presence sounds large. Since this magnetic material constituted only about 1% of the concentrate, it is evident that the cyanide consumption due to iron in the concentrate would have been 0.34 lb. Going one step farther, it is seen that the consumption in the ore would have been negligible in a laboratory test.

One thing worthy of note is that, as shown by the calculations, after iron consumed cyanide at the rate of 34 lb. per ton it had only begun, and that in long-period agitation (6-day, for instance) it is important to select crushing machinery that will contribute a minimum amount of metallics.

Will H. Coghill.

Evanston, Illinois, March 1.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

VOLUME of the lithosphere, or stony crust of the earth, including the continents elevated above the sea, is estimated at 1,633,000,000 cubic miles.

VELOCITY of an air current that appears almost stagnant may be estimated, where an anemometer is unavailable for immediate use, by the use of a heavy rag, or a piece of brattice cloth charged with dust. A rap of the hand on the rag or cloth will raise a cloud of dust which the air current will carry away, allowing the observer to form an estimate of the velocity.

WOOL GREASE, from wool cleaning, is sold to refiners, who by means of distillation obtain stearin (the better qualities of which are used for soap and the remainder for leather dressing) and olein, or wool oil, which is blended with other oil and used in the shoddy manufacturing districts. The residuum of wool grease distillation is known as wool pitch and is used, among other things, for insulating electric wires.

TOTAL sulphur in coal may be determined in the following manner. One gram of the substance is intimately mixed in a porcelain crucible with 2 gm. copper oxide and 1 gm. anhydrous sodium carbonate. The crucible is placed in a hole in an asbestos pad and heated with a bunsen burner; if stirred occasionally, the action is complete in about two hours. When cool the crucible is transferred to a large beaker and moistened with bromine water to oxidize any sulphites to sulphates; the residue is then treated with hydrochloric acid and bromine water, heated to effect solution and finally to expel bromine, filtered, and the sulphur estimated in the filtrate in the usual way.

CAUSE for the unstable condition of the graphite industry in this country is found in the facts that the largest domestic deposits are schists which carry small flakes of graphite disseminated through them and that the separation of the graphite from the accompanying minerals, especially mica, in such rocks is a problem of unusual difficulty. The one firm which can be said to have become firmly established in the treatment of such graphitic rocks, the Joseph Dixon Crucible Co., possesses an important advantage over other firms in that it manufactures much of its product into graphite paints, graphite grease, etc., before placing it upon the market. When the margin of profit is small, such control of markets becomes of vital importance.

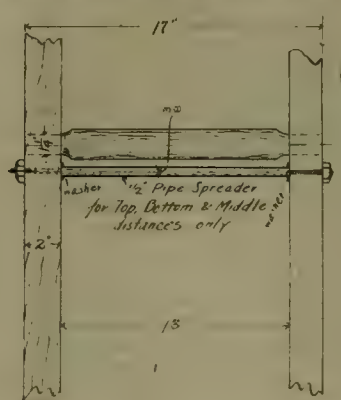
AUTHORITY controlling the use of explosives in the United States lies with the legislatures of the states. Up to the present day the regulations in different states have been far from uniform and in many states have been inadequate. Accurate information in regard to the action of different kinds of explosive materials is necessary for efficient legislation, and such information has been nowhere available. It is to remedy this condition and provide accurate data in regard to explosives, that tests of coal-mining explosives are being made by the Bureau of Mines. These tests serve to show which explosives are safe and which are dangerous for use in coal-mining, and to determine such other properties of explosives as are of importance in the safe and efficient use of these materials.

LOSS of head or pressure in compressed-air transmission has been found to be proportional directly to the density and the length of pipe, as the square of the volume discharged and inversely as the diameter in inches. In other words, the economy of transmission depends, exactly as in the transmission of direct-current electricity, on how much capital is to be tied up in the first cost. For example, in driving the Jeddo adit a 6-in. main was used to convey the air power to two 3¼-in. machine drills over a distance of 10,900 ft., and the loss of pressure was only 0.002 lb., a practically negligible loss. However, it would not be economy usually to design a pipe for such low velocity of air, as the interest and depreciation on the additional investment over the cost of a smaller pipe-line would more than counterbalance the saving in fuel, unless a future demand should make a decided change in the conditions.

WATER legislation, according to the 'California system', recognizes the law of appropriation and riparian rights, working side by side. The states which have adopted this are California, Montana, North Dakota, South Dakota, and Washington. Oregon recognizes riparian rights obtained prior to 1909, but at present only appropriated rights can be initiated. In these states having the 'California system', appropriation may be made subject to prior appropriation and riparian rights. As the United States is the owner of the public land and primarily of the water upon its land, and chooses to allow appropriations of water upon its land, the patentee of public land acquires the riparian rights that go with it (where they are recognized) subject to all prior appropriations, but no future appropriations disadvantageous to his riparian rights can be made over his protest, though the surplus may be appropriated.

TIN SCRAP is utilized by detinning old tin cans at the plant of the London Electrical Works Co., Ltd., which treats 20,000 tons per year. The process consists in unloading the cans upon a shaking conveyor, which frees them from readily detachable dirt. This is also used as a picking belt, only tinned scrap being allowed to enter the works. The cans then go through a series of drums, in which they are crushed, perforated, and heated. In the last, all extraneous matter, including solder, is removed. The cans are then pressed into briquettes ready for the detinning process. So far, in the United States, conditions of distance and wages have operated to render detinning of old cans more or less unprofitable, unless the new dry chlorine process has furnished what has long been hoped for; namely, a process so good as to overcome these inherent disadvantages and lead to a new industry which can still support highly paid labor.

MINE LADDERS should be constructed of good timber, as it is not worth while to risk a fall by a miner by using cheaper material. A convenient and good way to construct a ladder is shown in the illustration. The ends of the ladder rounds are tapered and fitted into round holes.



The ladder is held together by the ⅜-in. rod, which is provided with nuts on both ends, and the ½-in. pipe slipped over the rod serves as a distance-piece. Washers at each end prevent the pipe sinking into the wood. This is a more satisfactory method than splitting the ends of the rounds and wedging them into the sidepieces. Broken rounds can thus easily be replaced without resorting to the usual practice of nailing a piece on.

Special Correspondence

TORONTO, CANADA

TORONTO MEETING OF THE CANADIAN MINING INSTITUTE.

PAPERS AND DISCUSSIONS.

The fourteenth annual convention of the Canadian Mining Institute held at the King Edward hotel, Toronto, March 6 to 8, was the most important meeting since the establishment of the Institute. The attendance, which was nearly 300, was thoroughly representative of the mining interests of Canada, and included many prominent Americans. The papers read were of unusual interest and gave rise to several animated and instructive discussions. The chair was occupied by the president, Frank D. Adams, of McGill University. The convention was opened by an address of welcome by W. H. Hearst, Minister of Lands, Forests, and Mines for Ontario, who spoke of the growth of the mineral industries of the province. These have trebled in value in the course of five years and the silver mines of Ontario now produce one-seventh of the world's total production. Mr. Hearst paid a high tribute to the work of the Institute and pointed out that the field for mineral exploitation had been extended by the recent acquisition by the province of additional territory to the extent of about 100,000,000 acres, concerning the resources of which very little is known.

H. Mortimer Lamb, the secretary of the Institute, read a message from the Duke of Connaught expressing his regret at his inability to be present, and conveying his best wishes.

Frank D. Adams delivered the annual presidential address. He congratulated the members on the continued prosperity of the mining industry. The small decrease shown in the total mineral output of Canada was directly due to the protracted strike of coal miners in the West, which, besides lessening the coal output, had materially affected the copper smelting industry of British Columbia. He reviewed the work of the Institute, which now has 945 members on the list, as compared with 850 last year, and spoke of the service rendered by the geologist to practical mining, giving numerous instances of scientific discoveries which have proved of great value to the industry. The increasing appreciation of the value of geologic work is shown by the fact that so many of the large mining and railroad companies have secured the services of geologists on their staffs.

John McLeish, of the Canadian Department of Mines, presented the preliminary report of the mineral production of Canada for 1911. The figures, which are given subject to revision, show a total metallic output of the value of $46,197,428, and non-metallic $56,094,258, making a total of $102,291,686, as compared with $106,823,623 for 1910. The only item of metallic production showing an increase was pig iron, which was produced to the amount of 917,535 tons, valued at $12,306,860, as compared with 800,797 tons, valued at $11,245,622, in 1910. The coal output was 11,291,553 tons, valued at $26,378,477, as against 12,909,779 tons of the value of $30,909,779 the previous year. Statistics of smelter production showed 2,192,727 tons of ore treated, as compared with 2,683,714 tons in 1910. The miners' strike and the closing down of the Granby smelter are assigned as causes of the shortage.

T. W. Gibson, Deputy Minister of Mines for Ontario, presented a preliminary report of the mineral production of Ontario for 1911 showing a total value of $41,432,898, as compared with $39,313,895, or an increase of 5.38%. E. Jacobs presented a preliminary review and estimate of the mineral production of British Columbia for 1911, compiled by W. Fleet Robertson, Provincial Geologist, showing a total value of $23,211,816, or a decrease of $3,165,250. Theodore Denis, Superintendent of Mines for Quebec, presented the preliminary report of mineral statistics for that province for 1911, giving the total value of the output at $8,567,143, as compared with $7,323,281 for 1910.

At the afternoon session several papers on coal mining were read. Charles H. Clapp discussed the geology of the Nanaimo coal district, which furnishes one-third of the British Columbia output, pointing out that there are frequently great variations in the seams, due to the inequalities of the roof and the floor, which are often slickensided or contorted. These irregularities and disturbances are frequently the cause of industrial disputes on account of the difficulty of fairly adjusting wages where they occur. D. D. Cairnes dealt with coal formations of the Yukon, where lignite is found in the Tertiary formation and coal in qualities ranging from lignite to anthracite occurs in the Jura-Cretaceous. The most important deposits are those of the Tantalus area. The known Tertiary bed covers 2090 square miles, while the Jura-Cretaceous formation is 4000 square miles in area. The estimated amount of coal in known coal areas is 3,325,290,000 tons.

H. Foster Bain contributed a paper on 'Fuel Problems of the Pacific,' which was read by James McIlwain. The coal situation on the Pacific is rapidly changing, by reason of the competition of the cheap coal of Japan, which in some cases is delivered for less than $1 per ton, and the use of fuel oil, which is burned by many steamships. The output of Japanese coal has risen from 500,000 tons in 1877 to 15,000,000 tons in 1910. Hydro-electric power is also largely taking the place of coal for manufacturing purposes. 'International Coal Competition' was the subject of a paper by Allan Greenwell, which was read by the secretary. He pointed out that in working power a ton of coal equals the labor of 672 men for ten hours, and that it would require the labor of half the able population of the world to man the present steam-driven navigation. Canada is the only coal-producing country which consumes more of the imported than the domestic article. E. Jacobs gave statistics showing that 97% of Canada's usable coal deposits are in the Western provinces.

In the course of the discussion which ensued, J. B. Porter replied to Mr. Greenwell's statement as to the undue consumption of imported coal, pointing out that this is due to the demand for anthracite. The condition is only temporary, and the export trade will grow rapidly. Robert V. Norris regards the competition of oil for fuel as a serious matter. On the Pacific coast the only demand for coal is for domestic purposes, which renders useless the slack, amounting to about 40%. The market for coal is limited by its transportation range, and therefore it is natural that Eastern Canada should import American coal and the American West look across the border for a supply. This opinion was endorsed by several other speakers, who favored the free exchange of coal across the border. E. W. Parker said that the use of approximately 52,000,000 bbl. of oil for fuel displaced 15,000,000 tons of coal. Some of the Japanese steamers use oil on their trips west and cheap Japanese coal on the return voyage.

A paper by Victor G. Hills on the tungsten deposits of Nova Scotia dealt with the occurrence of scheelite in gold-bearing rocks. Other speakers said that this mineral had also been found in Porcupine and the Manitou area, and was likely to occur in most gold districts.

In the evening an interesting address on accident prevention was given by W. H. Tolman and illustrated by colored slides showing various safety devices in use by railways and in the steel industry. He complimented the American iron and steel interests in accomplishing as much in the way of prevention of accidents in three years as the Germans have done in twenty-five years. After discussion a resolution was adopted to the effect that the question should be brought to the attention of the Government.

Sanitary conditions in mining camps was the subject of an address by Charles H. Havi, in which he advocated timely action by health officials in the early days of a district, instead of waiting until a town had grown up before anything was done.

E. W. Parker gave a comprehensive address on the coalfields of the United States, expressing the opinion that with the adoption of improved methods production would continue for two centuries.

On the second day most of the morning was occupied by a discussion on the proposed workmen's compensation act, opened by an address by Charles A. O'Connell, of Cobalt.

[illegible] the views of the Cobalt [illegible]. They [illegible] the [illegible] of the [illegible] for [illegible] the [illegible] even though there had been no negligence on the part of the employer or defect in the plant, and [illegible] a system under which [illegible] employer and employed should contribute. The compensation in [illegible] in case of death should be equal to three years' earnings, but not less than [illegible] nor more than [illegible]. After discussion a committee was appointed to draft a resolution to be submitted at a later session.

Robert H. Richards discussed the concentration of silver ores and presented a series of tables showing the results of tests made on the concentration of Cobalt ores. J. W. Evans gave a description of the Evans-Stansfield electric furnace, by which he claims it has been found possible to produce tool steel direct from titaniferous magnetite at a cost of 2.0c. per pound of steel.

F. A. Jordan gave an address on the concentration of iron ores at Moose Mountain, Ontario, explaining the difficulties encountered in treating a refractory ore. These were not overcome until the company adopted magnetic separation and [illegible] a [illegible] plant of [illegible] capacity, which is expected to be in steady operation in May. David H. Browne described recent improvements and additions at the Canadian Copper Co.'s works at Copper Cliff, Ontario, where the [illegible] stands of [illegible] converters have been removed and five basic converters substituted. The erection of two large reverberatory furnaces was begun last year, and the first one was blown in last December.

The feature of the afternoon session was the reading of a paper by T. A. Rickard on 'The Deposits of Nova Scotia,' illustrated by a number of lantern slides explaining clearly the geological characteristics of the gold-bearing rocks. At its close, John Hardman asked if Mr. Rickard had not made a report to the Government of Nova Scotia in 1905, and why that report had not been published. Mr. Rickard stated that he had made a report to the Nova Scotia Government on the gold deposits, the substance of which was that while the deposits are not of such a character as to justify the organization of companies with heavy capitalization to exploit them on an extensive scale, they do justify the Government in encouraging mining enterprises by simpler and less costly methods.

A. E. Barlow read a paper on the origin of the quartz [illegible] of the Porcupine district, followed by one from Reginald E. Hore on the origin of the Porcupine gold deposits. Mr. Barlow expressed the opinion that there is less free gold in depth and the ore becomes more refractory. This drew forth a strong protest from H. T. E. Haultain against the assumptions of geologists. He said that a man brought up as a geologist remained hopelessly benighted, and that he was pleased to see that the conclusions of alleged eminent scientific experts were not always in accordance with each other.

Charles A. O'Connell dealt interestingly with Cobalt, its past, present, and future, and J. B. Tyrrell gave an address on the copper mine country in the extreme north of Canada, giving an account of early discoveries and present conditions. In the evening the members enjoyed a smoking concert.

On the third day J. Parke Channing gave an interesting address on the Miami copper mine and mill. A paper by F. L. Garrison on 'The Decrease of Value of Ore-Shoots with Depth,' drawing adverse conclusions, was replied to by J. F. Kemp, who said sufficient allowance was not made for the importance of secondary enrichment. T. A. Rickard [illegible] Mr. Garrison's conclusions. Carl Reinhardt presented a paper on the origin of the ores of Cobalt, which [illegible]. He [illegible] the origin of the ores to the Keewatin [illegible] underlying the diabase and overlying the Keewatin [illegible]. After a brief discussion, a resolution as regards the proposed workmen's compensation act was [illegible] adopted. The election of president resulted in favor of A. E. Barlow, of Montreal. The other officers were chosen [illegible] to the [illegible]. The convention closed with the annual banquet at the King Edward hotel, at which the principal speakers were G. G. S. Lindsey, W. R. [illegible], A. M. Hay, J. Parke Channing, Frank D. Adams, H. A. [illegible], W. G. Miller, C. A. [illegible], and H. Mortimer-Lamb.

JOHANNESBURG, TRANSVAAL

Results for 1911.—Significant Changes.—Grade versus Working Cost.—Consolidations and Cost Increases.—Need for Reduction.

With the appearance of the analysis of mining results for December, issued by the Chamber of Mines, it is possible to summarize those of 1911 and make comparisons with preceding years. It may not be necessary to go back for purposes of comparison beyond 1909, because prior to that date conditions were somewhat different from those prevailing today in several details, but in comparing present-day results with those of two years ago, some significant changes are noticeable, as the following figures show:

	——— Average ———				
Year	Tons Milled.	Yield. per ton.	Cost. per ton.	Profit. per ton.	Total Profits.
1909	20,5[illegible]770	28s. 10d.	17s. 1d.	11s. 6d.	£11,794,376
1910	21,432,541	28s. 6d.	17s. 7d.	10s. 6d.	12,216,103
1911	24,888,258	27s. 11d.	18s. 0d.	9s. 7d.	11,415,861

The most striking feature, perhaps, of the above statement is the steady decline in the yield per ton milled and the almost equal steady increase in the cost of production per ton, with the natural result that profits per ton are directly affected. It need scarcely be pointed out that after the recent extensive preaching of the doctrine that mines should be worked so as to procure the largest legitimate profit, the above results are anything but satisfactory, as it is known that in several instances this doctrine has been followed. Disappointing, however, as these results are, they are not so bad as promised during the first half of the year, when the yield sunk to 27s. 6d. per ton milled. A recovery to 27s. 11d. for the year shows that the grade of ore milled has taken at last an upward turn. This change for the better in the yield is not altogether due to selective mining, as several mines of decidedly higher grade were started during the second half of the year and could not fail to produce a beneficial effect on the grade, which in August had sunk to as low as 26s. 8d., but in December had recovered to 27s. 10d. per ton. It has always been the case on the Rand that an artificial raising of the grade of ore sent to the mill has been attended with higher working costs, which have to some extent neutralized the benefits, and it is therefore all the more encouraging to find a natural rather than an artificial increase in grade taking place. There are, however, no prospects of a natural increase in grade being sustained on the Rand to any extent, for even during the last three months of the year, when the grade of ore milled steadily increased, exactly one-half of the increase was swallowed up by the increased working costs. In the present condition of affairs the experience of the past three years goes to show that with an honest or natural yield, low working-costs per ton are more conducive to profits than artificial attempts made to improve the yield.

In dealing with the costs, it may be interesting to refer to the statement of results for the year 1909, in which it is shown that with working costs at 17s. 1d. per ton milled (the lowest cost yet reached on the Rand), the profits constituted a record at £11,794,376, and with the present higher costs it will require an increased tonnage milled of five millions to yield the same total profit. It may seem impossible to raise the present-day grade by mining on existing lines, to that of 1909, but there ought to be less difficulty experienced in bringing the costs of working down to, if not lower than, those of three years ago. This was one of the objects aimed at when the extensive amalgamations were brought about, but in almost every instance these amalgamations seem to have added to rather than reduced the costs of working. This increased cost of

working seems to have been brought about at the different amalgamated concerns by different causes, at the East Rand Proprietary Mines, by methcient administration and by placing the individual mines under less quantied control than before; in others, by more expensive administration and extra costs caused and rendered unavoidable by reason of the amalgamation. So far, nowhere does amalgamation seem to have resulted in improved methods of working to such an extent as to bring down the working costs; not because the methods cannot be improved, but because those in control do not seem to have the necessary courage to bring about the necessary innovations. There is more than one instance where the costs of working were expected to be in the neighborhood of 12s. per ton, but continue about 19s. per ton, with but little prospect of being reduced for several months to come. Results for 1909 may be taken to show that working costs can be reduced, and there must be something wrong where an increased output of more than 3,000,000 tons results in adding a shilling per ton to the cost of working. It is a well known axiom in mining that a big or growing output should cover a multitude of sins, particularly with regard to working costs per ton, and why it should not be the same on the Rand is difficult to explain.

LONDON

REPORT OF THE EXPLORATION COMPANY. — ENCOURAGING OUTLOOK.—THE BUENA TIERRA MINE.—PLANS FOR DEVELOPMENT.—RECORD OF THE MT. MORGAN.

The Exploration Company, of which R. T. Bayliss is the leading spirit, had not much of startling novelty to report as regards its doings during the past year. The only item of conspicuous interest is the flotation, as a separate company, of the Buena Tierra silver-lead mine. But before referring to this venture, I will give an outline of the position of the Exploration Company. The profits for 1911 were £34,871, and a dividend of £37,500, or 5%, was distributed. This is the same rate as last year. Mr. Bayliss, in his speech to the shareholders, stated that little change had been made in the company's holdings, and that the El Oro and Tomboy continued to be the principal producers under their control. He reported that the new subsidiary, the Santa Rosa, in Zacatecas, was now equipped with a modern 100-ton plant, and that development work at the Buena Tierra, in Chihuahua, had proceeded so satisfactorily that the time had arrived when it was advisable to float a separate company to continue operations. The Exploration Company still holds large blocks of shares in American copper companies, acquired before the last collapse of the copper market, and Mr. Bayliss expressed his confidence that within a short time these securities would advance in value owing to the present position as regards production and consumption of the metal. He also reported that the company's real estate in Johannesburg, which has for so long been unmarketable, is at present forming the subject of hopeful negotiations. Another point of interest is that a new company, the China Clay Exploration Syndicate, has been formed for the purpose of acquiring china-clay pits in Cornwall, and of applying the new refining process purchased two years ago. On the board of the syndicate, besides Mr. Bayliss and Mr. Shaw, are James Wickett and J. W. H. Bolitho, two well known Cornishmen.

As recorded in the preceding paragraph, the Exploration Company has floated a subsidiary, the Buena Tierra Mining Co., for the purpose of acquiring the mine of that name in the Santa Eulalia district, Chihuahua, Mexico. The mine has for some time been a producer, under local ownership, of argentiferous lead carbonate, occurring in limestone, and is on the same group of lodes as the Potosi, Santo Domingo, Velardeña, and Mina Vieja, mines which have been profitable producers. The ore also contains a large proportion of iron. During the 18 months that the mine has been worked by the Exploration Company, 47,624 tons of ore was shipped to the A. S. & R. smelter at Chihuahua, and the price received was $7.71 per ton. The cost per ton of ore delivered at the smelter was $3.89, leaving a working profit of $3.82. The results would have been more favorable if it had not been for irregularity in the operations of the smelter. The average content of recent shipments was 11 oz. silver and 16% lead. It is expected that the sulphide zone will be reached at 150 or 200 ft. below the seventh or present bottom level. Complete statements of the position are given by R. T. Bayliss, R. M. Raymond, and A. C. Brinker. They estimate the reserve at 250,000 tons, averaging $7.50 per ton, giving a profit of $4.50 per ton, and the monthly output will be about 4000 tons. The yearly profit is therefore figured at £43,000 for 5 years, the life of the present reserve. The capital of the company is £330,000. Of this, £300,000 in cash or shares is the purchase price paid to the Exploration Company, which had devoted £167,927 to the purchase, development, and equipment of the mine. In the present issue, it is intended to devote £30,000 cash as working capital.

The interim report of the Mount Morgan Gold Mining Co., Rockhampton, Queensland, is causing some perturbation in this country, and the facts disclosed come as somewhat of a surprise. During the half-year ended November 30, 82,476 tons of auriferous copper ore was smelted, together with 43,131 tons of fluxing ore from the Many Peaks mine; the former yielded 2269 tons copper and 36,136 oz. gold, and the latter 1009 tons copper and 335 oz. gold. In addition, 53,570 tons of silicious sulphide ore was treated by the chlorination process and yielded 26,726 oz. gold and 420 tons copper. The content of Mt. Morgan ore smelted during the half-year has shown a considerable decrease as compared with the figures for the year ended May 31, 1911, the yield of copper being 2¾% as compared with 3%, and that of gold 8¾ dwt. as compared with 10⅓ dwt. On the other hand, the ore treated in the chlorination plant averaged nearly 10 dwt. gold as compared with 9⅓ dwt. The explanation of the decrease in the quality of the smelting ore is that stoping is now done in such a way as to prevent falls of rock and other accidents. Important modifications are being made in the smelting operations; for it has been found that by the recent introduction of sulphide fluxing ore from the Many Peaks mine in place of the barren oxide iron ores from Iron Island, it is possible to adopt pyritic smelting. A. L. Dean, of the Mount Lyell smelter, has made an examination and recommends certain necessary alterations. The old practice of producing first a low-grade matte and subsequently re-smelting so as to produce a grade suitable for the converter is being abandoned in favor of a single process. During the half-year the revenue from the sale of gold and copper was £452,336,

TOMBOY MINE, COLORADO.

and the expenditure £381,730, leaving a balance of £70,606. A dividend of £50,000, at the rate of 1s. per £1 share, was paid in October last, and in order not to make a break in the distribution of dividends, £50,000 has been withdrawn from reserve and paid as a further dividend, bringing the total dividend for the half-year to £100,000, or 10% on the £1,000,000 capital. This course has been taken, as it is confidently believed that the decrease in yield and profit is only temporary.

NEW YORK

LATEST NEVADA-UTAH PLAN FOR REORGANIZATION.—LEWISOHNS AND LAKE COPPER.—GUGGENHEIM EXPLORATION REPORT.—GENERAL MARKET NEWS.

Nevada-Utah shareholders count the day as wasted which does not see the statement of some new plan for the reorganization of the company. The Stockholders' Protective Committee has formulated a scheme to issue $1,500,000 shares of stock, par $4, and $1,000,000 in bonds, making a total capitalization of $7,000,000; the new company to acquire the property of the old corporation and provide working capital; stockholders to pay an assessment of either 20 or 40c., as they may choose; those who pay 20c. to receive new stock, share for share against present holdings; shareholders paying 40c. to receive bonds in full for the amount paid in, and share for share of new stock as a bonus. On this basis there should be produced $600,000 in cash, and $400,000 in bonds left in the treasury. The debts of the old company aggregate $200,000. The reorganization expenses are estimated at about $50,000, on which it is calculated the new company will be enabled to start in business with a working capital of $350,000. A New York Stock Exchange house has succeeded to the management of the Shareholders' Syndicate, which is opposing the plan above outlined. The Syndicate is now submitting a modified plan to the stockholders, calling for an assessment of 50c. per share; a bond issue of $900,000, of which $750,000 is to be sold at once, and a new stock issue of 2,000,000 shares, par value $3. The Syndicate in conclusion works out its status of the new company to be called the Consolidated Nevada-Utah, which will be formed showing $750,000 of bonds outstanding; bonds in the treasury to the amount of $150,000; stock outstanding, 1,650,000 shares; stock retained for bond conversion, 300,000 shares; cash in the treasury (estimated), $390,000; from all of which it may be noted that the shareholder is expected to pay the bill, in reality the principal item. Judgments are piling up against the old company, and the shareholders must use a great deal of cold-blooded analysis in order to determine whether they are not repurchasing their equity in the properties at considerably more than their real worth.

There was a good deal of comment recently when the formation of the board of the Inspiration Consolidated showed a strong representation from the Lake copper country. Now it appears that the tide of invasion may be turned in the other direction. Announcement has been made that the Naumkeag Copper Co. will be formed by the General Development Co. under the laws of Michigan, to develop a tract of land comprising 1200 acres on the south side of Portage lake just west of Houghton. The property embraces 1200 acres and includes the Dakota, 200 acres; the South Side, 200 acres; the St. Marys Mineral Land Co., 160 acres; the Naumkeag, 400 acres; the Pacific, 140 acres; and the Sheldon Douglas, 160 acres. The whole territory is practically virgin ground. The management will be under the direction of J. Parke Channing, and the first work will be a thorough exploration by diamond-drills, which, if satisfactory, will be followed by immediate sinking of shafts and further opening of the ground. The entry of the Lewisohns into the Lake Copper Co. is a rather important move, and is undoubtedly due to the work which Mr. Channing did last year, in connection with the attempted Calumet-Hecla consolidation. Another new Lake Superior copper flotation will probably be brought out within a short time, covering some 2000 acres of land about six miles south of the Mayflower, the preliminary exploratory work to be carried on with the idea of picking up the southerly extension of the Mayflower lode.

The regular chain of Guggenheim dividends has been declared. The report of the Guggenheim Exploration Co. is interesting, as showing the holdings of this concern in the various subsidiaries, and the appraisal value attached thereto, as per the following:

Assets: Treasury stock, $1,206,700; American Smelters Securities Co., 'A' 154,000 shares, $13,860,000; American Smelters Securities Co. 6% bonds at par, $1,500,000; Esperanza, Ltd., 3016 shares, $15,094; Utah Copper Co., 404,504 shares, $9,161,767; Yukon Gold Co., 2,769,639 shares, $9,883,088; Alaska-Yukon Properties & Equipment, $1,170,230; miscellaneous investments, $831,179; furniture, fixtures, and equipment, $2704; bills and accounts collectable, $121,483; cash and demand loans, $7,721,033; total assets, $45,474,178.

Liabilities: Capital stock, $22,000,000; surplus, $23,474,178; total, $45,474,178.

An independent estimate of the value of Guggenheim Exploration stock, according to current quotation, is as follows:

American Smelters Securities Co. preferred 'A', 154,000 shares	$13,860,000
American Smelters Securities bonds ($1,500,000 at 103⅝)	1,554,375
Esperanza, Ltd., 3016 shares at £1 16s. 3d.	26,513
Utah Copper Co., 404,504 shares at 57¾	23,360,106
Yukon Gold Co., 2,769,639 shares at 3⅜	9,347,532
Alaska-Yukon Properties & Equipment	1,170,230
Miscellaneous investments	831,179
Cash and quick assets	7,846,120
207,033 shares at $278.91	57,096,055

This book value of $287.91 does not include the good will of the Guggenheim Exploration Co., which of very great value in mining enterprises. It will be noted that 404,504 shares of Utah Copper are carried on the books of the Guggenheim Exploration Co. at an average price of $22 per share. The present market in Utah Copper is between $58 and $59, so that the profit on this item alone is a tremendous one. The ownership of this stock carries with it the Guggenheim holdings in Nevada Consolidated, which is held directly by the Utah Copper Co. In this way there is a further stock-holding that does not appear upon the Exploration company's books in any way, but which in case of liquidation would of course be subject to separate appraisal.

The Ray Consolidated stockholders have authorized the increase in the capital stock from 1,400,000 shares to 1,600,000 shares, and the Ray Central shareholders are now given the option to exchange their Ray Central stock for Ray Consolidated stock on the basis of eight shares for one. N. Bruce McKelvey, Felix Rosen of Hayden, Stone & Co., Keith Stewart, C. W. Peters, and P. A. Clark have been elected directors of the Ray Central company, the old board resigning. Chino is to be the object of some new financing; 50,000 shares of new stock will be underwritten by Hayden, Stone & Co. and offered to the shareholders at $25 per share. Additional capital will be needed as a working fund in the first stages of production, and it is best to provide the funds in this way rather than postpone dividend payments until these requirements could be made up out of earnings. Both Ray Consolidated and Chino are now regularly listed on the Paris coulisse.

The Phelps-Dodge interests have never figured very largely in the present movement toward acquiring additional properties, and, like the mining properties controlled by W. A. Clark of Montana, have always been regarded as independents; that is, free from any numerous affiliations. The trend of affairs, however, is apparently to have its influence upon the Copper Queen owners. It is stated upon pretty good authority that negotiations are on foot for the acquirement of the Shattuck-Arizona. The James J. Hill people are said to be heavily interested in

the Phelps-Dodge company, and it is thought that Louis Hill has been picking up some Shattuck Arizona, probably for the Phelps-Dodge interests. The rumor is borne out in part by the fact that, although plans were completed for a smelter for the Shattuck Arizona some time ago, nothing has as yet been done, and the property is practically idle. The Shattuck-Arizona has developed some very rich orebodies, but in size is hardly sufficient to warrant the erection of a smelter such as would be necessary for profitable operations on Shattuck ores alone. The Phelps-Dodge output for February was hardly in line with general expectations. The increase in output has been anticipated all along the line, but the Copper Queen people produced 10,742,950 lb. of copper, this being quite a little less than was produced the previous month, or in February one year ago.

For some months shareholders in the La Rose Consolidated have been endeavoring, under the leadership of E. P. Earle, to secure some distribution of the cash surplus which the company has accumulated. Some two years ago or more the directors cut the La Rose dividend from 16% to 8%, since which time the company has accumulated more than $1,000,000. D. Lorne McGibbon, president of the company, has insisted upon keeping the treasury fund intact, and Mr. Earle, having concluded that his efforts in behalf of the shareholders were futile in this regard, resigned from the board of directors.

ST. PETERSBURG, RUSSIA

CONTROL OF THE MARKET BY EUROPEAN SYNDICATE.—RELATION BETWEEN PRODUCTION AND PRICE.—CAUSES OF FLUCTUATIONS.—DOMESTIC REFINERY.

Russia, rejoicing in her platinum monopoly, is very much exercised on the question of making this monopoly something more than natural. It has been a source of great vexation to nearly all leading Russian industrialists that the metal should simply be mined in the Urals and sent away half washed to western Europe to become the plaything of syndicates there that have had practically nothing whatever to do with getting it out of the ground.

The methods by which these syndicates have obtained control of the platinum situation is now sufficiently notorious and need not be further referred to. It is known that, whether these methods were wise or unwise, they were, at all events, effectual, and the platinum industry of Russia is really a foreign concern except in respect to getting the metal in semi-crude form from the sand, which is a simple operation for the most unsophisticated workman. It seems strange that a metal that could be so completely under the control of the Government, or even of a local combination of producers, should be the subject of such violent fluctuations in price. We find, for example, that in the year 1900 the price of platinum per pood (one pood equals 527 oz.) was 14,193 rubles for 83% metal, or 17,100 rubles for 100% metal. The corresponding price in Germany was 19,337r. per pood. This price remained practically stationary until 1904, when the 83% metal, which is the standard by which it is sold on the leading Russian precious-metal exchange (namely, Ekaterinburg), made 15,429r. per pood, rising to 17,435r. per pood in 1905, then careering through 1906 on to 34,000r. per pood in the month of October and declining to 29,560r. per pood in the month of December—the year averaging 23,000r. per pood. Then in 1907, after dropping to 21,120r. per pood in May, rising to 24,576r. in June, and reaching the nadir for the year of 17,764r. per pood, it averaged practically 20,000r. July 1908 showed a further decline to 14,208r. per pood, with a slight rise toward the end of the year, but finishing with an average of 16,500r. per pood; 1909 found the average 19,814r., 1910 showed platinum to have reached an average of 27,455r., and in the year 1911 the record price of platinum was registered, namely, 10 rubles 10-25 kopeks per zolotnik, or about 39,200r. per pood.

Now, as the production at the mines did not vary in anything like these proportions throughout the whole period under review, and again in the first four years 1900-3 the production did vary very considerably while the price remained practically stationary, and while again in 1906, when the production showed a marked increase, the prices instead of falling rose considerably, followed by a serious decline in price in 1907 with an even more serious decline in production, while 1908 again shows an even greater decline still with a decline from 328 poods of 83% metal in 1907 to 298 poods in 1908, it will be seen that the rate of production bears no relation whatever to the rise or fall of the market, but that, on the contrary, the market rose as production fell, or it may be argued *vice versa*. All the same, when platinum was scarce as far as production was concerned, the market was falling, and when platinum grew plentiful the market rose. This might appear to be a natural sequence if the production had followed the market, but as these two phenomena were coincident we must look elsewhere for the reason. The cause was undoubtedly in the maneuvers of the western European platinum controllers, who simply ran the market up and down at their own sweet will as they found it convenient in order to boss the situation in the Urals.

It is quite likely that the following is the correct explanation of the present high level of platinum prices, though the situation is sufficiently complicated to make it very difficult to assign to any one of the causes of preponderating influence. First are the operations of the western European syndicate referred to above. Second, there is, it is to be feared, indubitable evidence that the platinum sands are becoming exhausted and other discoveries must be made if the world's demand is to be satisfied. The third is the growing demand, as shown not only in the natural increase in the consumption of platinum goods, but also in the increased demand in the jewelry trades, probably called into existence by the very reason of the appreciation in the price of the metal; and the fourth reason is the almost certain enactment of a Government law on platinum and the complete control of the industry in Russian interests.

I am disposed, at all events for the moment, to give the palm to the operations of the syndicate, whose policy it is to make the Russian platinum producer as comfortable as possible, that he may resent the paternal interference of the Russian Government. All other reasons given, which may or may not be permanent, although the obvious exhaustion of the sands must be called a permanent one, would not operate so directly, at all events so immediately, on the price of the metal as to raise it to its present dizzy height. But the next important factor is, without doubt, the growing conviction that the sands are rapidly being exhausted and the increasing doubt as to whether other useful deposits are going to be found. This appears to be the position of the platinum industry at the present day. Whether it will ever suit the convenience of the foreign syndicate to run the price down again will depend upon the firmness with which the Government proceeds with its new policy of holding the platinum industry both as a producing industry and a manufacturing or refining industry in the country itself.

The reasons for binding the refining industry to Russia are sentimental rather than material, for the small plant that is required to refine the small quantity of platinum produced, although it happens to be practically all that is produced in the world, will add but a few thousand rubles to the earnings of Russian workmen, and it may be that to the country generally this money will be lost in lack of efficiency in refining. But against this must be set the retention of the precious associated metals, such as iridium and osmium, in the country; but which are obtained by the western European refiners at no expense to themselves whatever, or nearly so. The probability is that the Government will proceed on its present lines and that with the demand always remaining a good one (the frequently announced successful alloys having all proved failures) the value of platinum will retain a good high level, if not its present one; and it may be prophesied that under the encouragement of the Government, with the necessary advances to producers from the Imperial Bank, the violent fluctuations in the platinum market quoted in the article will have become a thing of the past.

General Mining News

ALASKA

Kuskokwim

(Special Correspondence.)—Work was continued this past summer at Golden Gate Falls. H. W. Reeth built a new station about 55 miles northwest of the falls to be used as a supply station and stopping place while traveling. It is about at the head of navigation on this river. He spent considerable time on the northwest slope of the second mountain range and reports a great variety of rock, probably of Post-Jurassic age. He found a sheared zone following a diabase intrusion in contact with slate, and traced it over 18,000 ft. It is from 50 to 500 ft. wide, and in one place a body of mineralized rock is exposed for 100 ft. vertically. Two samples assayed $2.40 to $9.98 in gold with a trace of silver. Two miles below Golden Gate Falls he dug a ditch 1000 ft. long and late in the season ran through 5 cu. yd. of gravel, using two sluice-boxes, one 12 ft. and the other 10 ft. long and over 12-in. grade. No quicksilver was used, but 60 grains of fine gold was cleaned up. Half a dozen parties were mining this summer near the Tuluksak, but made slow progress on account of the water. One miner came down the latter part of August with $900 worth of gold dust. A number of prospectors worked on the different tributaries of the lower Kuskokwim, and five miles below Quinhagak three drills were testing dredging ground. The men in charge report encouraging prospects. Gold is also said to occur on the beach between Cape Newenham and Cape Peirce. In what quantity is not stated. One great drawback to prospecting in this area is the high retail price for dynamite; No. 2 sells in Nome at 17c. per pound, and the Kuskokwim Commercial Co. at Bethel charges 50c. The prospector can never think of looking for any quartz vein with the price of powder what it now is. As a rule, he is a man with limited means and has to look for a placer ground and pass by the quartz leads.

Bethel, November 1.

ARIZONA

Gila County

(Special Correspondence.)—Besides the work of actual mining and underground development that is being carried on in the Miami district, another sign of the interest that is being taken by outside capital is the exploration by churn-drilling. Four companies are conducting this kind of exploratory work, with six churn-drills, all of 'Star' manufacture, in continuous operation. The Miami Copper Co. is working one drill northeast of the orebody in the vicinity of No. 3 shaft, on ground whose surface indications are considered very favorable for the development of another body of ore. The New Keystone Copper Co. is operating one drill northeast of the shaft. The Southwestern Miami Development Co., whose property lies to the southwest of, and adjoins, that of the Live Oak Development Co., is running two drills and intends to add another as soon as possible. The Lewisohns, who have an option on the Barney group, west of, and adjoining, the Live Oak, are operating two drills. In addition to these, others may be added in the near future. The Miami mine continues to produce at the rate of 3000 tons per day, all of which is readily handled by the concentrator, which is now in full operation. In the sixth unit of the concentrator, F. W. Solomon, the mill superintendent, is experimenting with the view of introducing graded crushing to a greater extent than is now practised and also the roughing system. An additional water-supply is being developed by air-lift wells on the company's ranch near the pumping station at Burch, about four miles from the mine. The work of enlarging shaft No. 2 at the Live Oak mine from 2 to 3 compartments, is proceeding rapidly and is expected to be finished this month. The surface equipment is being erected at the same time. The Southwestern Miami Development Co. hole No. 2 is 875 ft. deep. Ore is expected within a comparatively short distance. Hole No. 3 is 125 ft. deep. Hole No. 1 on the Barney group, under option to the Lewisohns, is 1175 ft. deep. Hole No. 2, near the Live Oak boundary, is 130 ft. deep. It was near this hole that a hole drilled by the Barney Copper Co. is reported to have cut ore at a depth of 500 ft., penetrating it for a distance of 20 ft. before it became necessary to abandon the hole on account of caving. At the Superior & Boston, development work continues on the 12th level. W. G. Rice, president of the company, is now at the mine. W. H. Aldridge, L. D. Ricketts, and W. D. Thornton, vice-president of the Inspiration Con. Copper Co., are visiting the mines and are in conference regarding the construction of the mill and other important matters.

Globe, March 14.

Pima County

Operation is to be resumed in the near future at the Gould mine, 11 miles west of Tucson, according to a recent report. The mine is owned largely by the Pioneer Smelting Co. The Pioneer company's new smelter is almost completed. About 50 tons of ore per day is being stored at the plant. The Southern Pacific railroad recently published rates to the smelter from nearby points. From Patagonia, the rate on ore less than $15 per ton in value is $1.50 per ton. From Vail, Calabasas, and nearer points the rate is $1 per ton.

Yavapai County

Press rumors from Prescott state that the Tiger Gold company, operating the Grey Eagle and Oro Belle claims, is planning extensive additions to its plant. The Ruth mine, near Prescott, owned by J. I. Gardner and James Slack, has a carload of ore ready for shipment to Pueblo, Colorado. It is reported that a stamp-mill will be erected on the Juanita company's property, in the Crook canyon district. C. E. Warren is superintendent for the company. A large quantity of telluride ore has been blocked. Reports from Prescott state that the vein assays $24 per ton.

CALIFORNIA

Nevada County

Recent reports state that the shaft of the Golden Gate mine, now down about 900 ft., is being sunk at a rate of 150 ft. per month. The 10-stamp mill of the property is in steady operation. W. P. Martin, superintendent of the property, states a Grass Valley rumor, is about to order more machinery for the mine.

Placer County

The Beaver Gold Dredging Co.'s dredge at Loomis, which sunk recently when a leak was sprung at the stern, has resumed operation. The dredge settled to the bottom of the 14-ft. pond at 5 p.m. Wednesday, February 21, and was in operation at 7 a.m. the following Saturday. S. B. Dunton, superintendent for the company, had charge of the floating of the dredge.

San Francisco County

The San Francisco chapter of the American Metallurgical Society on March 13 discussed the resolutions adopted in February against J. E. Raker's bill for Government free assaying and testing laboratories. The trustees of the State Mining Bureau have asserted that by such establishments promoters would be able to display Government assay certificates as for samples from their mines, and that an office for qualitative analysis is maintained in San Francisco, obviating the necessity for a Government station at Auburn.

Shasta County

(Special Correspondence.)—Adit No. 5 at the Mammoth mines is in 2455 ft. It is 9 by 10 ft. and will be used as the main working-level. A 700-ft. drift connects the new adit with the old workings. The company is installing electrical automatic bag-shakers at the bag-house, replacing the levers formerly used for this purpose. The ninth section of cooling pipes is nearing completion. This gives a total of 45 cooling pipes, employed in reducing fume temperature before the smoke passes into the bag-house. The Afterthought Copper Co. is reported to be consider-

ing the erection of a zinc extraction plant at Ingot. The company has developed a good body of ore in its mines, but the presence of large percentages of zincblende has made the smelting of ore difficult. J. H. Bull is superintendent. It is said the long projected railroad from Ingot to Bella Vista, a distance of 12 miles, will be completed this year. The Noble Electric Steel Co. is placing its furnace in condition to resume production of pig iron. E. P. Conner confirms the sale of his Grand Central claims to the Victor Mining & Power Co. The property is situated near Harrison Gulch.

Redding, March 11.

Siskiyou County

(Special Correspondence.)—The North American M. & D. Co. is arranging to erect concentrating equipment and a cyanide plant at the Mono mine, near Yreka. A large reserve of ore has been opened between the fifth and sixth levels, and deeper development is planned. About 25 men are employed, and the company has expended about $35,000 in development and equipment since last July, when the mine was acquired. The Mono has a productive record of $300,000. The main offices have been removed to Yreka. S. J. Silva is general manager, and Ernest Harrison secretary. Shepard & Co. are opening a group of claims containing gold and copper ore. In the Humbug district much quartz mining is under way at the Flag, Conservation, and other small properties. Redding people have taken over the Cape mine, Yreka district, for a reported price of $40,000. The group embraces six claims, of which three are patented. Harry Doggets reports the discovery of an 18-in. vein of $30 ore on Barkhouse creek, about 12 miles from Yreka.

Yreka, March 9.

Trinity County

A report from Trinity Center says that Angelo Belli, after taking $25,000 in one week from his claim last fall, sold the claim to San Francisco investors for $25,000 six weeks ago, as he thought he had exhausted the property. The purchasers have taken $17,000 from the mine, and expect to obtain much more valuable ore.

Tuolumne County

(Special Correspondence.)—It is reported that the management of the Harvard mine is considering the erection of a cyanide plant.

The old Mammoth works, near Jacksonville, are coming once more into prominence. Connections for electric power have been made, and the mill, which is being repaired, is about to start. Fifty stamps are now dropping at the Shawmut. At the If I Can mine, on the Stanislaus river, 20 men are at work. Grading for two big water tanks is in progress. The mill will handle 200 tons of ore per day. The new adit, which is about 400 ft. long, will be sent in about 1500 ft. to cut the main channel. At the Nonpareil, near Big Oak Flat, a mill test is being made of 300 tons of ore. Results will determine the future line of action of P. G. Gow, who holds the property under bond. An inspection of the Rising Sun mine, near Arastraville, was made this week by San Jose capitalists, who intend starting work shortly. New orebodies of unusual size and good grade have been discovered at the App mine. It is definitely announced that the famous property is about to change hands. A week's clean-up at the Gem mine, owned by J. F. Wulzen, near Confidence, has amounted to over $2000. One hundred and sixty acres of the old Pereira orchard, at Jamestown, which is interlaced with a network of gold-bearing veins, is to be developed by Pennsylvania capitalists.

Tuolumne, March 11.

COLORADO

Clear Creek County

(Special Correspondence.—Work has been resumed on the Shigley property on Griffith mountain. A streak of ore 6 in. wide is showing that is worth $24 per ton in gold and silver. A carload shipment of ore will be made from the Pulaski mine on Leavenworth mountain next week. The ore will be sent to Denver for testing purposes to determine the best method of treatment. When the report is made, work will start on a 50-ton mill. B. F. Kelly is manager. The Pixley and Aunt Jack mines on Saxon mountain have been taken over by McDonald & Poindexter of Seattle, Washington. Work will soon be resumed by the Gold Fissure M. Co. The property is situated on Silver mountain. Willis Bristol is manager.

Georgetown, March 9.

Gilpin County

The Black Jack mine recently shipped from its 100-ft. level four loads of ore from which $22 per ton was received. A raise is being driven to connect with the 140 and 100-ft. levels, and development will be pushed on the former level. E. Perley is superintendent of the mine. The shaft of the Coaley mine, of which Mr. Perley is superintendent, has been retimbered to the 200-ft. level, and some high-grade silver ore has been found. The latter mine was recently opened after having been idle for a number of years. From the Topeka mine about 80 tons of ore per day is being shipped to the Iron City mill for treatment. Development will be resumed soon at the Illinois and Edinburg mines on Quartz hill by Young & McGruder of Denver. The property of the Fifty Gold Mines Corporation will be sold at public sale April 17.

Ouray County

The Camp Bird, Ltd., has paid its regular quarterly dividend of 2s. per share on the 1,100,051 shares of stock outstanding, making a disbursement of $550,026. This brings the total disbursement in dividends by the London company, since 1901, to $8,470,152. A number of snowslides aroused some excitement in the district recently, and some railroad laborers were killed, but little damage was done to property. The boiler and boiler-house of the Atlas mine were moved about seven feet, putting them temporarily out of commission. The Camp Bird mill was not damaged.

San Juan County

The zinc plant of the American Zinc Ore Separating Co.'s Sunnyside mill at Silverton has been put in operation. Louis Schafer is in charge of the new plant.

INDIANA

Lake County

The International S. & R. Co. is about ready to let the contract for the construction of buildings for its proposed lead refinery at East Chicago, 24 miles from Chicago, according to an announcement by E. P. Mathewson. The company has bought a tract of land along the canal connecting Lake Michigan and the Calumet river. The site has good railroad facilities. The proposed plant is to have a capacity of 3000 tons per month and is to be completed in six months.

NEVADA

Esmeralda County

The Goldfield Merger Mines Co.'s shaft on the St. Ives claim is down 750 ft., and is being sunk at the rate of 140 ft. per month, states a recent Goldfield report. It is probable that the rate will be increased to 150 ft. per month. The shaft has penetrated two bodies of quartz, which, while not of profitable grade, will be prospected later by lateral development.

The Goldfield Con. Mines Co. has declared its regular quarterly dividend of 30c. per share, and the customary extra quarterly dividend of 20c. per share, payable April 30 to stockholders of record March 30.

Nye County

In the week ended March 9 a total of 9072 tons of ore was produced in the Tonopah district. The production of the various companies was as follows: Tonopah Mining, 3550 tons; Belmont, 2250; Montana Tonopah, 962; Tonopah Extension, 1015; West End, 775; and the MacNamara, 520 tons of ore. The estimated value of the whole production was $226,800.

The profit of the Tonopah Belmont company for Feb-

ruary is reported at $165,632. The company produced 9813 tons of ore, of which it milled 7642 tons and sent the rest to the smelter. The gold produced amounted to 3891 oz., and the silver to 374,973 ounces.

The Montana Tonopah has intersected a 2½-ft. vein of valuable ore on the 615-ft. level. Development is to be resumed at the Wandering Boy shaft of the Jim Butler property. An electric hoist will be installed.

STOREY COUNTY

In the Con. Virginia mine during the week ended March 9 the 3-compartment raise from the 2400-ft. level was carried 9 ft. and timbered. From this work 34 cars of ore valued at $1112 was saved. The Ophir company produced during the week 247 tons of ore, valued at $7618, and also shipped 329 tons of ore to the Kinkead mill. The Mexican mill, running 88% of the time, treated 482 tons of ore, of which the gross assay value was $12,021. The Union Con. extended the west cross-cut from the winze used jointly with the Sierra Nevada, for 52 ft. Timbering was not needed. The Mexican cleaned out the north drift from the winze, and is clearing a heavy cave, south of the line between the Mexican and Union mines. The Crown Point produced 660 cars of ore, valued at $4637. The pumping report showed the level to be below the 2500-ft. level of the C. & C. shaft. The Yellow Jacket mill resumed crushing Jacket dump ore. The usual repairs were made in the mine.

NEW MEXICO

SOCORRO COUNTY

The new Socorro power-plant is operating both mine and mill. The full mine-crew is again at work. A crack in the crank-shaft of the oil engine at the Deadwood Mines was discovered last week, and the mill is temporarily closed pending replacement of the defective part. Development will continue in the mine, hoisting being done by gasoline engine. The Ernestine M. Co.'s ore treatment last week was 640 tons. Bullion for the second 10-day period of February amounted to 7675 oz., with a concentrate product of 11,000 lb. The second 10-stamp Allis-Chalmers battery was started on February 26. The Deep Down lessees have installed a temporary gasoline pump in the adit and unwatered the winze, where good ore has been discovered. The Deadwood mill will handle the product. The Oaks Co.'s winze in the Pacific adit has intersected high-grade ore in limited quantity. There are indications of a rich ore-shoot below this point. Work is going on in the South shaft and also the drift from the North shaft.

Mogollon, March 1.

TEXAS

LLANO COUNTY

N. J. Badu, of Llano, and associates, who are extensively interested in iron ore deposits in the Llano district, are preparing to erect a hydro-electric plant for smelting purposes. Mr. Badu claims that the electric process he plans to use is not only feasible, but that its practicability has been proved in Sweden. It is planned by Mr. Badu and associates to erect a large dam across the Colorado river at a point about 12 miles from Llano to form a storage reservoir which will give a water-supply for generating the electric power. The iron furnaces will be situated near the plant.

The Llano Gold & Rare Metal M. Co., which placed its 50-ton reduction mill in operation at its Heath mine, northeast of Llano, a few weeks ago, is preparing to double the capacity of the plant. This mine is a gold producer and the mill is said to be the only one of its kind in Texas. It has been running day and night since the completion of the pipe-line by which it was provided with the necessary water supply, and has a capacity of 50 tons of ore per day. The company owns 200 acres adjacent to the mine. Recently representatives of a Chicago syndicate visited asbestos properties near Llano and after an investigation made a favorable report on them. The Chicago syndicate has obtained control of the deposits and will soon begin mining operations, it is announced.

UTAH

JUAB COUNTY

The Iron King Con. M. Co. has stopped operation, owing partly to failure to secure advantageous ore contracts, it is reported. C. E. Loose, general manager, stated that the management has not abandoned hope for precious metals under the iron orebodies developed by the company. When the sale of iron proves sufficient to meet the expense, exploratory work will be started. During 1911 the adit was extended 840 ft. Assessment No. 6 will meet all obligations and leave a balance.

The Grand Central shaft has reached a point 25 ft. below the 2300-ft. level and the work of cutting a station on that level is under way. With that completed driving will be started. Good ore was found at the 2200-ft. level and in a 40-ft. winze sunk from that level. The shaft last month was sunk at a rate of 108 ft. in 30 days. New shaft timbers are being placed in the Black Jack mine, preparatory to resuming development in the Star Consolidated part of the property.

TOOELE COUNTY

The second furnace of the lead smelter at the International S. & R. plant at Tooele is to be started in the near future. As soon as the business warrants it, more blast-furnaces will be erected, says a recent announcement. The company is reported to have a stock-pile of 60,000 tons, and contracts to come in force May 1 will provide ore in excess of the plant's capacity, 500 tons.

UTAH COUNTY

The directors of the company operating the Dream mine, near Salem, recently decided to install machinery to rush development. Twenty men are employed, being paid in stock. Lars Olesen is superintendent of the property.

To facilitate development at the Dream mine, near Spanish Fork, machinery will be ordered, and an adit driven to tap the bottom of the workings. Lars Oleson is superintendent for the company.

CANADA

BRITISH COLUMBIA

For the first time in many months the Granby smelter is running at full capacity. In January the company produced 1,607,558 lb. copper, 29,693 oz. silver, and 4440 oz. gold, against a production in January last year of 1,758,518 lb. copper, 33,730 oz. silver, and 4426 oz. gold.

ONTARIO

The directors of the McKinley-Darragh-Savage mines are considering the construction of a wire-rope tramway to deliver ore from the Savage mine to the McKinley mill. Coarse crushing and regrinding of the oversize, as employed at the mill, has been notably successfully, as has the by-passing of primary fine for treatment in independent units.

QUEBEC

The La Compagnie des Champs d'Or de Rigaud-Vaudreuil, with offices at 107 St. James street, Montreal, has secured a concession of about 70,000 acres south of the St. Lawrence, in the central part of the province, says G. Willrich, consul at Quebec, in the *Daily Consular and Trade Reports*. The company has completed extensive preparations for resuming hydraulic mining on a large scale. It started operation in 1911, but was troubled by lack of water. The company secured machinery from the United States, and has in its employ Californians experienced in this class of mining. While Quebec has not produced gold in recent years, recent quartz discoveries have caused the Bureau of Mines to organize an exploration party to investigate the northeastern part of the province.

YUKON

The Canadian Klondike M. Co. has ordered from the Marion company a duplicate of its 16-cu. ft. dredge, the

Canadian, now operating near Dawson. The new machine is to be completed in four months, and it probably will be assembled on the Boyle concession, says a news despatch from Dawson. Charles Boyle is resident manager for the company at Dawson.

MEXICO

SONORA

It is reported that the Pedrazzini Gold & Silver M. Co. probably will close the Las Chispas mine, near Arizpe, on account of labor troubles. The miners decline to submit

MILL OF PEDRAZZINI G. & S. M. CO.

to the searching process which the company instituted to stop 'high-grading.'

Press reports state that the freighting contract has been let for the delivery of the machinery of the new reduction plant of the Richfield Copper Co. The mill will be erected on the property, about 45 miles from Querobabi, the station where the machinery now is. J. A. Cooper, general manager for the company, recently returned to Nogales, Arizona, after an inspection of the property.

Reports from Navajao state that the Promontorio mine, which has been shut down for several years, may be reopened in the near future. It is rumored that machinery soon is to be ordered for the South Sonora Silver M. Co. property in the Promontorio district. W. G. Du Bes is manager for the company. The Plata Fina M. & D. Co. has its shaft down 108 ft., in good ore. The property, which is in the same district, is in charge of T. P. Brinegar.

PHILIPPINE ISLANDS

(Special Correspondence.)—Mining in the Philippines does not amount to much. The Headwaters property is closed temporarily on account of several typhoons in succession, that smashed things up generally, and of a painful lack of cash at the same time. Dredging has had a small run of luck lately, but nothing worth mentioning until it is seen whether or not the properties will pan out equal to expectations. Sixty-odd inches of rain has fallen in seventy-two hours, and several of these showers occurred in quick succession, so that transportation and everything else is badly smashed.

This country has suffered from the rankest kind of wild-catting and also from extremely bad engineering, or no engineering at all. There are some good properties, and eventually some of them will become steady producers, but it will take a new generation of capitalists and operators to make them. Mining is expensive, owing to local conditions in many places and also owing to the character of the deposits, which are generally lenticular, with spotty ore in big soft veins that take a lot of timber and careful mining to handle.

Manila, February 8.

Among the Copper Mines

THE PHELPS-DODGE SMELTERS in February produced 10,724,950 lb. copper, compared with 11,423,100 in January.

The CALUMET, ARIZONA, smelter turned out 4,132,000 lb. of copper in February, as compared with 4,544,000 lb. in January, and 3,570,000 lb. of copper one year ago.

The INSPIRATION CONSOLIDATED offering of convertible 6% bonds met with flattering success; 99% of the bond issue is reported to have been taken by the shareholders.

THE SHANNON COPPER CO. in January produced 780 tons of copper, the largest month's production for the company since 1907. It is reported that the company is planning to exceed during 1912 the production for last year by about 3,000,000 lb. The Leonard Copper Co., a subsidiary of the Shannon company, is shipping about 5000 tons of ore per month to the Shannon smelter.

The CALUMET & HECLA M. CO and its subsidiary companies in February produced 10,803,641 lb. of copper, it is estimated, as against 10,796,956 lb. in January and 11,125,979 lb. in December. The total estimated production in pounds of the Calumet & Hecla and subsidiary companies for the past two years is as follows:

	1912.	1911.	1910.
January	10,796,956	10,684,785	11,651,527
February	10,803,641	10,235,801	11,358,545
March	.....	10,030,364	12,277,142
April	.....	10,732,707	11,115,793
May	.....	12,190,543	10,975,331
June	.....	11,515,759	10,742,250
July	.....	10,551,847	10,507,713
August	.....	11,374,064	10,628,106
September	.....	10,596,233	9,842,635
October	.....	10,676,411	10,774,602
November	.....	11,608,122	11,800,263
December	.....	11,125,979	11,253,933
Total	.....	131,322,615	131,927,840

February Copper Review

By MISHA E. APPELBAUM

From February 8, when the January statistics were announced, until March 9, copper has ruled very firm, and closes at 14⅝c. per lb., delivered 30 days, for electrolytic and 14¾c. per lb. for Lake. The statistics for the month of February were in line with what most of the producers expected, but the decrease was about 20,000,000 lb. less than I estimated. The domestic deliveries were very low at 56,000,000 lb., and the exports fell to 63,000,000 lb. It may be that, due to the strikes abroad, the full quantities of copper contracted for were not shipped, and if such is the case, then the exports for the present month will be so much greater; that is, of course, supposing that the coal strike will be settled during the next few days. The visible supply in this country now is about 66,000,000 lb. However, there has been quite a change in the financial district and a slight improvement can be noted in most lines, with every indication that the improvement may go further. Should this materialize, I am afraid a runaway copper market might develop. A visible supply of 66,000,000 lb. of copper is none too large, and is a very small one with which to enter upon a period of business expansion. One thing appears to be certain, that the low copper prices which have existed for the past few years will not again be witnessed for some time to come, and that the average price of copper during the present year will be nearer 15 than 13½c. per pound. A steady market at that level would be desirable to all concerned, as it would not interfere with the consumption, and would leave a good margin of profit to the producers.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

VICTOR BARNETT, of Tonopah, is in San Francisco.

A. DEWINT FOOTE was in San Francisco last week.

F. L. SAGE has gone to Calaveras county, California.

T. A. RICKARD is expected in San Francisco tomorrow.

FRED H. REECE has left southern Colombia for New York.

S. F. SHAW has left New York and is now at San Antonio, Texas.

SUMNER S. SMITH has returned to Juneau from Fairbanks, Alaska.

ROSS B. HOFFMANN and CHARLES JANIN leave San Francisco today for London.

C. W. KNIGHT was married to Miss GRACE E. HEWSON, at Toronto, on March 2.

C. W. BOESCHE has been inspecting properties in the Kelly district, New Mexico.

ROBERT E. CRANSTON has opened offices in the First National Bank building, San Francisco.

DIAMOND MACGUCK will leave soon for Spitzbergen, where he will assist SCOTT TURNER.

A. H. COX is manager for the Tennessee Copper Co., instead of acting manager as formerly.

VICTOR C. ALDERSON, president of the Colorado School of Mines, spent February 23 and 24 at Telluride and Ouray.

J. H. TIPPLER has accepted the position of superintendent of the River Bed mine, Walker, Siskiyou county, California.

T. LARSEN, of the Waihi Gold Mining Co., has left Sydney for Siberia, where he joins the staff of the Spassky Copper Mining Co. at Akmolinsk.

E. A. JULIAN, general manager for the Nevada Hills Mining Co., who has been ill in San Francisco, is convalescent and is now visiting friends at Mare Island.

FRANKLIN GUITERMAN has been made technical director for the Guggenheim interests, with an office in New York. The work in Colorado will hereafter be in immediate charge of L. G. EAKINS.

Obituary

GEORGE OSLER SMART, who died on November 29, 1911, at the age of 47 years, though a comparatively young man, had long been prominent in South African mining affairs. He went to Natal from his home in Scotland in 1881, and in 1885 went to the Rand, where he was successively with the George Goch and Sumner & Jack companies, being at the time of his death reduction works manager for the latter company. He was considered one of the best millmen on the Rand and had a prominent part in the development of the methods of South African metallurgy.

WILLIAM CHAPIN WETHERILL, an engineer and metallurgist best known for the prominent part he took in the development of the metallurgy of zinc, died of heart failure at Denver, on February 10, at the age of 60 years. A graduate of the Polytechnic College of Philadelphia, he engaged in railroad construction in Arizona, later going to Brazil for railroad surveys along the Amazon, and upon his return engaging in surveys for the Northern Pacific; later he was chief engineer of the Mexican Central railroad. In 1880 he was appointed general manager for the Empire Zinc Co. at Joplin, and in 1881 became vice-president of the Empire Zinc Co., at Canon City, Colorado, for which he was also consulting engineer; these positions he held at the time of his death. He was well known throughout the metallurgical world, and leaves many friends. He was the son of Samuel Wetherill.

Market Reports

LOCAL METAL PRICES

San Francisco March 14.

Antimony	11—11½c	Quicksilver (flask)	46.50
Electrolytic Copper	15½—15¾c	Tin	47—48½c
Pig Lead	4.25—5.25c	Spelter	7¼—7⅜c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

Average daily prices in cents per pound, based on wholesale transactions, standard brands.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Mar. 7	14.33	4.00	6.60	58½
" 8	14.33	4.00	6.70	58½
" 9	14.33	4.00	6.70	58¼
" 10	Sunday.	No market.		
" 11	14.40	4.00	6.70	58¼
" 12	14.40	4.00	6.70	58½
" 13	14.40	4.00	6.70	58¼

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, Mar. 14.		Closing Prices Mar. 14.
Adventure	7¼	Mohawk	$ 56
Allouez	44½	North Butte	28½
Calumet & Arizona	61¼	Old Dominion	49
Calumet & Hecla	453	Osceola	
Centennial	20	Quincy	78
Copper Range	56½	Shannon	12½
Daly West	7½	Superior & Boston	3½
Franklin	13¼	Tamarack	70
Granby	37	Trinity	53
Greene Cananea, ctf.	8¼	Utah Con	10
Isle Royale	28½	Victoria	4½
La Salle	5½	Winona	6¼
Mass Copper	7½	Wolverine	105

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, March 14.

Atlanta	$ .20	Mayflower	$ .02
Belcher	.80	Mexican	3.57
Belmont	10.90	Midway	.32
B. & B.	.12	Montana-Tonopah	2.60
Booth	.10	Nevada Hills	2.50
Chollar	.10	Ophir	1.42
Combination Fraction	.16	Pittsburg Silver Peak	1.35
Con. Virginia	.75	Round Mountain	.46
Florence	.64	Savage	.22
Goldfield Con.	4.75	Tonopah Extension	1.90
Gould & Curry	.05	Tonopah of Nevada	7.62
Jim Butler	.55	Union	1.15
Jumbo Extension	.36	Vernal	.18
MacNamara	.23	West End	1.57

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, March 14.

Associated Oil	$42.0	Peerless	$ 4.50
Brookshire	.60	Pinal	4.00
Caribou New Stock	1.45	Premier	.58
Claremont	.60	P. S. Petroleum	.18
Coalinga National	.14	Republic	.35
Con. Midway	.02	Silver Tip	.90
Empire	1.10	Sterling	1.40
Enos	.04	S. W. & B.	.18
Maricopa 86	.45	Turner	.90
Midway Premier	.29	Union	98.25
Monte Cristo	1.90	United Oil	.39
Palmer	.60	W. K. Oil	2.10

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. Mar. 14.		Closing Prices. Mar. 14.
Amalgamated Copper	$ 71¼	La Rose	$ 3¼
A. S. & R. Co.	76¼	Mason Valley	12½
Braden Copper	27	Miami Copper	24
B. C. Copper Co.	4¼	Mines Co. of America	3¾
Butte Coalition	22¼	Nevada Con.	19¼
Chino	23¼	Nevada Utah	1/16
Davis Daly	1	Nipissing	7¾
Doble	¼	Ohio Copper	1¼
Dolores	4	Ray Central	2½
First National	2¼	Ray Con	17¼
Foley O'Brien	¼	South Utah	¼
Gifford	4¼	Superior & Pittsburg	16½
Goldfield Con.	4¼	Tenn. Copper	28¼
Greene Cananea	7¾	Trinity	5½
Guanajuato Con.	¼	Tuolumne Copper	4
Hollinger	11¼	United Copper	1½
Inspiration	18¾	Utah Copper	57
Kerr Lake	3	Yukon Gold	3¾

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EDITORIAL

MEXICAN conditions continue extremely unsatisfactory, and to none more so than the mine operators who see silver mounting in price while their mines are perforce idle.

ANNOUNCEMENT that Mr. George W. Perkins has bought control of the New York *Evening Mail* suggests that the desire for publicity may sometimes even lead to the ingestion of indigestible wood-pulp.

EUROPEAN banks have increased their holdings of gold during the past five years by $500,000,000; a little less than one-quarter of the total gold production of the world during that period. The amount consumed in the arts, accretions to the treasuries of the nations, and to private banks and individuals, go to make up the difference.

TRANSFER to America of art collections owned by Mr. J. P. Morgan should elicit only approval. European cities naturally regret their loss, but it is not possible to sell cake and have it to eat as well. Exhibition of the collections in the second largest city of the world will make them accessible to a larger and no less appreciative public, and Mr. Morgan deserves compliment in procuring for the people an educational advantage that, though needed, was not likely of realization by public initiative.

DESPATCHES from Seattle announce a rush of men and material from that port to Alaska, in anticipation of the spring thaw, which renders the trails to the interior impassable during the transition from winter to summer. The stampede of early spring and the exodus of early autumn are characteristic and iterative episodes in the life of the Far North. They reproduce annually some of the features of the old days when the spirit of adventure was gay and unsoiled, of the days when the West was all on the frontier, when the world was young and life an epic.

FREE SUGAR and pension increases are to be made possible by the excise tax bill which passed the House on Tuesday, according to the Democratic program. This provides for an income tax on all incomes of $5000 per year, or over, including salaried persons, though nominally a tax upon the privilege of doing business. One result of carrying out these proposals is clear; radical readjustments of our social and economic relations will be made necessary, and Congress might well consider first whether the possible advantages to be gained will compensate for the inevitable cost of readjustment. But the Congressman with one ear to the ground is naturally unable to see very far.

PATENT laws in the United States are in a notoriously unsatisfactory condition, and the recent decision of the United States Supreme Court will not contribute to their popularity. The maker of a mimeograph decided to sell his machine at low profit, but imposed as a condition that the buyer should use only a specified brand of ink which the maker of the mimeograph manufactured and upon which the profit was large. The court held that the manufacturer was not only within his rights in imposing this condition, but might impose others as well. The possible results of

this decision are startling, and we shall wait anxiously to know whether users of vacuum or other patent filters are to be required to buy only certain brands of overalls, and to wear silk hats while working.

CONVICTION of Mr. George Graham Rice and his associates is principally important in that it establishes criminal responsibility for what has been commonly considered heretofore punishable only by civil action. It is interesting to note that men can be sent to prison for what is not legally a crime in most states, and only becomes a crime when the mails are used as one of the means to inviegle money from the pockets of the unwary. Many of the worst frauds are perpetrated without recourse to the mails, so while the decision is of large import and will make it easier to prevent many frauds, state legislation is necessary if complete reform is to be effected.

ORGANIZATION of a central body to keep in touch with associations and chambers of commerce throughout the country, and to represent commerce in its relations to the national Government, was effected at Washington recently. The suggestion came from the President, and invitations to the conference have been widely extended. In the United States, chambers of commerce have heretofore had no official standing, being purely volunteer organizations. In England the Board of Trade is a body of large powers, and in Germany and elsewhere on the continent there are close relations between the commercial organizations and the Government. In Japan, directors of each chamber of commerce are elected by popular vote, and it may interest the suffragettes to learn that women property holders are qualified voters. More and more governments are becoming agencies for securing social justice and commercial well-being, and the conference at Washington should be productive of much good.

ONE of the interesting suggestions of the week is that made by Mr. Walter Fisher, Secretary of the Interior, that the men and machinery which will be thrown idle by completion of the Panama canal, be shipped to Alaska and utilized in building a railroad from Seward to Fairbanks. This is in line with his earlier suggestion that the Government open a colliery in the Alaska coalfields and supply the necessary transportation facilities. We have already indicated our approval of the general scheme. The Secretary now points the way to practical work. The development of Alaska is a great national duty and a trunk-line railroad is the first desideratum. Rightly or wrongly, the old policy of Government guarantee of bonds of a private company, with or without a land grant, is now condemned. Private capital can not afford to do the work except on the basis of monopolistic exploitation. The Government has the trained men, the machinery, and the money. Why not give Alaska the same help as was given the Western states, though the means be in keeping with the times?

FINE ORE, when present in too large proportions, is often the *bête noire* of the metallurgist, interfering with the proper distribution of heat throughout the smelting column by occluding the passages through which the gases of combustion must pass, and producing an undesirable quantity of flue-dust that is even more difficult to treat than the fine ore from which it is derived. There appears elsewhere in this issue a classification, by Mr. Walter S. Landis, of all the processes that have been devised for the agglomeration of fine material of whatever nature. Mr. Landis is many centuries in error, however, in citing the briquetting of peat at Paris as the earliest example of the agglomeration of fine material, for, like many other useful inventions, it was known to the Chinese in early times. Ibn Batuta, who in the fourteenth century followed in the footsteps of Marco Polo in his travels through Cathay, very clearly describes the making of balls of combustible material by the agglomeration of fine bituminous coal with a small percentage of clay as a binder, just as is still done in the cities of that country today. Origination is less to the point than application, however, and the metallurgists of recent years who have done so much to solve this difficult problem of the smelters' art have accomplished much more than had been achieved in all the centuries which preceded.

ENGINEERS are the men who, according to Wellington's definition, can do well with one dollar that which any bungler could do with two, after a fashion. This faculty of the true engineer can be exhibited in many ways, and often no more effectively than in economy of labor. This is well illustrated in the admirable contribution, by Mr. George Spence, to the discussion of the efficiency of native labor, which appears on another page. Too often an engineer who would be disturbed by the necessity for employing machinery of low efficiency is entirely unmoved by a 50 per cent efficiency foreman. This is not altogether unnatural; the efficiency of a machine is easily determined, but it is not practicable to obtain the indicator diagram of a foreman for comparison with ideal standards of efficiency. Mr. Spence's contribution is equally notable as an example of the valuable jottings of an engineer's notebook that escape becoming of service to the oncoming generation of engineers unless thus made public. Many men have neither the leisure nor facilities for preparing long technical articles upon a topic of interest, and others have valuable bits of experience to communicate which, from their nature, can scarcely be made the basis of an article. We hope that our readers will more and more recognize in our 'Discussion' columns a proper place for the publication of such suggestions, reflections, personal beliefs, and bits of experience as might otherwise never see the light of publication.

Cobalt and Its Future

The argentiferous deposits of the Cobalt district of Ontario are an inexhaustible source of interest to economic geologists. The association of a variety of silver minerals with arsenides and sulphides of cobalt and arsenic is unusual, though not unparalleled. Their mode of occurrence is equally interesting. Conglomerates, graywackes, and graywacke slates, forming the Cobalt series, rest unconformably upon a greenstone complex which is regarded as Keewatin. Both series have been intruded by a sill of quartz-diabase, which is nearly horizontal in some parts of the district, but steeply inclined in others. As soon as development of the mines had proceeded far enough to furnish evidence, considerable differences of opinion developed as to the nature and origin of these deposits, which have been studied, to some extent at least, by nearly all of the more prominent economic geologists, the most extensive work having been done by Mr. W. G. Miller, provincial geologist of Ontario, and his assistant, Mr. C. W. Knight, who in addition to field studies has, in conjunction with Mr. W. C. Campbell, made detailed petrographic studies of these ores. The most generally accepted opinion, if any one may be regarded as of general acceptance, is that ore-bearing fissures, due to contraction upon cooling after the intrusion of the diabase, have been filled by up-rising solutions subsequent to the intrusion. The diabase and the overlying Cobalt series was naturally more fractured than the generally underlying Keewatin; the conclusion was early reached that the fissures would extend to no great depth, tending to disappear in the Keewatin, and early de-

velopment tended to confirm this generalization which, in the form of an amusing verse, gained wide publicity.

With later work, increasing numbers of veins were found, both in the diabase and in the Keewatin, and recently, as recorded in our Toronto letter, the No. 9 vein in the Conagas has been proved not only to persist, but also to be profitable in the Keewatin. Apparently the prospects in depth are not so hopeless as was at first supposed. Another view as to the origin of these deposits was held by the late S. F. Emmons, who in a notable paper published in this journal shortly before his death, advocated the hypothesis that the veins occurred in fissures of the ordinary type, their small size being due to their representing only the 'roots,' as it were, of larger veins formed in great thickness of overlying rocks. With this conception as a basis it is easy to ascribe the phenomenal richness of the veins to secondary concentration during erosion. This view also leads to a pessimistic outlook as to the ore-content of the Keewatin rocks. One swallow does not make a summer, and a few veins traced a short distance into the Keewatin cannot be assumed, after the fashion of promoters, to indicate that the ores extend to the *ewige tiefe*, but the outlook is at least now more hopeful. A district which has one producer of five and one-half million ounces of silver annually, a second of three and three-quarter million, and a third of nearly a million ounces, has established a place for itself among the great districts of the world, even if it should be subject to a too early decline. We hope the deep levels may prove unexpectedly remunerative, and that this district, of which the early days were youthfully spectacular, may have a succeeding period of quiet productive maturity.

The Canadian Mining Institute

By T. A. Rickard

The recent meeting of the Canadian Mining Institute (at Toronto, March 6 to 8) must have left pleasant and enduring impressions on those who were in attendance. The three days devoted to the convention at the King Edward Hotel passed rapidly and profitably, affording opportunities neither too long to be tiresome nor too short to be hurried for discussion of technical subjects of immediate interest. The chair was occupied most worthily by Mr. Frank D. Adams, professor of geology and dean of the science department in McGill University. His presidential address was devoted to a most appropriate subject, namely, the service rendered to mining by the geologist. Several instances were adduced of the actual discovery of mineral deposits and the consequent birth of profitable industry due to the application of scientific observation in the field, notably the case of Cobalt, which owed its beginning to the detection of uncommon minerals by Mr. Willet G. Miller. Other instances, chiefly in the iron regions, were mentioned. I venture to add, however, that the first aid to mining on the part of the geologist is not often the most impressive, for the simple reason that usually he comes in the wake of the prospector: he does not precede him. Most of the big ore deposits of the world have offered a readily recognizable aspect to the first seeker that happened upon them, for example, the Comstock, Broken Hill, Mount Morgan, Goldfield, Calumet & Hecla. Not often is the geologist the first to arrive; he contributes intelligence to exploration, he unravels complexities, he gives the miner a chart underground, but his place is rarely in the forefront of mineral exploration. At Tonopah, Leadville, Cobalt, Nome, and Bendigo the conditions were not simple, and the miner stood with pick in hand until the student of nature overtook him on the trail; but this has happened rarely.

This address, the appearance of which in print will be welcomed by my readers, was followed by the dry recital of statistics by representatives of various mining departments, and in the afternoon a series of papers on coal was submitted. These papers gave a vivid impression of Canadian fuel resources. According to Mr. D. D. Carnes the quantity of coal in the Yukon alone is enormous; indeed, the sub Arctic regions of the American continent appear destined, like Spitzbergen, to modify our ideas of essential cold. On the Pacific coast, as stated by Mr. H. Foster Bain, whose paper was read by deputy, the use of California oil is now general in maritime transport and the supply of Japanese coal suggests another fact affecting industrial expansion. This writer submitted several suggestive ideas in regard to the influence of the Panama Canal upon the trade routes of the world and outlined the far-reaching effects of the artificial union of the Pacific and Atlantic waterways. On the program Mr. Eugene Coste was set down for another paper on the "fallacies" of other people in regard to the origin of oil, but he did not appear, and so we lost a chance of seeing once again how oil does not smooth the troubled waters of disputation. That proverbially benign effect apparently is not a quality of oil having inorganic origin. At the evening session the sanitation of the miner's and metallurgical worker's environment was discussed in a lecture by Mr. W. H. Tolman. The relentless flow of his speech and the rapidity with which his magic-lantern slides succeeded one another on the screen were almost too much for any but the most alert of his hearers. I was again convinced that the magic lantern as an aid to exposition is overdone by my American friends. The picture thrown on a screen leaves no enduring image, it is erased from the memory by a rapid succession of similar pictures, and often tends simply to bewilder the mind with cinematographic phantoms. One or two photographic illustrations are a decided help to the lecturer, but an orgy of slides is tiresome. They leave confused impressions and detract from the value of the spoken word, which, skilfully used, should be a sufficient exposition. At the following morning session the principal papers were those of Mr. Robert H. Richards and Mr. W. R. Ingalls. The famous author of 'Ore Dressing' received an attentive hearing to his timely description of tests made by him in the concentration of the silver ores of Cobalt. The editor of the *Engineering and Mining Journal* gave an excellent paper on recent progress in electric zinc smelting, a subject on which he is a recognized authority. So far there had been but little discussion; in the afternoon, however, the paper on the domes of Nova Scotia, by myself, put several of the representatives of the maritime Province on the alert. It was known that in 1905 I had made a report for the Government on the best method of aiding the Nova Scotian gold-mining industry, and it was known that the report had not been published, because it was not optimistic. The beautiful structure of the doubly anticlinal lodes of this region and the attempt to explain the mysterious crenulation characteristic of the veins was subordinated to the personal and political aspects of the subject. However, my desire to be fair and to be as discreet as circumstances permitted was fortunately appreciated and elicited the most friendly comment from Messrs. John E. Hardman and F. H. Sexton, both of whom made notable contributions to the ensuing discussion. Papers on the geology of Porcupine were then presented by Messrs. A. E. Barlow and Reginald E. Hore. These received close attention, and the comment of Messrs. J. B. Tyrrell and W. F. Ferrier. Then came an unexpected outburst on the part of Mr. H. E. T. Haultain, professor of mining in Toronto University. He complained that certain geologists took themselves too seriously and so forth. This provoked no retort, despite the fact that the

president invited the culprits to respond. Good nature marked all the proceedings and prevented friction throughout. Mr. Charles A. O'Connell gave the story of Cobalt and foretold the extent of its probable productivity. His recital of facts was interesting and his forecast seemed to me to be reasonable. Incidentally, to those of us who had not been to Cobalt he gave an instructive outline of the ore occurrence in that area. Mr. Tyrrell submitted the data collected by him in regard to the Coppermine district, an almost mythical part of the Northland. He has traveled widely throughout sub-Arctic Canada, a part of the earth's surface that has been as yet but slightly explored and offers many chances to the mining adventurer. During this session the president announced that Capt. Scott had reached the South Pole, evoking general (but mistaken) applause, for we learned next day that Capt. Roald Amundsen was the man who had accomplished the feat. He also is the man who deserved whatever honor it may carry, for he found the northwest passage, the chief result of the long continued gymnastic exercise and misplaced sentiment associated with polar adventure. If 5-ounce gold were announced at either Pole, or near either of them, I venture to say that there are a hundred prospectors in Canada and Alaska that would get there, without fuss, medals, or speeches. In the evening of this, the second day, we had a smoking concert, rendered memorable by one of Mr. James F. Kemp's humorous sketches. This time it was an account, illustrated by the magic lantern, of how he reached the Pole and what he found there. Colonel A. M. Hay sang a clever composition of his own on a kindred subject; Mr. J. Parke Channing told some excellent stories; I ventured, under the protection of the chairman, Mr. J. J. Penhale, a fellow Cornishman, to read some supposedly humorous verses; and the harmony of the proceedings was emphasized by a glee club from the University, together with general singing, such, for example, as the chorus following the rendering by Mr. R. W. Brock, the director of the Canadian Geological Survey, of 'Drill, ye tarriers, drill', the official saga of the Canadian Mining Institute.

The last morning session was devoted to several important papers. Mr. J. Parke Channing gave a lucid and instructive description of the mining and milling methods practised at the Miami copper mine. The ore averages 2.58 per cent copper, disseminated in schist as chalcocite. Of this, 75 per cent is extracted, so that the yield is 37 pounds copper per ton of ore. Among the noteworthy features is the saving of water, only 365 to 500 gallons of new water being consumed per ton of ore treated in the concentrator. The total consumption of new and re-used water is 2100 American gallons per ton of ore. Reference was made to the good work done by the Hardinge conical tube-mills, a mention highly pleasing to the inventor, who was present in the audience. Power at Miami costs 1.25 cents per kilowatt-hour, oil being used at $1.70 per barrel delivered. In response to a question, Mr. Channing outlined the story of the discovery of this famous mine, and showed how sometimes romance is linked to science. This was a pleasant touch. Then came another unexpected incident, Mr. Haultain drawing attention to the fact that two such authorities as Messrs. Richards and Channing had adopted the style of using the singular of tailing, concentrate, slime, sand, and similar terms, when the meaning does not involve a plural idea. Mr. Haultain congratulated the reformer to whom this usage was to be credited, but asserted his own undeviating conservatism in the matter. After Mr. Channing came Mr. F. Lynwood Garrison with a paper on the persistence of ore in depth. The subject, of course, is highly contentious but always fascinating. The discussion was started by a recognized authority, the Columbia University professor, Mr. Kemp, and was continued by several other experienced men. This discussion, when it appears in print, will prove interesting. A thoughtful paper on the education of miners was presented by Mr. F. H. Sexton, who is known to have done excellent educational work in Nova Scotia. The paper was based on his experience in that Province, supplemented by the careful study of European methods. The professor of mining at McGill University, Mr. J. B. Porter, offered some useful comment, and others followed. It was evident then, as at other times during the meeting, that those assembled were as quick to appreciate careful scientific study as they were to detect slipshod reasoning or merely showy observations. It must be added, however, that there was not much of the meretricious type of exposition. The papers were mainly earnest contributions to technology. In the afternoon two famous geologists, Messrs. James F. Kemp and Waldemar Lindgren, addressed the convention on favorite subjects, namely, contact zones and vein formation. Mr. Kemp supplemented his researches on the garnets and other minerals that testify to the agency of magmatic waters at the contact of eruptive rocks with limestone, as illustrated by andradite, a ferruginous garnet. Mr. Lindgren described the detailed structure of the veins at Republic, in the state of Washington, and drew attention to the replacement of calcite by quartz; also the frequent presence (in veins of geologically recent age) of adularia, a variety of orthoclase. I had heard him lecture at McGill University, Montreal, a few days previous, and regretted that others present had not been so fortunate. In the evening a public banquet marked the close of the meeting. This concluding function was likewise highly successful. The result of the election for a new president was announced most gracefully by the unsuccessful competitor, Mr. G. G. S. Lindsey, K. C., a public-spirited citizen of Toronto, who honored himself in his generous tribute to Mr. A. E. Barlow, elected president that day. A society is fortunate that has the choice of two such men. Mr. Barlow, I ascertained later, is beloved throughout the northern mining regions of Canada, as much for his geological ability as for his manly sincerity. The toast of the Ontario legislature received response from Capt. H. A. C. Machin, who used his fine voice, not only in an effective speech but in song as well, later in the proceedings. The Mining Industry was the toast to which Mr. Channing responded; it is not often that engineers are good speakers, but this was the second time the same day that my friend had proved an exception. Responses to the toast of the Sister Societies were made by Messrs. Kemp, Sexton, and myself. This suggests the mention of the fact that the American Institute sent a delegation of thoroughly representative men, many of whom might be rated as also representing the Mining and Metallurgical Society of America. The British Institution was not officially represented by anyone, for I was there unofficially. This was a great pity, for at one time it had been planned to hold a joint meeting of the Institution and the Canadian Institute. All I need to say is that my compatriots missed a rare chance to become acquainted with men and things worth knowing. The meeting, in my opinion, was one of the most pleasant and instructive ever held. It was marked by the hospitality of the Canadians and the valuable papers of the American contingent. For the excellent arrangements all of us were in debt to Mr. H. Mortimer-Lamb, the secretary. This, I am glad to add, was generally recognized. The Canadian Institute seems destined to be a common meeting-place for those that search for minerals and describe their experience in the language if not always of the Bible, nor even of Shakespeare, then at least in a tongue that passes current throughout the chief mining regions of the world

The Future of Cobalt

By Charles A. O'Connell

*Having resided in Cobalt for the past seven years, I am more of an optimist than the majority of engineers, but the longer I live there the more I am convinced that this district is without a peer on the continent. The proved ore-bearing zone is a rectangle five by three miles, and from within this zone there has been produced in seven years to January 1, 1912, 126,064,189 oz. of silver. I do not think there has ever been anywhere on the continent a district as rich as Cobalt, which was so long producing before it attracted particular notice. It was not until August 1906, three years after the discovery, that

MAP OF THE COBALT DISTRICT.

more than passing notice was given the district. At that time there were about twelve producing properties. The whole of the township of Coleman had been staked, and any man who could show 'cobalt bloom' on his claim could sell it. Some have said there was an orgy of speculation, but that was largely fabrication. I know well that all the statements issued by the Department of Mines, and most of those over the signature of W. G. Miller, warned the public time and time again against reckless speculation and the purchase of claims that were not inside the proved ore-bearing zone or that had not been examined by a competent mining engineer. Mr. Cochrane and the officers of the Department did all in their power to protect the public.

The production to date is stated as being 126,064,189 oz. fine silver, worth $64,918,752. The first shipments were made in 1904. The total shipped that year was 159 tons. The following year the shipments amounted to over 2300 tons, and from then increased by leaps and bounds until the year 1910, when 33,000 tons was shipped. The shipment in that year had a value of $15,500,000. In 1911 the tonnage declined somewhat and less than 25,000 tons was shipped, but the grade was higher, owing to the fact that more was shipped in the form of bullion and concentrate. It is difficult to state the exact amount of dividends paid, but the records show that $31,671,622 was distributed by companies making returns to the Department of Mines. To this should be added at least $2,000,000 as the profits from privately owned properties. From the inception of operation in the year 1904 to date 47 separate mines have shipped to the smelters, but 17 of this number did not contribute to the output during 1911.

Much has been said and written as to the geology of the Cobalt area, and the articles by W. G. Miller, Cyril Knight, and others have been especially important. The bulk of the ore, as formerly, comes from the Lower Huronian formation, and while the amount contributed from the Keewatin series has been considerable, it forms only a portion of the whole. The quantity of ore extracted from the veins in the diabase is small. Since the year 1906 the extent of the proved ore-bearing zone has not been enlarged. The limit is marked on the south and east by the Temiskaming mine, on the west by the Princess, and on the north by the Hudson Bay. The district west of the town of Cobalt, extending to Portage bay, has been prospected, but no productive veins have as yet been found. The properties on what is termed the 'West Ridge', extending from the Hudson Bay on the north to the Buffalo on the south, have been especially consistent producers. This is largely accounted for by the multiplicity of veins in the Huronian formation along this ridge. Taking a line from the Hudson Bay through the Trethewey, Coniagas, and Buffalo mines, I would venture to say that in this area there are more than 80 known productive veins. These are largely made up of the main vein systems running east and west from which innumerable branches lead. The Trethewey property alone, from the main vein system near the south end of the property, has 22 productive veins. Some of these are branches from the main vein system, which strikes east. It will doubtless interest all mining engineers and geologists to know that only four of these veins showed a marked outcrop on the surface, and ore was found in only two at the surface. More than six do not come closer to the surface than 50 feet.

As to the origin of the ore, much has been said and written during the past eight years, and many theories have been advanced. Personally I am firmly convinced that the theory first advanced by W. G. Miller is the only one tenable.

During the past three years much has appeared in the public press as to the decline of the Cobalt, but I am extremely doubtful whether the peak of production has yet been reached. The immense quantity of milling ore which is to be extracted leads to the belief that the maximum number of tons per annum will not be reached for several years. The Nipissing Mines Co. is now constructing a mill with a capacity of 200 tons per day, and this will be in operation some time in the fall. This will largely increase the output of the district, as it is admitted by all that this property (the Nipissing) is still the premier producer. On this property, comprising 846 acres, has been found the greatest number of veins, and the tonnage of milling ore will undoubtedly be much larger than that contained in any of the other mines at Cobalt. There has been a vast improvement in the method of concentration during the past five years, and the tonnage in all the mills has been largely increased.

The history of most mining districts of a similar nature shows that the time from the inception of operation to the peak of production does not cover more than seven or eight years. The decline to nominal production covers a much longer period, and when it is known that there are extremely favorable chances of finding other productive orebodies within the proved ore zone it will be seen that ten years would not be too long a period to estimate as the future minimum life of Cobalt. I am willing to predict that the total production will exceed 250,000,000 oz., and while this statement may be criticized as being the view of an extreme optimist, I make it without reserve, for it is largely based on the figures covering the past seven years' production as herein given.

*Abstract of a paper read before the Canadian Mining Institute.

Packing Supplies in a Mining Region

By James Davis

Many undeveloped prospects, that are miles away from a railroad, and by no means accessible with wagons, remain undeveloped for no other reason than that they are too hard to reach with suitable machinery. From a purely economic standpoint, the miner who goes into mining to win, necessarily must ask the question: "Is it accessible? Can this prospect be reached with supplies without too much expense; without enhancing the cost of the venture beyond hope of profit?"

This problem can be met, to a certain degree, by the proficient packer. In many instances an unskilled muleteer is employed to transport heavy pieces of machinery and supplies, to the detriment of the enterprise, owing to

Fig. I. The saddle.

the cost such a course involves, not only in regard to unnecessary labor, but also in the maiming and often complete incapacitating of animals. In this article I aim to remind those who are confronted with such difficulties that there is a comparatively easy and scientific way to transport certain loads; that there exist certain 'tricks of the trade', certain hitches and devices in packing, that call for attention on the part of the adventurer. The following illustrations will, I hope, give some idea of the use of the most important hitches, and frames, used by experienced packers, which I have seen employed with success in northern California by such skilled men as B. J. Neilon and Herbert Finley, who have packed machinery in the most rugged section of the state.

The Saddle

The modern pack-saddle is composed of two distinct parts; the tree or frame, and the pad and cover. The frame is usually built of seasoned oak timber. It has six component parts, as shown in the figure, which are fastened together with bolts suitable to the size of the frame. In many instances nails are used for fastening, but they are far inferior to bolts, as there is apt to be some 'give' to nails when they are not clinched. Such 'racked' saddles are likely to cause injury to the animal, and should be avoided. The saddle should always be built to fit the animal's back, therefore 1 and 2 of Fig. I should be hewn, and smoothed accordingly. Incidental to the frame are the breast-strap and crupper. These are fastened to the frame by means of buckles, which can be used to regulate the position of the frame upon the back.

The pad and cover may be taken together as the second part of the saddle. The pad is made of canvas and leather, and takes the form of a rectangular bag with holes cut in the plane across the centre, large enough to accommodate the horns of the frame. Both sides of this bag are filled with grass of some sort, so that the rough sur-

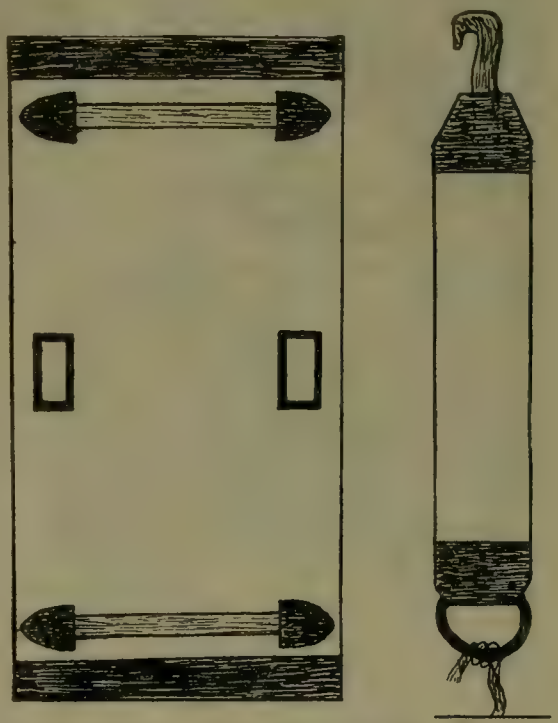


Fig. II. Cover and cinch.

face of the pack may rest upon this soft pillow. The cover is nothing more than a canvas strip which is thrown over the saddle-pad to bear the brunt of wear and tear. It fits on the saddle exactly like the pad, and is in fact a part of it.

Ropes

Pack ropes may be divided into three classes, of which the cargo ropes are the first class. These are usually half-inch ropes about 35 or 40 ft. long, with a noose at one end. The cargo rope is used to lash or bind several packages into side-pack, which in turn is half a mule-load. It is much more convenient to handle a tightly lashed side-pack consisting of several different parts than to handle the same parts separately. As a rule, there are two cargo ropes per animal, in a well regulated outfit, as provision must be made for two lashed side-packs.

The sling ropes are the second class. These ropes are also about 35 or 40 ft. long, and are frequently interchanged with ropes of the first class. In fact, most pack ropes are of this average length. At each end of this rope there is a 'turks-head' knot. The sling rope is fastened on the fore horns of the saddle by means of a double half-hitch at the centre. The primary purpose for

which this rope is used is to hold the side-packs in position in order to strike a balance.

The last and most important class embraces the lash ropes. Rope, cinch, and hook comprise the lash-rope. The cinch is generally made of heavy canvas, while the rope is ¾ or ⅞ in. and about 40 ft. long; the hook may be made from any hard, tough wood, oak being very serviceable.

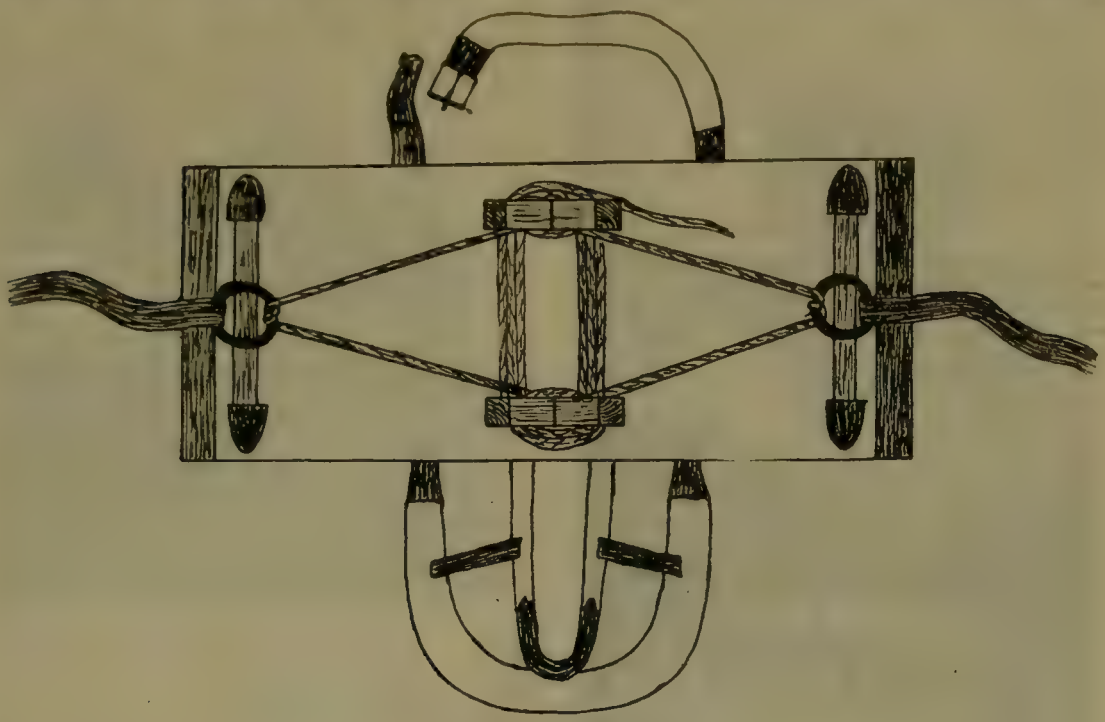


FIG. III. THE PACK-SADDLE.

THE DIAMOND HITCH

It is with the lash-rope that the well known diamond hitch is formed. Too much cannot be said in favor of this simple, effective, systematized device. As soon as the packer determines that the load is riding straight by sighting along the line of the horns of the saddle and the animal's back as it is being led away at its regular pace, he completes his work with the diamond hitch. There are various other hitches, as the 'double diamond', and the 'squaw hitch', but of all hitches the diamond is far superior, except in a few special cases. The double diamond is frequently used with high top-packs, and the squaw hitch is often the choice of those who work alone, but even in such instances the diamond is preferred by men who know the relative merits of the two. The figure illustrates the diamond hitch better than a detailed description, while skill in the art of 'throwing' the diamond, as distinct from 'weaving' it, can only be attained with satisfaction by actual experience and instruction by proficient packers. Fig. IV shows a view of a diamond hitch from the top.

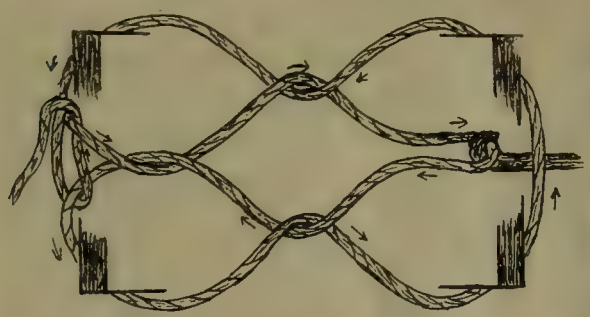


FIG. IV. THE DIAMOND HITCH.

THE COMMON LOAD

The common load, as I have chosen to call it, is usually made up of two side packs. I shall not exclude from this load the incidental top pack, for very often packages of small weight deserve special care, and therefore cannot be lashed to other portions of the burden. In this case such a top-pack may be placed on top of the two side-packs, directly above the horns of the saddle, assuming that the side-packs are of equal weight. However, a top-pack of this type can be made an effective instrument in balancing an uneven load. In that case, the lesser side-pack is lowered slightly and the top pack placed on top of it rather than on the horns, as mentioned before. It is always best to place the top-pack beneath the tie-ends of the sling rope, which crosses over the pack. Frequently, however, the sling rope is tied and the top-pack placed

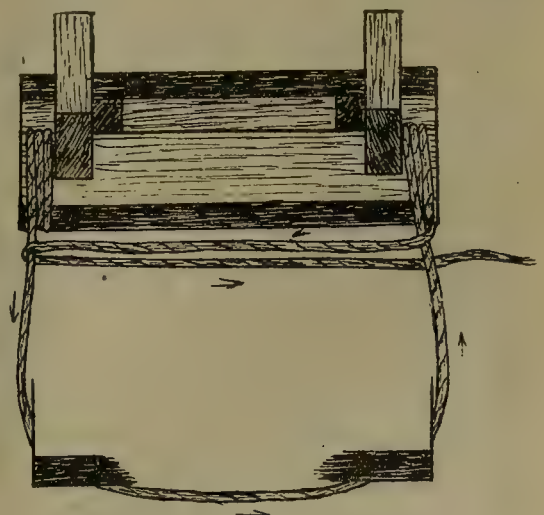


FIG. V. TOP-PACK FRAME.

over it, but the first method is preferable where possible.

Weight Against Bulk

Inexperienced men have often called my attention to a 'crooked' load while on the trail. Such loads are generally not crooked except to the passerby. Among muleteers who know the business there exists what might be called the rule of 'bulk against weight.' A bulky box weighing 100 lb. can often be placed to offset a side-pack of smaller proportions weighing 150 lb. Such a load appears awkward and uncomfortable on the beast, but so long as the saddle sets straight the packer rests assured that no discomfort is produced. The essential thing, then, is to strike a balance with the load, and to always keep the saddle in position, and in proper relation to the burden and the saddle blankets.

The Barrel and Pipe Hitch

Freight in various forms and shapes is constantly confronting the muleteer with as many different problems. Barrel loads are a source of much chagrin to the inexperienced adventurer, and yet professional packers rejoice

PACKING CABLE FOR THE NELLIE TRAMWAY, TELLURIDE.

when barrels of sugar, pork, and particularly whisky, must be transported many miles. The barrel hitch, a handy device to meet the difficulty, readily transforms the load from an eyesore to a treat. Here again the trick is performed with the sling rope. I have explained above how the sling rope is attached to the saddle. One division of this rope is thrown to the 'off' side of the animal. The 'near' side rope is brought around in such a way that it is wrapped several times around the rear horn, leaving a small loop between the two, which is then permitted to hang suspended on the 'off' side, similar to the first rope. The barrel is then lifted to the top of the saddle, so that it rests on the forks of the horns. The two ropes are gathered up in a coil and thrown over the top of the barrel, so that they pass over the top and bottom hoops respectively, or at least very near them. With the first barrel still resting on the horns, and the two ropes as described, barrel No. 2 may be lifted into position. The rear rope can then be drawn over barrel No. 2 near the band, as in the first case, and carried through the loop between the horns, and thence back over the front band. At this point the first rope, which was described as being beneath the fore part of barrel No. 2, is carried over and tied to the rear rope, which has already been passed through the loop. Having tied these two ropes, the off-side man may roll barrel No. 1, from the top, settling it in position on the off-side. If the load sets too high, or the side packs are unevenly balanced, the trouble may be easily remedied and adjusted by slacking up in the knot.

The same hitch may be used for pipe loads, in fact this hitch is, properly speaking, the 'pipe-hitch,' though it is most frequently called the barrel hitch. When packing long joints of pipe, however, the cargo ropes are used to tie the ends together to hold the loads in place, as well as to prevent any overhanging tree branches from catching hold between the two side packs.

The Top Pack

Large unwieldy top-packs cause more trouble than any other load, both to animal and muleteer. They are constantly shifting from balance, and a very slight movement may plunge an animal to destruction. In order to accommodate single packs which are too heavy for side packs, the top-pack frame was devised. This construction is nothing more than a heavy, false frame built of 2 by 4-in. scantling and made to fit solidly on the saddle. The two pieces on the side are notched on top at each end, and into this incision is carefully fitted the cross-piece that joins the two sides. When fitted upon the saddle these cross-pieces are level on top, any slipping either to the front or to the rear is prevented by the horns of the saddle as these are adjacent to the cross-pieces, respectively, and between them. The principal knack in using a top-pack frame lies in tying it firmly into position. On every frame there is usually about three inches of the longitudinal scantling (as distinct from the cross-pieces) that extends beyond the cross-pieces of the frame. Beginning again at the point of origin of the sling rope, which is at the front horn of the saddle, the two divisions of the rope are used to fasten the frame on both sides of the saddle. On the near-side the rope is drawn free and is then carried over the jutting scantling, given about three turns completely around, thence it is carried down around beneath the saddle corner, over the cinch, around the rear corner, up again, and over the jutting point at the rear end of the frame; about three turns are taken as at the front end and then the rope is tightened and tied as shown in the figure. The same operation is performed on the off-side, and when well done and completed the frame is fixed and immovable. The top of the cross-pieces then affords a level plane which will accommodate any angular load. On a top-pack no hitch with a sling is necessary. The load is merely balanced, adjusted, and, if it is a piece of machinery or the like, may often be prevented from slipping by the use of nails which can be driven into the frame. The diamond hitch with the lash-rope is really all that is needed. Very often where the trail to be followed is very much down-hill, or up-hill, the front cross-piece can be built up a trifle higher than the rear, or the reverse, according to the grade of the trail which the pack must be carried. Fig. V shows the top-pack frame fitted to the saddle and tied with the sling rope.

The Lumber Frame

One of the most useful contrivances of the muleteer is the lumber frame. Lumber being a necessary article must often be carried miles on mule-back, and as it is unwieldy and cumbersome it is often more expensive to transport it by pack-train than to whip-saw it. In fact it would be almost invariably so, if the inventive mind of the packer had not quickly devised an easy way of loading lumber. The lumber frame is easily described, because of its simplicity. It is built up of two divisions which are similar in structure. Each division is made of 1 by 12 by 36-in. lumber. Across each end of this piece is nailed a strip to strengthen the board, and at the same time to accommodate pegs which are driven into holes near the lower ends of the strips. The lumber rests upon these pegs, is balanced, and lashed by the lash-rope. The sling rope is used to tie the ends together. The two divisions are tied together with ¼ or ⅜-in. rope, and in order to make them firm the two tie-ropes are in turn tied together with a third rope which can be twisted by means of a short stick, held in place by a string.

Packing a Muller Ring

It seems that there is always a solution for every problem. For a long time a muller ring, if packed over a very rough trail meant much risk, owing to its shape and weight. A ring weighing 450 lb. and of awkward shape naturally falls into the class of hard top-packs. But after packing these rings on top for many years the idea of placing the rings around the mule occurred to one of the packers. The ques-

tion of how to get the mule into the ring arose, but met with ready solution, as it was of sufficient diameter to hitt over the mule's rump, consequently it is no more than a matter of placing the ring on the ground, and leading the mule over it so that its hind feet will be within the circle. Here the top pack frame comes into use again, as the pack must be elevated so that the lower portion will not interfere with the mule's stride nor strike the ground when inequalities in the trail must be crossed. Another ideal pack presents itself in transporting a long wire cable. It is practicable in such cases to wind the cable into coils, making the regular load of two side packs on every mule, and having these coils as numerous as the length of the cable requires, linking them together by lengths that will fit the trail turns best.

PACKING A MULLER RING.

THE TOP PACK.

The Purisima Grande Mill, Pachuca

By E. Girault

*This mill, designed and built under my supervision, is at the place once occupied by the oldest *hacienda de patio* of Pachuca, where it is said that Bartholomé de Medina invented in 1557 the amalgamation process. Some interesting features of the new mill are that it is built on practically level ground and that Chilean mills are used as primary grinding machines; four of these were taken from the old mill. These four Chilean mills are the only old machinery used in the new construction. About 100 tons of ore is put through the mill per 24 hours; the general plan of operation consists of fine grinding, concentrating, agitation in Pachuca tanks, filtration with Moore filters, and precipitation on zinc-shavings.

Ore Treated.—The ores are from the Guadalupe and Fresnillo mines; ore coming from the lower levels contains an average of 75% silica, 10% lime, and 7% iron. The ore from the upper levels carries oxides of manganese and iron; and although it proved refractory in the old patio process, it causes no trouble in cyaniding.

Grinding.—There are one 15 by 9-in. Blake crusher, and five Krupp Chilean mills with runners of 1.5-metre diameter, weighing with new tires 4080 kg. each. The runner shafts can move up and down independently, by which arrangement the wear of the tires and dies is uniform. The five Chilean mills are driven by a 100-hp. motor and have a speed of 18 r.p.m.; the power consumption of each mill varies from 15 to 20 hp., depending on the hardness of the ore and the proportion of fine and coarse.

The consistence of the pulp in the mills is 1 of solid to 6 or 7 parts of solution of 0.2% cyanide. Nine kilograms of lime is added per ton of ore. The mills are provided with No. 4 screens, the discharge is 10 cm. above the bottom, and the depth of the pulp is 20 centimetres.

The average capacity per mill per day is 24 tons when the feed consists of 78% fine and 22% coarse, calling fine that which does not exceed 5 cm. Recent sizing tests of the discharged pulp showed:

	Per cent.
On 100-mesh	38.2
On 150-mesh	9.5
On 200-mesh	5.1
Through 200-mesh	47.2

The tires and dies are of manganese steel. The tires, when new, weigh 1660 kg.; they last six months, and at the time of renewal weigh 400 kg. The dies weigh 1500 kg.; they last three months and when worn down to 300 kg. are renewed. The consumption of iron is 830 gm. per ton crushed, which is three or four times as much as in stamp-mills. Taking into account the total iron and steel consumed, it amounts to 1.054 kg. per ton of ore crushed.

Concentration.—The discharge from each mill goes over one Wilfley table. The extraction on these tables is about 18% of the content in ½% of the weight of the ore. At the same time part of the classification of the pulp takes place on the tables, some slime being sent directly to the thickeners.

Classifiers.—There are two Dorr classifiers.

Tube-Mills.—Of the two No. 5 Krupp tube-mills, 1200 by 6000 mm., only one is in operation at this time. They are provided with El Oro linings, cast in Pachuca with 25% manganese steel from old tires and dies. These linings weigh 6 to 7 tons and last more than a year; the price is $0.12 per kg. Instead of flint, hard 10-cm. pieces of rock from the mine, selected from the dump, are used. The daily consumption is about 1500 kg. The tube-mill discharge is pumped up about 14 ft. to the Dorr classifiers by means of a 10 by 54-in. Frenier pump.

Centrifugal Slime Pumps.—The slime is pumped 20.5

*Abstract from the *Informes y Memorias* del Instituto Mexicano de Minas y Metalurgia by G. Witteveen.

metres to the thickener by means of No. 2 Traylor centrifugal sand-pumps. Each pump has a capacity of over 100 tons of slime per day, the slime having a consistence of 1 of solid to 7.7 of solution. Each pump is driven by a 20-hp. motor and consumes 16.3 hp. They are fed under pressure through a conical receiver of 6 ft. diameter. The pumps have been in operation almost one year without causing the slightest trouble. The Traylor pumps make 1700 r.p.m. and can lift slime of 1 to 4 solution to a height of 20.5 m. The mechanical efficiency by actual measurement is 18.4%. The linings are cast in Pachuca; they are set with cement and last two weeks. The shafts last three months, the packing three weeks. With the exception of the high power consumption the pumps are satisfactory.

Thickener.—One 30 by 12-ft. Dorr thickener handles easily more than 100 tons of the thickening pulp from 1:7.7 to 1:1.44. A sizing test of the discharged pulp showed:

	Per cent.
On 100-mesh	12.27
On 150-mesh	8.50
On 200-mesh	3.95
Through 200-mesh	75.28

Pachuca Tanks.—There are four 15 by 45-ft. Pachuca tanks, which are charged with 94 tons of slime and 136 of solution, of about 0.257% KCN. It takes a little less than 24 hr. to fill a tank. During the filling a moderate agitation is maintained. After the tank is full, agitation by means of the air-lift is kept up for 36 hr., using air at 25 lb. pressure. The tank is then left to settle for about four hours. A series of comparative tests showed not only that lead acetate is not necessary, but that the extraction was not as good and the cyanide consumption higher when using acetate. With acetate the cyanide consumption was 676 gm. per ton and the extraction 73.40%, against 524 gm. per ton and 74.7% without it. These results coincide with those obtained in other small mills in Pachuca, but not with San Rafael practice, where a constant use of acetate is necessary to get a good extraction. The reason for this difference seems to be that in the small mills, all the solution is passed through the zinc-boxes, which is not possible in San Rafael, owing to the large quantity of solution in circulation.

Compressor.—The 300-cu. ft. compressor for agitation, filtration, and other purposes, has in some cases proved to be insufficient. The pressure of the air is 25 lb. Two tanks in active agitation consume 26.3 hp.; two tanks and the filter, 31 hp., which is also sufficient to keep the four tanks in moderate agitation. In the plans, the air consumption per tank was estimated at 100 cu. ft. per minute with a power consumption of 10 horse-power.

Filter Plant.—A Moore filter with two sets of twenty 10 by 6-ft. leaves is used. The contents of a Pachuca tank containing 95 tons of dry slime is filtered as follows: New filter-leaves, 20 cycles in 12 hr. with 1 to 1¼-in. cake; half-worn leaves, 23 cycles in 14 hr. with ¾ to ⅞-in. cake; old leaves, 30 cycles in 20 hr. with ½-in. cake. Taking the average of 62 tanks, the unwashed cake contained 50 gm. of silver per ton and the washed cake 49 gm. The water of the discharged cake has 2.5 gm. silver per ton.

Precipitation is effected in five zinc-boxes of five 3 by 3 by 2-ft. 9-in. compartments. No. 9 zinc is cut into shavings 0.15 mm. thick. The zinc consumption is 1.450 kg. of precipitated silver.

Melting.—There are four coke furnaces, 2 ft. 2 in. inside diameter and 4 ft. high, with 2-ft. sheet-iron chimneys 80 ft. high. Either No. 300 Dixon graphite crucibles or Morgan crucibles with clay lining are used. The precipitate, air dried in the Shriver press, contains 8 to 14% moisture and is melted with the following fluxes:

	Kg.
Moist precipitate	100
Ground glass	10
Ground borax	6
Carbonate of soda	8

The first melt lasts about 6 hr., the next one 4 hr. The total cost of the mill, including what has been adapted from the old mill, has been about ₱1500 per ton per day capacity. The total power consumption is 2.07 hp. per ton of ore. From the results obtained in this mill, it seems that with a small mill the installation cost of the combination slow-speed Chilean mills and tube-mills is less, and that the operating cost and the extraction are about the same as with stamp-mills.

Philippine Bureau of Mines

The Division of Mines has had four men in the field for the past two months, investigating the iron deposits of Bulacan province. Recent development work has shown that a much greater deposit exists than formerly was thought to be the case. The special work that the Division of Mines party is undertaking is the magnetic survey of the whole field, and investigation of adjacent water-power sites. It is very gratifying to report that Wilson & Rose, of Cavite, have completed plans for an improved cupola furnace and up-to-date machinery for making plough points and shares to be operated in this field. They expect to have their new plant in operation in about six months. There are now five native furnaces running in the district.

Three large companies are making serious preparation for the construction of cement mills in the Philippine Islands. One of these will be on Laguna de Bay, not far from Manila, and the other two probably on the island of Cebu. It is understood that machinery for one of these plants has already been ordered.

The Division of Mines has recently moved into commodious quarters on the ground floor of the new wing in the Bureau of Science in Manila. There is now space for a museum and laboratories, making this probably the largest geological and mining headquarters in the Far East. The work of this division has recently been extended beyond the confines of the Philippine Islands, assaying and cyanide tests having been made on samples from the Celebes, Indo-China, Mongolia, and neighboring localities.

The staff has been increased so that in addition to the chief of the division, who is chief geologist, there is one mining engineer whose specialty is gold and copper, an assayer who has had special training, a coal engineer, a geologist who has had special training in the geology of non-metallic minerals, and assistant geologist with special training in petrography, and two Filipino assistants who have studed in engineering schools in the United States and Europe. Also, the Division of Mines coöperates with the geological department of the University in special research work. For the fourth annual carnival, which took place between February 3 and 10, 1912, a large exhibit has been prepared in which the Division of Mines and the various mining men over the Islands are coöperating. It is expected that within another year the equipment of the Division of Mines will be augmented by the installation of a complete ore-testing laboratory. A lack of funds has delayed this very much needed feature.

On the whole, the Philippine mining industry is in far better condition than at any time in the past, as the unscrupulous promoter has been pretty generally weeded out of the mining element, and the ridiculous prospectuses of the early days have been replaced by more conservative promotion literature. It is almost a certainty that the present mining laws, which have seriously hampered development, will be materially changed in the near future. The labor situation seems to be improving in some quarters at least, and the main thing needed now is capital, with experienced men to properly invest it. The outlook is, on the whole, distinctly encouraging.

The Waihi Grand Junction Co. in 1911 produced bullion to the value of £142,604, an increase of £9081 as compared with 1910. The total value of bullion produced by the mine is £544,714.

Gold Mining in Formosa

By W. M. Knox

Formosa, or Tai wan, as it is called in the vernacular, is a large island lying ninety miles off the southeast coast of China, and extends from 25 19′ to 21 54′N. and from 121 15′ to 122 05′E. It is shaped like an ellipse, with its longer axis north and south, corresponding with a chain of mountains, the Ta shan, which has lofty peaks, one of which is said to reach 12,850 ft. This range divides the island into a broad western versant with alluvial plants, and a narrow eastern versant ending in a precipitous coast line. The western portion was, at the advent of the Portuguese in the sixteenth century, occupied by Chinese, while the rougher central and eastern parts were given over to savage natives. Owing to the hostility of the native tribes, the notorious head-hunters of Formosa, the interior of the island has been very little explored and is practically inaccessible. This being the case little is known of the geology of the mineral deposits and natural resources of this area. At the close of the Chino-Japanese war the island was transferred to Japan, and its administration is now in the hands of that country. Gold, silver, copper, coal, sulphur, and petroleum are the principal sources of mineral wealth. The production of these during the past five years is shown in the table below:

MINERAL PRODUCTION OF FORMOSA, 1906-1910.

Year.	GOLD.		SILVER.		COPPER.		COAL.		PETROLEUM.		SULPHUR.	
	Ounces.	Yen.	Ounces.	Yen.	Pounds.	Yen.	Met. Tons.	Yen.	Gallons.	Yen.	Met. Tons.	Yen.
1906	45,362	1,864,311	13,542	17,072	.....	.....	103,203	340,457	209,238	33,509	801	15,876
1907	39,697	1,632,362	17,442	22,714	103,286	28,912	135,260	481,482	287,048	58,759	1,316	28,494
1908	53,202	2,190,319	32,771	35,232	713,822	179,698	154,324	543,211	212,382	65,600	1,969	44,593
1909	52,657	2,162,830	49,787	51,420	956,241	241,637	183,412	705,686	269,714	29,901	2,162	53,599
1910	53,201	2,184,053	58,189	62,775	988,325	255,120	231,641	824,147	152,810	18,175	2,245	32,725

*1 tsubo = 3.95 sq. yd. = 1/1210 acres.
1 yen = 49.8c.
1 sen = 1/100 yen.

The gold deposits are in the northern part of the island, and consist of both placers and veins. The main alluvial deposits are found flanking the Keelung river, a stream about 30 ft. wide, with a fairly steep gradient. The ground now being worked is that on the benches bordering on both sides of the river. The river bed is too low grade, and the water too troublesome to handle. Claims have been taken up for a distance of about twelve miles along the river bank, but not all this area is covered by mining rights, there being sandy places and barren patches intervening. About 1,500,000 sq. tsubo, or 1250 acres, held at present under mining patents, will cover the workable places. During my trip twenty of these claims were visited and carefully tested by panning, and the whole twelve miles of river was traversed and inspected.

On a claim owned by Kimura, consisting of 600 tsubo, 15 Chinese were at work. One day's output by these miners was purchased for 1.65 yen. The gold was weighed, its value calculated, and the yardage treated estimated, and it was thus found that the value of the gravel treated was less than 5c. per cubic yard. Farther down on another claim 30 Chinese were at work, each averaging about 20 sen or 10c. gold per day, treating 1 cu. yd. per man per day, and paying a royalty to the owner. Another claim gave pannings of about 30 sen or 15c. per cubic yard, but this ground has been almost all worked out. There are in all about 300 Chinese at work in this district, all working on the tribute system. The method of working consists of sorting the fine gravel by hand into small baskets, carrying it and dumping it into small sluices.

The gravel is, on an average, 9 to 20 ft. deep, overlain by a stratum of soil 6 to 10 ft. thick. It varies in size from fine pebbles to huge limestone boulders weighing tons. The bedrock is hard slate and flat-lying shales.

As a dredging venture I regard this district as hopeless, the conditions here making that form of mining impossible for the following reasons: (1) the ground is too low grade, being less than 5c. per cu. yd.; (2) the bedrock upon which most of the gold is found is too hard to be cut by the buckets of a dredge, and consequently bedrock gold cannot be recovered; (3) the area is too limited to warrant a dredge, besides the claims are scattered and not adjoining; (4) the nests of hard limestone boulders would soon destroy a dredge.

The method of mining at present employed, that of tribute by Chinese, is in my estimation the only one suitable for this district. Hydraulicking is not adapted to work here, owing to the flatness of the country and the impossibility of disposing of the large amount of tailing made by that form of mining. A hydraulic giant would soon block up the harbor of Keelung, and for this reason would never be permitted by the Japanese governmental authorities to be put into operation.

This is the most important placer district of the island. Two other small districts are known at the mouths of rivers flowing toward the east coast. Years ago natives prevented work on these and nothing has been done since. The fact that they are not now being worked is good evidence of their not being rich.

The sole district where profitable gold-bearing veins are known to exist is in a small range of hills in the northeastern part of the island, close to the sea. Here an intrusion of andesite in limestone, about 1½ miles in diameter, contains two parallel veins of auriferous quartz, 2 to 20 ft. wide. These fissures are confined to the andesite, outside of which they do not extend.

The Zuiho gold mine, owned by Fujita & Co., is situated on the coast about ten miles southeast of Keelung and one-fourth mile from the shore. There is excellent tide-water transportation; a wire-rope tramway about 6000 ft. long handles ore from mine to mill, working 100 tons per day of about 27 yen ore, which costs 12 yen to mine and mill. The equipment consists of 6 Huntington mills, 8 filter-presses, 18 cyanide tanks, settling-vats, and other machinery. The gold content of the tailing is 2.76 yen. The country rock here is slate and limestone and the gold occurs in two parallel veins, 2 to 20 ft. wide, averaging 6 ft. Nearly 1000 men are employed. Surface men are paid 38 sen per day; 80 sen to miners. The property contains 2,451,360 tsubo and produces about 80,000 yen per month.

The Kinkwaseki gold mine owned by Tanaka & Co., is a little to the north, adjoining the Zuiho mine on the same vein. It is fully equipped, having about 20 stamps, 6 Huntington mills, and works 80 tons per day of 50-yen ore. The cost is 9 yen per ton for mining and 5 yen for milling. This mine produces 100,000 yen per month, and comprises 2,198,400 tsubo.

The Botanko mine, adjoining both these mines, is owned by Kimura & Co. It has 36 stamps, 2 Huntington mills, and full cyanide equipment; it works about 33 tons of 40-yen ore. The cost is 15 yen per ton for working and the output is 150,000 yen per month at a cost of 80,000 yen. This mine consists of 566,083 tsubo.

These mines are not for sale, and as their lines unfortunately cover veins there are no extensions. So it is use-

less for others to try to get a foothold in this district. It may be remarked in passing, that the placer gold found in the district previously described has been derived from the weathering and erosion of these veins. It cannot be seriously questioned that these veins are on the watershed of the Keelung river, and they are beyond doubt the source of all the placer gold on this river. Outside of this district, no other quartz mining is being done on the island, and indeed no other veins are known to exist.

As you leave Keelung to go to Teipeh, the coal mines commence to be seen. No better coal is to be found in Japan proper; many of the seams are from 2 to 10 ft. in thickness. Only one coal seam is known in the southern part of the island and but ten working mines are known to exist in the north.

Timber in the Arisen district is in the interior about 55 miles distant from the west centre; about 560 square miles of timber land averaging 28,000,000 ft. per mile. Many of the trees are 14 to 18 ft. diam., and are known as *hinoke;* they resemble Oregon pine.

At a place called 'Sod' on the east coast is a gold mine owned by a Japanese. The owner started to equip this with modern machinery, but was prevented working by natives who had been prevented from doing placer work at Shaukoran.

At Hokudo north of Teipeh is a large extinct volcano in which is one of the largest sulphur mines in Formosa. Ditosan mountain, nearly 4000 ft. high, in the same locality, contains large quantities of sulphur. From Broutsh, where there is a producing oil well operated by Samuels & Co., down the west coast to Hazen, three-quarters of the length of the island, there are over 170 distinct and well defined evidences of petroleum. In many places the natives simply cut the sod, and it is so saturated with oil that it will burn.

Steam-Shovel Work at Chino

During January 1912 the No. 1 Marion model 91 steam-shovel of the Chino Copper Co., equipped with a 3½-yd. dipper, loaded 101,547 cu. yd. of material in place in 59 shifts. Of this material, 88,172 cu. yd. was rock and 13,375 cu. yd. was earth. The work for the shovel was complicated, as part of the material was waste and part of it was ore, some of the ore having to be sent to the ore-dumps over a haul of 4500 ft., having a total of 225° curvature with adverse grades up to 4.3%; while the other portions of the ore had to be loaded in 50-ton ore-cars for the mill. Out of a possible 590 hours, the shovel was actually loading 505.56 hours, or at the rate of 200.8 cu. yd. per loading-hour. This is thought to be the record for moving material. The conditions were not especially favorable for work during the month. The shovel was served by two trains only, and was somewhat handicapped through having only 12-yd. cars instead of 18-yd. cars. The shovel crews and the train crews, however, took the deepest interest in the work and used their heads to the best advantage to prevent any delays. The actual cost for labor and supplies for this shovel for January was 12.84c. per cubic yard for stripping, and 9.33c. per ton for loading ore.

L. VOGELSTEIN & Co. give the following figures of German consumption of foreign copper during January 1912:

	Tons.
Imports of copper	17,872
Exports of copper	956
Consumption of copper	17,342

as compared with consumption in January 1911 of 12,690 tons. Of this quantity 16,328 tons was imported from the United States.

PLANS are under way for the construction of 16 new nitrate works in northern Chile during 1912, with a monthly capacity of 1,070,000 Spanish quintals of 101.4 lb. each, and giving employment to 6500 men when in full operation.

Liquid Products From Natural Gas

By IRVING C. ALLEN and GEORGE BURRELL

*By fractionating natural gas, either during or after liquefaction, four products can be commercially obtained. Roughly, these four products may be described as follows: (1) The gaseous product, the common natural gas of commerce; (2) the semi-liquid product, known as the new 'wild' product, which should be used only as a liquefied gas and should be held in high-pressure steel containers only; (3) the light liquid product, or light gasoline used for blending with heavy naphthas; and (4) the heavy liquid product, or ordinary high-grade gasoline. The possibility of handling the second product in the way that Pintsch and blau gases are handled, enabling small towns, hotels, and country estates to have the advantage of gas illumination, manifestly opens a new field of comparatively great importance in the natural-gas industry and should add materially to the investments made in it.

The liquefaction of gases by pressure is not a new industry, but only recently has its application to natural gas been recognized as practicable. Until the past two years the general practice followed in the manufacture of liquid natural gas was to make the product by compression of the gas in single-stage compressors operated at a pressure of 150 to 300 lb. per square inch. The one product obtained, so-called 'natural gasoline', was run into a tank and 'weathered.' The weathering consisted in allowing the lighter portions to volatilize spontaneously and escape into the open air until such time as the boiling away of the liquid had practically ceased. Thus the process involved a loss of 25 to 50%, or even more. This loss was an absolute waste, not only of power and of cost of operating the engines and compressors, but of the product itself.

The next step in the industry was to pass the waste gases (of which only the small quantity used for power had been utilized) from the single-stage compressor through a higher-stage compressor, thereby getting a second and more volatile product—a 'wilder' liquid—which was run back into the first and mixed with the first or heavier condensate. This mixture was then again weathered to a safe degree, whereby it lost the greater part of the more volatile product than had been condensed in the second stage. Recently the process has been improved another step, in that the first-stage compressor product is run into one tank and handled as ordinary gasoline; the second compressor product is run into a second tank and handled as lighter gasoline, with which the heavy refinery naphthas can be enriched.

The last-mentioned method of using the second-stage compressor product should receive wide recognition, and a market for the product should develop that would be no mean factor in the industry. Blending in the proportions of, say, one part of the product to four or five parts of the refinery naphthas makes these heavy naphthas more volatile and of greater value as fuel for automobiles; it also greatly increases their general usefulness. The proportions to be used in blending, however, must be determined more definitely by test. The natural gas of this country frequently contains light products that do not condense in the second-stage compressor, and for which it is practicable and necessary to install three, four, and even higher stage compressors. These light products, true gases at ordinary temperatures and pressures, can be compressed and liquefied, but the liquid gases so obtained must be handled as gases and not as oils.

The mistake heretofore made in the 'natural-gas gasoline' industry, as some have recognized, has been the attempt to handle the light gaseous products as oils and not as gases. Until the manufacturers of this lightest third or fourth-stage compressor product recognize its gaseous nature, the absolute necessity for insuring the safety of the public involves certain restrictions in its transportation, and not until it is realized that this extremely volatile liquid should be handled only in strong steel containers capable of withstanding high pressures will it be transported with safety.

*Abstract from Technical Paper No. 16, Bureau of Mines.

Rogue River Gravel Beds

By Clement H. Mace

In the present search for new dredging fields, the gravel deposits along Rogue river, in southern Oregon, should not be overlooked, and merit careful investigation. The Rogue is a clear mountain stream rising in the Cascades and flowing through the valley of Medford and Grants Pass, now famous for its apples. As compared to the physical surroundings of most mining districts, this region is a paradise, especially to one accustomed to desert or high altitude mining camps. The hills are covered with pine, fir, maple, oak, manzanita, and laurel, while here and there along the river are orchards of apples, pears, and peaches, and vineyards of every variety of grapes. A few miles northwest of Merlin the river narrows to a gorge known as Hell Gate, and from there to the coast flows through rough country. The available dredging ground is therefore confined to Jackson and Josephine counties. The river has a velocity of from one-half to two miles per hour and is subject to sudden rises in the winter, the rainy season in Oregon.

THE ABBIE J. CHAMPLIN.

ALONG ROGUE RIVER, OREGON.

In the early days considerable gold was won by wing-damming the river and cleaning the bedrock. At Gold Ray, while constructing a large power dam, it was necessary to build a cofferdam, and from 100 sq. ft. of bedrock thus exposed $1750 in gold was obtained. A nugget worth $289 was picked up years ago in Spanish gulch near the river. The pocket from which it came was never found, however. Below Grants Pass there is an ancient channel to the west of the present bed of Rogue river, in places adjoining it and in others a mile or so distant. In recent geological times the river has been in its eroding stage, leaving the old channel high and dry, and hydraulic mines on it are throwing their tailing into the present stream. These mines claim they are losing 40 to 50% of their gold, which of course is being added to the gravels of the present channel.

In Sections 2 and 11, Township 36 S., Range 7 W., the river makes a big bend, with the ancient channel cutting across the open end of the U. At the lower side of this bend bedrock is slightly above the surface of Rogue river, and a hydraulic mine at this point has exposed 75 to 100 ft. of gravel with 10 ft. of overburden. Reposing on the upturned slate bedrock is 15 ft. of a rather stiff blue gravel. One pan (small size) taken in this blue gravel gave twenty good-sized colors weighing 0.018 gm. Estimating 135 pans to the cubic yard, the value per yard would be $1.60. The channel exposed so far is 600 to 700 ft. wide, and the back rim is not reached yet. The surface gravels were tested both by pan and rocker, and colors were always obtained wherever the gold had a chance to deposit; that is, where the sand was heavy and contained a fair sprinkling of boulders. In a few places a third or a half of a cubic yard was measured off and put through the rocker, and these tests returned an average of 25c. per cubic yard.

Owing to the selective action of running water, the richest streaks are found on the concave side of the river bends, as these points represent the region of slack water. The swift current is continually cutting out the convex side of the curves and re-depositing its burden on the inside of the next bend. The gold is coarse with rough edges, which indicates that it has not traveled far. It is mostly scale and plate gold and generally melon-seed shaped. In places the colors are very large, but no nuggets are found in the gravels.

For the most part the boulders are small, averaging under 6 in. diam., and there is no clay except in part of the overburden. There are places along the present channel where the gravel is only 4 ft. thick, and others where it is evidently at least 30 ft., but where the gravel in the ancient channel is exposed by hydraulic operations it varies from 75 to 150 ft. in thickness. Bedrock consists of upturned slate beds that are hard where exposed to the river action, for the running water continually wears away any disintegrated material. But under the gravel, in places where it can be observed, the slate is soft and decomposed and could be picked to a depth of a foot or two. Benches along the river have been worked in a desultory sort of manner by means of a gasoline-driven pump and sluices. The gravel was fed to the sluices with wheelbarrows and the men cleaned up from $2 to $3 per day each.

MAP OF OREGON.

The only dredge in Oregon that is working successfully and returning a profit is on Foots creek, a tributary of the Rogue, between Gold Hill and Woodville in Jackson county. Near its junction with the river, Foots creek spreads out in a broad fan-shaped delta, and on this tract the dredge *Abbie J. Champlin,* owned by the Champlin Gold Dredging Co. of Chicago, has been working for several years. Recently, however, the dredge met with a serious accident. The heavy bucket-ladder line broke and sank the boat in its pond, but it is understood that the damage will be repaired at once.

The prospecting was done with Keystone drills, there being too much water in the ground for shaft-sinking. Subsequent dredging gave slightly higher results than the test holes. The boat was built by the Allis-Chalmers Co. and is equipped with 8-ft. open-connected manganese steel buckets weighing over a ton apiece, exclusive of the link. Lighter buckets were used at first, but were found inadequate to handle the heavier boulders and were replaced by the present set at a cost of $9000. Too light construction seems to be the principal reason for the failure of several dredges in Oregon, and future undertakings should profit by the lessons of the past and ereet no more monuments.

Electricity from the Ray power-plant operates the boat; 250 hp. is used. Two 12-hour shifts of three men each are worked; a winchman, a pump and motor man, and a deckhand. The buckets are run at a speed of 7 per minute, the actual working capacity of the boat being 2000 yards per day. Bedrock is not reached and is supposed to be 100 ft. deep on the average, while the dredge digs but 40 ft. The gravel from the buckets is fed to a trommel and the boulderes discharged through this over the side of the boat. The undersize passes over a set of riffles to a sump or well, whence it is elevated by a huge centrifugal pump to the tail riffles shown in the foreground of the illustration. These long sluices are supported in the centre by an auxiliary barge. The major portion of the gold, however, is caught on the boat before reaching the tail sluices.

No gold-saving tables of any kind are used, as it is claimed that the gold is all coarse enough to be saved by Hungarian riffles, though it would seem that there must be a certain amount of fine gold being lost. The gold averages 850 fine. According to the figures of the U. S. Geological Survey for 1910, $34,010 was produced in Oregon by gold-dredging.

New York as a Metal Market

The following letter, written by J. H. Lang, recently appeared in the *American Metal Market:*

Changes recently made by the New York Metal Exchange and shortly to become effective are two in number, both relating to tin. (1) The adoption of a standard form of contract covering all kinds of trading, whether on or off the Exchange. This contract makes for clarity in dealing; defines the rights of both parties and minimizes the possibility of misunderstanding. It has already been agreed to by the leading importers and dealers, and will be generally adopted. (2) Postponement of the daily call from 12:30 to 1:30 p.m., so that the closing prices from London may be received, and operators and dealers who base their transactions thereon be fully advised.

The object of both these changes is to extend and broaden trading on the Exchange. It is believed that consumers and the trade generally will find it to their advantage to send orders to the Exchange, and that business will be chiefly done there hereafter rather than by private negotiation as at present.

On account of the new rules of the London Metal Exchange forbidding trading in Straits and Australian tin, business on the Exchange there has been greatly curtailed, and exchanges have been established in Hamburg, Berlin, Havre, and other European cities to take advantage of this situation. Most of the business done in London originates in America or is based on transactions here, and the Governors of the New York Metal Exchange would have been derelict in their duty had they not also made an effort to avail themselves of this opportunity to secure for the local institution the important position it should rightfully occupy.

It seemed wise to start with tin in the attempt to make the New York Metal Exchange what it should be and once was—the real metal market of the country and a factor in the metal markets of the world, because there is an open market for tin and considerable speculation in it, and America uses nearly half of the world's production and three-quarters of the Straits production. New York has the men, the money, the material, and the machinery for doing the business, and there is no reason why it should not be done here. Another reason for keeping this business at home is that the rules of the London Metal Exchange permit transactions akin to what is commonly known here as 'bucketing'; that is, it is not compulsory in London to execute orders on the Exchange and buyers ha : no assurance that they are so executed. In fact, quite frequently they are not executed, but are taken for account of the brokers or dealers themselves, or used as offsets against other orders, a practice not sanctioned in this country. While the London Metal Exchange was revising its rules, it should have reformed this abuse.

The promoters of this movement in New York hope eventually, after trading in tin has become established, that trading in pig iron, copper, lead, and spelter will follow. The theory of restricted markets, eliminating speculation, of cutting out brokers, jobbers, and middlemen, of producers selling direct to consumers only, etc., which accompanied the consolidation era in the early nineties, will eventually be superseded by a more liberal and intelligent policy. Necessarily so, for while an individual may elect to sell only for certain prescribed deliveries, and decide to whom he will or will not sell, such methods when followed by a corporation doing an interstate business in staple commodities are of doubtful legality. It is not the policy of the state to create a corporation which may discriminate among the citizens of the state. The inventors of this system doubtless had an eye to the main chance, but are beginning to find that knowledge which comes from control of a market is of little value if it cannot be used, and it cannot be used in a market where there is no trading.

That is the situation here at the present time, and as a result all American business goes to England, encountering there the adverse conditions referred to above. From whatever motive considered, it is of decided advantage to build up the New York Metal Exchange, and it is hoped that efforts to that end will have the unanimous support of the metal trades.

A Proposed French Copper Exchange

By James E. Dunning

In January a meeting was held at Havre to discuss the establishment of a regular copper exchange. There already is a good market for spot copper at this port, and what is desired is the admission of quotations for futures. The proposals of the commission having this matter in hand comprise, among others:

"Futures shall be on a basis of 25 tons; brokerage shall be, for both spot and future delivery, ⅛% for purchase and ⅛% for sales; the Caisse de Liquidation (the Havre commercial clearing house) shall register all business in copper for a commission of 1 franc ($0.193) per ton; the deposit shall be 100 francs ($19.30) per ton; differences shall be calculated at 1 franc or loss per 100 kg. (220.46 lb.); telegraph expenses shall be calculated at 0.25 franc ($0.05) for each contract."

The Havre Chamber of Commerce has approved the propositions made to it by the Syndicated Chamber of Sworn Brokers, for the establishment during 1912 of a committee charged with drawing up official quotations, appearing twice weekly, of copper futures. The total importations of copper into France during 1910 were 80,676 tons, of which 51,391 tons came from the United States. During this same year the copper importations at Havre amounted to 50,820 tons.—*From a Consular Report.*

The Austrian Government has bought the only two radium mines at St. Joachimsthal, that were owned by private individuals. The purchase price is said to be $609,000. It is estimated that the two mines will annually yield about 3 gm. of radium and 3000 kg. of uranium salts; the latter valued at $30,000.

Agglomeration of Fine Materials

By Walter S. Landis

*The earliest example of attempting to form finely divided materials into larger masses for more proper adaptation to commercial use was probably the briquetting of peat and lignite-waste at Paris by the use of clay binder. It was from this attempt that our word briquette has arisen (Fr. *la brique*), the formed masses being shaped similar to the ordinary bricks. This term does not, however, lend itself to the many shapes of such formed material as are now being produced, as few of them, outside of some of the European brown-coal products, bear any resemblance to the shape of that well known article. I have therefore chosen the term 'agglomeration' as more accurately descriptive of the products now being manufactured, this term including the molding as well as the sintering processes.

With the increasing prices of fuel and ores and the greater demand for economy in the operation of industrial plants more attention has been paid in recent years to the utilization of waste products and low-grade ores and fuels. Much of the waste has been occasioned by the inability to utilize finely-divided ores and fuels in the furnaces because they could not be kept there, or else they clogged up the furnace shaft so that gases could not be forced through under ordinary conditions of operation. As a result all the fine was thrown on the dump. Again, with the exhaustion of the richer deposits of ores, concentration of lower-grade ores becomes a necessity, and most concentrate is produced in a finely divided condition. Aside from these considerations there is also the economy in the cost of operating the plant; a furnace running on agglomerated material will have a much greater output than one working on fine. In one case the charge of an iron blast-furnace was changed from fine concentrate to briquettes and the output was increased four-fold; better results could have been obtained had facilities been at hand for taking care of the increased output.

To attempt to catalogue all the materials that have been agglomerated by one or another process is manifestly impracticable, and I have given here only a list of a few of the more important ones at present attracting attention:

I. *Fuels.*—In the mining and preparation of fuels like coal and lignite much fine material is produced. Also certain lignites slack and fall to pieces on storage. The agglomeration of this fine has long been practised in Europe, where fuel is scarce and expensive, and the U. S. Geological Survey and Bureau of Mines have been active in calling attention to this phase of conservation of our own fuel-supplies.

II. *Concentrate.*—The shaft-furnace is probably the most economical of our smelting devices when fed with lump material. Also the economy incident to the smelting of pure ores in such a furnace is too well known to merit discussion here. This has led to a wide application of ore-dressing to prepare such pure material, and since nearly all dressing operations require more or less fine crushing of the ore, it is almost a necessity that some agglomerating device be used to prepare the concentrate for advantageous blast-furnace use. In the United States the agglomeration of magnetite concentrate has received considerable application.

III. *Fine Ore.*—Years ago many metallic ores, particularly those of iron, were plentiful and cheap. Furnace-men would not accept fine ore, and as a consequence large quantities of this material accumulated at the mines and the furnaces. With the increasing cost of ore the heaps of fine all have increased in value and may be profitably agglomerated and sold. Moreover, the long hauls and frequent transhipments necessary with many ores in the United States cause much breakage, and this condition opens up another field for the industry.

IV. *Flue Dust, Sweepings, Etc.* The disposal of the dust carried out of blast-furnaces has frequently offered a disposal problem quite comparable with the actual intrinsic cost of the dust to be handled. The agglomeration of this material, together with the sweepings of the plants, is now attracting the attention of the industry, and great saving would be attained by charging all such material back into the furnace in such form that it will not again be blown out. In the year 1910 the United States produced nearly 28,000,000 tons of pig iron. A conservative estimate of the flue-dust made by the blast-furnaces in the same year is 3,500,000 tons, carrying at least 35% of iron. At a low value of 4c. per unit of iron, this dust cost almost $50,000,000 for its iron content alone, not to mention another $1,500,000 worth of coke contained in it. Surely a process that would enable the utilization of this enormous by-product is worth attention.

V. *Scrap Metal.*—Even finely divided scrap metal, such as filings, chips, etc., are now being formed into briquettes for more efficient handling. Sometimes flue-dust, sweeps, etc., are agglomerated together with the metal, the whole making a mass possessing many advantages in certain branches of metallurgical treatment. No single method of procedure is applicable to the treatment of the widely different materials listed in the above five classes. In fact, the diversity of the agglomeration processes used makes it somewhat difficult to outline a simple classification which will be comprehensive, and the classification here proposed may sacrifice completeness for simplicity. In general the agglomeration processes may be divided into:

I. Those utilizing certain properties in the material for producing the desired coherence.

II. Those obtaining coherence through the addition of a foreign substance or binder.

Under group I are four classes:

1. Certain materials when moistened with water and molded into form and dried possess considerable coherence. Ores carrying soluble salts, clay, easily hydrated compounds, etc., are frequently found amenable to this simple treatment. A few iron ores and roasted products are actually treated in this manner, but the product possesses the great disadvantage that on heating to a temperature sufficiently high to drive off the water the briquettes fall to pieces.

2. Pressure greatly assists in developing the cohering power of many materials; probably if a high enough pressure could be uniformly applied throughout the mass to be formed, all substances would agglomerate under this treatment, but the use of pressure alone is limited to but very few cases in practice. Sometimes the best results are obtained on dry materials, sometimes a certain amount of moisture is necessary; the pressure so far used runs up to about 2000 atmospheres.

3. All materials on being heated to a high enough temperature pass through a pasty or semi-fused state and cohere to such a degree that on cooling a more or less firm mass results. This phenomenon is called sintering. If done in a rotating furnace or rotary kiln the sticky masses roll together like snowballs, and small round particles are formed which are called 'nodules'; the process is called 'nodularizing.' This same sintering property of a material may be taken advantage of by molding the material into briquettes, using only a slight pressure to insure filling the mold, then burning the briquette so formed at a temperature that will insure cohesion. This is the principle of the well-known Gröndal process.

4. This class is represented by processes employing a combination of pressure and sintering. It is difficult to fix exactly the limits which differentiate a process truly belonging to this fourth class from one of the third, since the difference is wholly in the degree of pressure employed. I have chosen arbitrarily to place in this fourth class all processes which use pressures exceeding 30 atmospheres for the formation of the briquette. The best example of this fourth class is the originally Ronay process as installed at Catasauqua, Pennsylvania, in 1904. The Ronay process has since been modified by limiting the attempts to apply it to ores which will agglomerate under application of high

*Abstract of a paper presented at the New York meeting of the American Institute of Mining Engineers, February 19. Preliminary edition.

pressure alone, without the necessity of afterward sintering them.

Under group II are included the greatest developments of the briquetting processes. The use of a binder for causing the agglomeration much simplifies the whole operation, as the binder acts like a cementing medium to hold the inert particles of material together. It is almost impossible to list all the binders that have been used; a few of them are clay, lime, ground slags, natural and portland cements, water-glass, kieselguhr, carnallite, tar, pitch, asphalt, petroleum, sulphite residues, naphthaline, paraffine, molasses, resin, starch. Most of these act of themselves without taking further precautions other than to insure a thorough mixing with the material to be briquetted. Others require that the briquettes be aged, or even heated after formation, to temperatures up even to redness.

The operations of group II may therefore be divided into three sub-classes: (*a*) processes in which the binder is mixed with fine and molded under low pressure; (*b*) processes in which higher pressures are used along with the binder; (*c*) processes in which a binder and pressure are used together, with a subsequent heat treatment. The first two are self-explanatory; the last may be subdivided into processes which use a baking in superheated steam, or even agglomerating in a furnace, such as, for instance, where lime is added and later passed through an agglomerating press.

It does not seem to me that proper attention has always been paid to the selection of a binder for the particular case at hand. Too often is the intrinsic cost of the binder the main item in its selection, the subsequent cost which it entails in passing through the smelting or refining furnace being entirely overlooked. The waste-product possessing binding power may become very costly if it entails the production of an extra amount of slag to be smelted, or introduces in the furnace product a small amount of impurity which is difficult to remove afterward. Where limestone is an essential ingredient of the furnace charge, lime can be profitably used in considerable quantities as a binder. If the materials are self-fluxing, a minimum of binder should be used, no matter what its composition may be.

Pressure increases the effectiveness of all binders, enabling one to obtain the desired results with the use of a minimum of extraneous material. Around metallurgical works, where power is usually cheap, an extensive investigation of the most economical balance between binder and pressure should be carried out. The importance of the industry is such that soon some enterprising briquetting company will erect a central testing plant similar to an ore-testing laboratory, and such questions will be absolutely settled for each particular case at a minimum cost.

The physical properties which a briquette should have may be summed up as follows: It should be strong enough to stand handling without undue breakage. The simplest test to determine this property is a drop test. A number of briquettes should be dropped from a height of at least 6 ft. upon a hard stone surface. Not over 25% of the number so dropped should break, and none of the broken ones should fall to powder of the original texture of the material before briquetting. The breaking of a briquette into two or three pieces is not a serious matter, but in no case should it pulverize.

Where the agglomerated material is to be stored or transported before use, a weathering test should be applied. Storage in the open which subjects the agglomerated material to rain, snow, frost, and sunshine should be resorted to, since none of these agencies affect a well made product. For proper reduction in the shaft-furnace, the agglomerated material should be porous. Where briquettes are to be tested, the dropping of water from a measuring device upon the known volume briquette gives a fair test if care be taken to do it slowly and carefully, so that no more is measured out than is absorbed by the mass. A simpler and easier test is made by weighing the agglomerated mass and submerging it under water for at least 24 hr. and again weighing. This may be hastened by assisting in the displacement of the entrapped air by performing the absorption under a vacuum. A good briquette should show a porosity of 20%; that is, should take up 20% of its volume of water. One of the greatest drawbacks to the nodularizing process is that the nodules are non-porous, and therefore difficult to reduce. The addition of lime to the charge of the nodularizing kiln somewhat counteracts this tendency to form non-porous nodules, but unless carefully made the nodules will not withstand some of the other tests recommended.

Disintegration should not follow the exposure to water-vapor at 150°C. This test is best performed by submitting the briquette to a steam-pressure of 60 lb. per sq. in. for several hours. The top of the furnace contains vapor at this temperature, and care must be taken to submit briquettes containing certain binders to this test, since some of them will fall to pieces under the action of hot water-vapor. Briquettes should not disintegrate when heated to redness. The test can best be done in a muffle, and, if conditions permit, should be in an atmosphere of carbon monoxide and dioxide. Many of the hydrated briquettes, or those bound together by hydrating influences, will not stand this test. Of course, it is understood that no briquette should contain a binder that exerts a harmful influence on the product of the furnace. No sulphur compound, for instance, should ever be introduced into a briquette to go into an iron furnace.

Cornish Tin Mines

The St. Ives Consolidated, an aggregation of old tin properties in the neighborhood of St. Ives, Cornwall, under the control of the Schiff-Dietzsch group, is asking for more capital and offering debentures for subscription. The same group now wants £60,000 for their St. Agnes Consolidated, which was formed more recently to acquire the West Kitty and other properties in the St. Agnes district. Reports by Ferdinand Dietzsch, the company's consulting engineer, and by William Thomas, of Camborne, have recently been issued. The further funds are required to provide additional stamping power and equipment for West Kitty, and presumably in part to meet existing liabilities, seeing that the consulting engineer estimates that an expenditure of £39,052 will cover his proposals. The capital of the company is £175,000, of which £137,500 has been issued, and £125,000 in 6% participating bonds has been authorized, and £35,000 subscribed. If the debentures now offered are all taken up, the liabilities of the company will be £232,500. In spite of all the possibilities of West Kitty and East Blue Hills, the only properties of the group receiving attention, it will be many a day before the profits will be sufficient to pay interest and dividends on so great a sum. Mr. Thomas speaks highly of the recent discovery in the cross-cut at the 80-ft. level between the Friendly and Reynolds sections, and he anticipates that by deepening the shafts on those properties the lode will be intersected in each. The letter accompanying the reports states that "when the full 60 stamps are completed and all at work, it is estimated by the engineers that they can deal with at least 200 tons of ore per day, which, taken at the moderate assay-value of 45 lb. of tin oxide per ton, would yield about 4 tons of tin oxide per day or 100 tons per month, equal to over £10,000 in value." In face of the fact that the ore being milled at West Kitty shows a recovery of less than 14 lb. per ton, and that only low-grade ore has so far been opened up at East Blue Hills, 45 lb. recovery on a monthly tonnage of about 5000 tons is an optimistic anticipation, especially at this stage in the development of the recent discovery. But West Kitty has great possibilities, and if the company had been moderately capitalized, investors would have had no reason to regret their connection with the property.

THE report of the South African Gold Trust for the year ended December 31, 1911, shows a net profit of £107,976. A final dividend of 2s. per share has been declared, making a total of 3s. 6d. for the year, and £88,804 carried forward.

Gold and Silver for Jewelry Manufacture

The raw gold and silver used in jewelry manufacture in Germany are obtained from the banks or from the smelters, the important one of the latter being at Frankfort. It is a very interesting fact that gold coins, such as 10-mark and 20-mark pieces, having a fineness of 900, are used largely as material, and the imperial mint frequently turns out these coins in vain, as they remain in circulation for only a short time. The local branch of the Reichsbank issues 20-mark pieces unstamped at the price of 20.06 marks ($4.7743). This gold is thus money and material at the same time, and the manufacturer is in a position to melt the credit afforded him by the banker. Naturally the business standing of the various merchants is watched closely.

Many concerns have come into being through methods of reclaiming and using waste gold. By means of various processes, some very complicated, the particles of gold are extracted from the wash-water, the workmen's overalls and towels, polishing cloths, and other material. Some proprietors of these concerns furnish manufacturers with free aprons, blouses, polishing cloths, towels, and head cloths for women who do polishing work, and sometimes pay for this privilege, in return for which they retain the gold they are able to recover.

The price of gold in July 1911 was $666.40 per kilogram (2.2 lb.), at which it has stood for some time. The price of silver is subject to great variation. In 1905 it was $18.33 to $23.09 per kg. Platinum costs $1190 to $1356.60 per kg. While in 1892 platinum could be bought for $261.80 per kg., or half the price of gold, today it costs double the price. Platinum is used more and more in the manufacture of jewelry, and in Pforzheim $1,190,000 worth is used in a year.

There are great losses in the manufacture of jewelry, and on an average, in a medium-size factory, unsold goods of a value of about $2380 must annually be melted up, which means a loss of about $1666 in wages and manufacturing costs.

According to a British Government report under the census of production act, the actual cost of production, without the manufacturers' profit, of certain classes of jewelry in Great Britain in 1910 was as follows: Goods made wholly or in part of gold, including mounted articles, £495,000 ($2,408,900); gold leaf and gold thread £88,000 ($428,250); goods made wholly or in part of silver, including mounted articles, £1,844,000 $(8,973,825); stampings, handles, and other parts for silver goods, £15,000 ($73,000); total gold, silver, and electroplated goods, £4,939,000 ($24,035,650); gold chains, £654,000 ($3,182,700); silver chains, £49,000 ($238,450); imitation, £55,000 ($267,650); other jewelry, gold, and platinum, £1,762,000 ($8,574,775); silver, £177,000 ($861,370) imitation, £231,000 ($1,124,160); gold and silver articles not separately distinguished, £240,000 ($1,167,960); total jewelry of all kinds, £3,292,900 ($16,020,500); total value of all goods made of precious metals and work done in the United Kingdom, £8,563,000 ($41,671,850).

The value of the jewelry manufactured in the United States in 1909 was over $80,000,000, of which $36,000,000 represents the cost of the raw materials used.—*Daily Consular and Trade Reports.*

Federated Malay States Gold Output

The quantity of gold exported during the month of December 1911 was 768 oz. from Raub. The total amount exported during previous months of the year was:

	Ounces.
From Seremban	241.79
From Raub	6,909.00
Total	7,150.79

This, with 768 oz. exported during December, gives the total of 7918.79 oz. exported for the year. The duty collected was ₱2105.48. This includes ₱377.50 as the amount of royalty collected on gold not exported from Kuala Lipis. It is reported that the amount of gold purchased by gold buyers in Batang Padang (Perak) during the year was 1077.6 tahils, which i equivalent to 1309.57 oz. No duty or royalty was collected on this. In 1910 the amount reported to have been purchased was 898.5 oz. Comparative figures of gold exported and duty collected are as follows:

	1911.	1910.
Gold exported (oz.)	7,918.79	15,868½
Duty collected	₱2,105.48	₱14,091.64

There is a decrease of 7949.71 oz. in 1911 against 1910, and a decrease of ₱11,986.16 in the amount of duty collected.—*In Tinland.*

Trestles for Pipe-Lines

Where pipe-lines have to be laid across rolling country, it is obviously impossible to keep the pipes always just beneath the surface, for the line of pipe should be kept as nearly straight as possible. This is not because a straight line is the shortest distance, thereby economizing in pipe and fittings, for the cost of trestles and deep cuts will often be much greater than the cost of the extra length of pipe required in following the surface. But the important point is that a loss of head results from every change in

INEXPENSIVE PIPE TRESTLE.

direction of the flowing stream, and unless the line of flow is kept straight or in gentle curves, a prohibitive amount of pressure head may be lost. The line of pipe must be kept in sweeping curves, and it will be worth while to spend considerable sums to secure this. High points may be crossed by deep trenches, while narrow gulches may be spanned by a simple trestle, like that shown in the illustration. This is made of hewn or split timber, obtained nearby, the simple form of Howe truss serving for the central span. The railroad bridge in the background is a similar, but more elaborate, type of construction and the two together illustrate the fundamental principle of engineering; making a dollar go as far as possible. The light, cheap construction of the pipe trestle is amply good enough for the service required of it, while the heavier service on the railroad necessitates heavier and more expensive construction.

The gentle sag of the pipe-line over the trestle serves, to a slight extent, in compensating for expansion and contraction due to changes in temperature, where these are not too extreme. The water flowing through the pipe is not ordinarily in any danger of freezing, unless the velocity of flow is very slow. Where freezing is likely to occur the pipe can be housed in roughly with thin boards and the space between filled with moss or any other non-conducting material that is convenient and cheap. Air vents should be provided at the top of each vertical curve in the line.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Is 'Cheap' Labor Economical?

The Editor:

Sir—It is, of course, a truism that a definition of terms is required in discussing this subject, as stated by C. R. Gent in his interesting communication which appears in the December 30 issue of your paper. No abstract comparison, can, in fact, be made as to the merits of African, Chinese, Indian, or Mexican labor and that of the 'white' races from the point of view of economy. Concrete cases, either of mines, or of certain limited districts of a given country, must be taken if positive and conclusive data are to be obtained as to the relative working efficiency of so-called 'cheap' and 'dear' labor. In each case the labor will be dear or cheap according to the results obtained, that is, ultimate results in the shape of decreased costs, or their reciprocal—increased dividends. It is hardly a fair statement of the case to say, as Mr. Gent does, "that when a mine will not pay for the skilled labor that is necessary to properly extract the ore, it is time to close down." With labor slightly less skilled, but considerably lower in price, not only might it not be necessary to close the mine down, but lower working costs and increased profits might result from the change.

As regards Mexico, let us take the concrete case of the Natividad mine, in the district of Ixtlan, Oaxaca, where an approved system of working costs is kept and available for careful comparisons. Here all drilling is done by hand, although ample water power could have been harnessed for the purpose. The rock is harder than is to be found in most of the mines of Mexico. There is no doubt but that more could be got out of the labor supply and better economy by using machine drills both for development and stoping. The economy here in stoping operations would be much less than in development, as the costs are now very low, as will be shown, for in development so much depends on being able to drift rapidly, and machine drilling becomes important. So much for the drills. Now as to the labor.

From an economical point of view the efficiency of this can be measured by the cost of the work. In the great variations that occur in mining work, there is always a difficulty in comparing results even under similar conditions, but it is possible to get at it fairly closely, particularly in such expenses as driving costs, where nothing but the hardness of the rock and the cost of supplies are the variables that have to be taken into consideration in order to gauge the other variable of labor. And if a hard rock can be driven in the United States for $10 per foot and in Mexico for $10, there can be no argument as to the comparative 'cheapness' of the labor in this case. The figures given below will still further strengthen this case. Costs per ton of ore mined are not generally comparable, because many mines have wide veins, timbering costs differ enormously, and there are other variable factors. The following costs will be seen to be very low in the case of the mine in question, as conditions are almost all unfavorable, namely, a hard vein, false walls requiring much timbering (700,000 ft. of timber in the costs shown), high cost of supplies, a small tonnage, and a large amount of development necessary per ton of ore developed. The other factor, labor costs, stands out very strongly. The cost is the total for 1910 reduced to United States currency and the short 2000-lb. ton, and includes development. As regards the driving cost, it is also an average, taken on over 3000 ft. of work under all conditions. Some of the places in the upper part of the mine have soft rock and would help to bring costs down, but most of the work was done in hard andesite and indurated slate.

Shaft-sinking at the Natividad mine, 3 compartments, cost per foot	$22.55
Total mining cost per ton (1910)	2.74
" " " (1911) Jan. to June	3.14
Average cost of shafts, drifts, raises, winzes, etc., per lineal foot	6.94

(The last cost is made up on 1716 ft. of development done January to July 1911, including 118 ft. of sinking a 7 by 15-ft. shaft and 313 ft. of winzes and raises. Cost includes all expenses against development.)

Compare now these costs with those of other important mining centres, such as those given by J. R. Finlay, for example, in his 'Cost of Mining', covering four districts (Rand, Goldfield, Kolar, and Cripple Creek), and then decide whether the labor with which such a result is achieved is cheap or the reverse. These figures bear out the opinions of many that development work can be done in Mexico almost for the amount in pesos which it would cost in dollars in the United States; and this is directly attributable to the labor. As to machine work, many cases can be recalled where Mexicans did nicely on machine contracts at a price no American would take, although many offered.

But there is another important point, seldom touched upon in connection with Mexican labor, and doubtless the same is true of native labor wherever employed, and that is its abominable handling by American or foreign overseers, speaking, of course, here, from a purely economical point of view. Starting on the principle that labor is cheap, they so often make it vastly more expensive than any other in the world, solely by their mismanagement of it. The shift-boss who does not profess to speak Spanish "but can make himself perfectly understood by the natives" as the saying is, has his gang of men stand idle for an hour while he attempts to give the poor benighted heathen an object lesson as to how the work should be done. This type of man would no doubt consider Mexican labor 'dear', and so do the stockholders who have to pay for it. This is a fair example, and it is repeated *ad libitum* throughout this country. And when the system is extended to every grade and class of work, and to large companies, the aggregate lack of efficiency is very great. The South African plan of depriving the stockholders of companies of their fair dividends (there is little enough profit as it is), in forcing costs up, by making it illegal for the black to do the work of the white, when the experience with the Chinese, and during strikes, has shown that the former could do it as well (dollar for dollar) as the latter, and far cheaper, is not particularly to be commended. The result is that while white labor is employed underground in South Africa doing work which the blacks and Chinese could do cheaper, the mines are closed down. Much the same atmosphere exists in Mexico in this respect: that is, among a certain class of 'white men', there are those below who fear they would lose their jobs, or that the work would be lowered in dignity if the Mexicans could do it, and those above, who prefer to have men under them to whom they can explain their orders without fear of misunderstanding from linguistic shortcomings. They are not themselves footing the bill.

There is no doubt but that very few attempts are made, in mining, to get the best results out of the native labor, in fact, the usual thing is to work the other way. And among Mexicans themselves there undoubtedly exists a perfect knowledge of the fact that self-respecting Mexicans, the very element that should be encouraged, would rather work at anything else than in a mine run on the usual English-speaking plan, and that only those who do not take offense at the continual punctuation of orders with offensive expressions are those who are preferred in most foreign companies. There are doubtless many exceptions to the rule, but, as a general thing, there is no doubt that the native labor is about as poorly handled as it well could be. The whole thing hinges upon whether the companies are to be worked for the benefit of the stock-

holders, or for that of those who want to hold their jobs. That all 'cheap' labor furnished by Mexicans is bad, would be about as good a generalization as to say that all high priced labor is good, and if a mine is to be worked in the interests of the stockholders (the only light that is reasonable), Mexican labor should be handled by Mexicans, so far as it is economical to do so, that is to say so far as it is possible to find competent Mexicans to do the work. Patriots will never be lacking who will spread the news that such a method has worked to the sorrow of the company that does such a thing, but facts point the other way. All this does not mean that a good white man, with a good drill and plenty of air behind it, will not do work that will throw everything the average Mexican can do, into the shade. He will run away from him, of course. But a good Mexican machine man will take a contract on the same work at a figure upon which the American would starve, and will stick to it. This is the ultimate test of cheapness.

Speaking of the labor problem in Mexico generally, it requires a lot of attention and patience, and it needs capable men who are willing and able to explain and to teach where necessary, the work that has to be done, if the natives are to be educated and built up to modern requirements, and the desired results obtained. To educate the Mexican up to doing his work properly is not going to deprive any white man of his position, for cheaper costs will allow industrial and mining expansion, and there is still room in the world for all. It is hard to imagine any subject of greater importance to the mining industry everywhere than the one under discussion. On a proper grasp of it depends, in many cases, whether an enterprise shall be a failure or a success.

GEORGE SPENCE.

Mexico City, Mexico, February 28.

Nicaragua and Its Possibilities

The Editor:

Sir—The paper on the geology of the Pis Pis district, by Oscar H. Hershey, is one of the most interesting communications regarding that district that I have read in a long time. In October 1910 I had the pleasure of preparing a paper for the American Institute of Mining Engineers on 'Mining in Nicaragua.' Up to that time hardly anyone had written on the mineral resources of this interesting country. The increasing number of papers dealing with Nicaragua and its mines, appearing not only in your journal, but in the other leading publications as well, shows the interest that is being taken in this republic.

One of the reasons why I so appreciated Mr. Hershey's paper is that it agrees so well with my own conclusions, formed after a year spent in Nicaragua. Mr. Hershey's remark, "In short, the geology of the Pis Pis district is generally favorable to the future of its mines," is a very important statement. What impressed me so much was the fact that indications are found of the same kind of formation as at Pis Pis, in other places south of the district, approximately parallel with the coast line. In the Bana Cruz country, about 15 to 18 miles southeast of Siempre Viva, encouraging indications of gold can be found; farther along, in the Oconguas district, there are a large number of prospects. In this district I opened a mine showing, in a cross-cut, an assay value of $11 (United States currency), over 33-ft. width. In the Oconguas district most interesting deposits of gold occur in the form of small veins and veinlets, in a highly crystalline limestone. I have seen buckets of picked ore from these tiny veins with the most remarkable display of visible gold.

Far down toward Costa Rica is the La Luz y Los Angeles mine, which, in my opinion, is the most interesting mine in Nicaragua, with the possible exception of the Bonanza. La Luz is probably the premier gold producer today of Nicaragua. Still farther south, on the Rama river, is the Topaz mine, which has promised so much and so far has accomplished so little. To go over such a big stretch of country and find so much gold is certainly encouraging and makes the engineer hope for the future, in spite of the disappointments of the past and the drawbacks of the present.

One point in regard to the gold veins of Nicaragua may be mentioned, and that is the large amount of silver associated with the gold. In the Pis Pis district it is seldom that the gold will run as high as 700 in fineness; in the Oconguas district I found that the gold ran about 350 to 400 fine. Mr. Hershey brings out very well the fact that the geology of the Pis Pis district indicates that Nicaragua will have mines requiring a large tonnage and low working cost. It is not a poor man's country, in spite of what the prospectors have already accomplished down there. Had these large veins been worked from the start by large corporations with plenty of money and experience, Nicaragua today would be noted as a gold producer. While the economic conditions have in the past been so bad and are at present unsatisfactory, and while the prices often asked for mere prospects in Nicaragua are absurd, it is encouraging to hear men like Mr. Hershey say that the geology of the country is so favorable.

T. LANE CARTER.

Chicago, March 1.

Cyanidation at Silverton

The Editor:

Sir—Warren A. Prosser, secretary of the Silverton Commercial Club, takes exception to one sentence in my January 20 letter, and attempts to prove it untrue by the use of names prominent in cyanidation. I do not attempt to deny, nor did my letter, that some investigation has been carried on here by competent men, and I do not pretend to criticize the work of such men as Messrs. Callow, Argall, Milliken, and some of the others named, nor have I any quarrel with Messrs. Root, Norton, and Schaefer. I merely desire to call the attention of the public to the dangers arising from too hasty installation of cyanide plants and the extravagant statements of those who are not thoroughly informed. Cyanidation may solve some of our metallurgical problems, but much thought must be given to the design of proper plants. Already too many people believe that the only thing necessary for success with a telluride, or other gold and silver ore is a crushing plant, a vat for applying the cyanide, a zinc-box, and a retort for reducing the metals to bullion.

SILVERTON CORRESPONDENT.

Silverton, Colorado, March 1.

The Estimation of Tonnage

The Editor:

Sir—In your issue of February 24 T. B. Greenfield described at some length the practical difficulties met in determining the specific gravity of an ore, and in the same issue A. W. Allen describes methods which may be followed. Neither of these gentlemen allude to a factor which may easily be a source of error in such determinations, namely, the change in specific gravity of an ore due to the formation of colloid hydrates during fine grinding. According to the method of computation, this may be a source of error, or it may not. The mass (in the exact sense) of the ore is clearly not affected by chemical reactions, but its volume and, therefore, its specific gravity may be considerably altered. Where the solid material is separated, dried, and weighed the water of hydration would largely be lost, though changes due to oxidation may be of some effect, and the resultant error will be probably very small. But where, in the case of a slime, the method suggested by Mr. Allen on page 309 of your issue of February 24 is followed, x will represent the percentage of ore in the slime, but *not* the percentage of solid in the slime. Exact quantitative determinations of the influence of colloids on ore-dressing problems is much needed, and it is to be hoped that research along these lines may be undertaken in some of our technical schools.

THOMAS T. READ.

San Francisco, March 18.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

NEFT-GIL is a hydrocarbon, occurring abundantly in the naphtha region of Cheleken island, in the Caspian sea. It is a mixture of paraffines and a resin, consisting of 66% of a wax-like substance insoluble in alcohol, 18% soluble in alcohol, and 13⅓% resin. It has a chocolate brown color, and melts at 75° Centigrade.

APPLICATION of liquid air in rescue work was devised by M. Süss, the inventor of the Aerolith apparatus; but in spite of the interest aroused by this apparatus in all who are interested in such work, the apparatus itself has not made any headway. The reason for this is to be found in the difficulty of handling and transporting liquid air.

A PIPE in limestone or granite, giving a small surface only to work on, and being probably irregular both in shape and course, is extremely hard to prospect by any method; in fact, the only thing to do is to follow the ore wherever it goes, which will generally mean that the pipe is worked out as it is followed up, a proceeding that hardly fits in with ordinary ideas of prospecting. Real prospecting, however, will be accomplished by not throwing up the work when the ore becomes unprofitable, but by pushing forward steadily as long as there is ore in the face, or minerals, such as sulphides and fluorspar in limestone, and tourmaline in granite, that indicate a possibility of more ore existing beyond.

AGREEMENTS made by patent applicants to deed certain portions of claims or rights after patent to those threatening adverse in consideration of no adverse being made, are sound and valid as between two claimants for lode claims. An agreement to deed a claimed lode within the limits of a placer for which patent had been asked, would raise such question as to the good faith of the placer applicant, in that he thereby recognized the lode in question, as probably to require exclusion of the lode ground from the placer application, or, in view of the difference in price of placer and lode ground, to afford basis for vitiating the patent on the basis of fraud. The law with regard to known lodes in placers has not been entirely tested in the courts, as regards discovery before patent, and the good faith of the applicant for placer patent would be especially important.

ASSESSMENT work to the value of $100 is required by the Federal statute within each calendar year succeeding location. Various state statutes require specific forms of location notices and the filing for record of a location notice within a specific time after location. Whether, in event of a location having been made in December 1910, for example, and the location notice being filed in the succeeding January, annual work would be necessary in 1911, seems never to have been decided. Apparently such work would be necessary, since the Federal statutes do not require filing of the notice, and therefore, so far as the requirements of the United States are concerned, the location was complete in December. Certainly this would be the interpretation called for by the spirit of the law. The intent of the latter is that anyone holding a mineral claim on public land should do work, at least to the value of $100 per year, in an effort to demonstrate its value.

RUSHING the can has come to connote a hasty trip of the pitcher to the bar, but in the lead and zinc districts of the Mississippi Valley the phrase might equally well be applied to rapid hoisting. In these districts the use of cages and cars is unusual. Ore is ordinarily hoisted in buckets or 'cans,' to apply the local name. These cans are handled under ground on small four-wheeled trucks and are hoisted by friction hoists set in the head-gear over the shaft and above the mill-bins. Extremely rapid work is done with this simple and light equipment. At the Vinegar Hill mine near Galena, Illinois, 1019 cans of 1000 lb. capacity were hoisted recently in a 9-hour shift. The shaft here is 200 ft. deep. In such work it is customary to have one man at the top to run the engine and dump the buckets and another at the bottom to land the empty cans and hook on the loaded ones. Generally hoisting is done without signals. The bucket is dropped to the bottom and the man at that point must unhook the rope and attach it to the loaded can within a given time determined by the engineer.

BROWN-PRINTS are prints similar to blue-prints, except that they are made on brown-print paper instead of blue-print paper. If a print be made on brown-print paper from a tracing as a negative, the print will show white lines on a dark brown background. This paper requires a little longer exposure than rapid blue-print paper, and must be washed three times, first in clear water from three to five minutes, then in a solution of fixing salt and water for about the same time, and finally are rinsed thoroughly in clear running water. The fixing salt is hyposulphite of soda, and a can comes with every roll of paper. Use in the proportion of half an ounce to a quart of water. From the brown prints made as above, showing white lines on a brown ground, other prints can be made by using the brown print instead of a tracing. If these other prints be made on the same kind of paper—brown-print paper—they will show brown lines on a white ground. If ordinary blue-print paper be used, there will be blue lines on a white ground. These secondary prints require a longer exposure and must be carefully made to insure clearness. The white ground is convenient, because additions can be made on the print in pencil or ink. Brown-prints are much used because of the fact that tracing can be made and kept at a central office and brown prints from them distributed to the various agencies or branch houses which are then enabled to make for themselves as many duplicates as are required.

THE use of graphite in the manufacture of pencils is probably both its oldest and its best known application. This industry in Germany and England is several centuries old, and many of the modern factories manufacture hundreds of varieties of pencils, yet the percentage of graphite used for this purpose is not large, being undoubtedly less than 10% of the world's production, and one authority estimates it is low as 4%. In this industry the physical character of the graphite is of great importance. Crystalline graphite, however pure, would, if used alone, yield a 'lead' that would slip over the paper without leaving more than a faint streak. Furthermore, it is almost impossible to grind the easily cleavable flake graphite into a powder of the fineness and evenness of grain requisite for the better grades of pencils. The purer grades of amorphous graphite constitute the bulk of the material used in pencil manufacture. For some of the cheaper pencils only one kind of graphite is used, but the graphite for pencils of the better grades is a careful blend of several kinds. One blend, for example, contains about one-third Ceylon graphite, one-third Bohemian graphite, and one-third Mexican graphite. The Ceylon graphite adds to the smoothness of the 'lead,' the Bohemian graphite being added for its blackness. Graphite when used for pencils is mixed with carefully refined clay, which is usually imported from Germany; no domestic clay has yet been found entirely suitable for pencil manufacture. The more graphite and the less clay the softer the pencil; the less graphite and the more clay the harder the pencil. The cores of softer pencils are usually made larger than those of the harder ones in order to give them equal tensile strength. For a pencil of medium hardness (HB) about one-third clay is commonly used. The wet mixture of clay and graphite is worked and reworked until it is so pliable that it can be looped in coils and even tied in loose knots.

Special Correspondence

BLACK HILLS, SOUTH DAKOTA

MOGUL M. CO.'S CYANIDE PLANT DAMAGED BY FIRE. COMPANY TO REBUILD.—WINTER IS UNUSUALLY SEVERE.—WASP MILL RESUMES OPERATION.

Fire on March 8 damaged the cyanide plant of the Mogul M. Co. at Pluma, to the extent of probably $75,000. Insurance to the amount of $155,000 was carried on the mill, assay office, machine-shop, warehouse, office building, and other property at Pluma, covering the loss. The fire was discovered about 4 o'clock in the afternoon, the origin being unknown, but it is thought electric wires were crossed near the bottom of the mill. Before the employees could get the fire hose coupled and in action, the flames had spread until a large portion of the roof was blazing. A visit to the plant shows the Moore process department, sand leaching tanks and building, and precipitation department to be practically unharmed. The rolls and Chilean mills are in fair shape, and can be used again. They rested on concrete foundations, near the bottom of the mill, and the flames were for the most part far above

WASP NO. 2 MILL.

them, in the roof and superstructure. The settlers, Dorr thickeners, crushers, crusher motors, sampling-room, ore-bins, and about two-thirds of the mill building were destroyed beyond repair. J. V. N. Dorr, general manager for the company, states that it is the intention of the directors immediately to rebuild the plant, as soon as adjustments are made with the insurance companies. In the meantime ore shipments are being made at the rate of 75 to 100 tons per day to the L. D. & W. mill, at Terry, and negotiations are pending which may result in additional ores being handled elsewhere. The fire was confined to the mill, and none of the outlying buildings, such as the assay office, machine-shop, or office, were injured.

The Black Hills has experienced one of the most severe winters in its history. Old-timers say that the snowfall is greater than in any previous winter—in fact, it is the greatest since Government weather-observing stations were established. E. F. Irwin, timekeeper for the Homestake company at Lead, is a voluntary observer, under the Government Weather Bureau, and he reports that in the past five months (up to March 15) nearly 9 ft. of snow has fallen. Most of this is still lying on the ground and bids fair to be there for several months yet. The railroads have had an especially hard time of it, and have only kept open those tracks which were in constant use. On March 12, after the Mogul M. Co. had decided to ship its ore to the L. D. & W. mill, the Northwestern was called upon to open some of its spurs which had been unused this winter. In places the snow was 17 ft. deep and solidly packed. From present indications there will be a great abundance of water for mining operations during the coming summer.

The Wasp No. 2 mill is operating steadily again, after a shut-down caused by severe winter weather. Paul Danckwardt has resigned as superintendent of the Black Hills Smelting Co., and his successor is expected soon. The North Homestake company is cross-cutting both east and west from the bottom, or 620-ft., level of the shaft, to develop veins which were found in diamond-drilling. Three shifts of men are employed, and the work is being hastened in every way. It is expected that the full volume of available water will be turned into the Homestake hydro-electric plant on March 15, when the entire plant, including the generating station, will be given a test. As has been noted previously in these columns, the plant is practically ready to run.

RHODESIA

GOLD OUTPUT FOR THE YEAR.—CONSERVATIVE DEVELOPMENT.—OUTLOOK FOR 1912.—SPREAD OF MINERS' PHTHISIS.

The gold output of southern Rhodesia for the month of December has been declared by the Chamber of Mines, and the production for the whole year can be computed. It amounted to £2,647,895, an increase of £79,697 over 1910, and £24,186 more than the previous record year, 1909. This result must be adjudged satisfactory from every point of view. The year 1910 was characterized by the praises of Rhodesia being sounded by loud trumpets from the housetops, while 1911 has been singularly free from excitement, and there has been none of the feverish rush of the two preceding years. In fact, the outstanding feature of 1911 has been a quiet, unostentatious policy of development. This is what Rhodesia has been in sad need of for a long while past, and it is a matter for all-around congratulation that during the past twelve months the ore reserves of Charterland mines have been greatly augmented, while, at the same time, the gold output has been increased and there has been a marked improvement in dividends. Excluding small syndicates, mining development and finance companies paid £954,613 in dividends, against £883,000 in 1910. As regards other branches of the mineral industry, there has been a gratifying development in the direction of base metals. The existence of cassiterite in Mashonaland has been established, and, while it is as yet much too early to make any predictions as to the future of the tin industry in Rhodesia, it may be stated that in certain localities the indications are very promising. With regard to chrome iron ore, there has been a year of steady work, and production exports through Beira have increased. The outstanding feature in the coal trade has been the reduction of prices by the Wankie Colliery Co., which is, at the present day, the only producing concern in Rhodesia. The Colliery company hopes to sell a much larger output in consequence. Another important development in connection with Rhodesian coal mining has been the preliminary exploitation of a large coal concession by the Consolidated Gold Fields of South Africa.

The outlook for 1912 is altogether a promising one, although one is not justified in anticipating any remarkable increase in output. The fly in the ointment (and a very large and undesirable fly it is, too) is the labor problem. The Rhodesian Native Labor Bureau has been reorganized and everything possible is being done to better the supply. Despite all this, however, the demand greatly exceeds the supply, and probably to the end of 1912 things will be but little better than they are at the beginning.

Hitherto Rhodesia has been practically free of miners' phthisis; at least, very little is heard of this disease in the country. It is, therefore, distressing to observe that in the last report on the public health, issued by the British South Africa Co., reference is made to the prevalence of this dread malady in certain districts. Unfortunately, no statistics are given, and from the report in question it is not possible to gauge to any definite degree the accuracy of the identification of silicosis in southern Rhodesia. The district surgeon of Hartley, in the course of his report, draws attention to the increasing number of phthisical workers in that area, but he asserts that phthisis is confined

to miners who have worked on the Rand. Miners' phthisis has proved such a terrible obstacle to the advance of the industry in the Transvaal that the Rhodesian government might be expected to take immediate steps to investigate the whole question and to ascertain whether the first seeds of the disease were brought from the Witwatersrand.

LONDON

DOLCOATH REPORT SHOWS REDUCTION IN COSTS.—ARIZONA COPPER PAYING DIVIDENDS AT RATE OF 50%.—COLOMBIA GOLD MINING.

The results of operations at Dolcoath, the premier tin mine of Cornwall, are of perennial interest. For some time now I have been sending news as to the improvements effected in mechanical equipment, both in the mine and in the metallurgical plant. The new deep-level shaft, the 'Williams,' has been in operation for some months and the electrical and pumping plant lately has been put in commission. Since the first of the year an unusual influx of water has impeded operations, but things have once more arrived at normal state. The full figures for the results during the second half of 1911 are now available, and by far the most important feature is the fall in the cost. The tonnage crushed was 46,343, and the recovery 853 tons of black tin, or 41¼ lb. per ton of ore. The amount realized was £98,647, or £115 12s. 6d. per ton. The total receipts were £100,011, the working cost £57,853, lord's royalties £6576, and the working profit $35,581. From the latter, £4340 was written off for depreciation of plant and buildings, and £15,526 was brought in from the previous half-year. The dividend distributed was £34,450, being at the rate of 10% for the half-year. The figures per ton treated were as follows: receipts 43s. 1d., working cost 24s. 11d., lord's dues 2s. 10d., and working profit 15s. 4d. The development work done during the half-year amounted to 2076 ft. The rich ore reported in No. 1 winze, 306 ft. east of New Sump shaft, has not proved to be continuous, for on further sinking the content fell from 80 lb. to only 20 lb. per ton. Eight of the new Holman air-cushion stamps have been in continuous operation during the half-year, and the foundations are ready for another four. The most important point, as already mentioned, is the reduction of the working cost by 4s. 5d. per ton. This is due chiefly to the advantages gained by the new Williams shaft. There is every expectation that further substantial reduction will be effected when the electrical and pumping plant is in full working order, and when the additional Holman stamps are completed.

In a recent letter I gave details of the new policy adopted with a view to reconstructing the smelting plant at the Arizona copper mine at Clifton, Arizona. The company has its headquarters in Scotland, and the new plant has been designed by L. D. Ricketts on lines similar to the plant at Cananea, over the border in Mexico. During the year ended September 30 last, 744,746 short dry tons of ore was raised, yielding 17,292 short tons of copper, or 46.4 lb. per ton. Of the ore raised, 582,335 tons of sulphide ore and 104,754 tons of oxidized ore was sent to the concentration plant. The smelter treated 153,991 tons of concentrate and raw ore, and the sulphuric acid leaching-plant 90,526 tons of oxide tailing. The revenue from the sale of copper was £866,862, and from profits of the railway and other subsidiary interests £72,827. The mining and metallurgical expenses were £625,210, and general charges for administration £29,288; £5266 was paid as debenture interest, £17,881 as income tax, £24,531 as preference dividend, £45,000 was transferred to new capital outlay, and £189,987 distributed as dividend on the ordinary shares, being at the rate of 50%. The debenture issue made for the purpose of building the new plant was sufficiently successful to warrant immediate carrying out of the plans, and orders were at once put in hand for the supply of the plant required. The whole issue was not, however, subscribed, and circulars are now being sent to shareholders with the object of placing the balance.

Gold mines in Colombia do not come often before the London public, but the Marmato Hill mine is now attracting favorable attention, after the English company owning it had passed through a preliminary stage of failure. The company was formed in February 1908 to acquire an extensive tract of country in the districts of Supia and Marmato, containing a number of gold and silver mines and prospects. Operations have been chiefly directed to the development of the Marmato Hill mine, which had yielded profits to previous local owners. The properties were examined at the time of flotation by C. Olden, L. Parker, and H. H. Knox, and subsequently, when progress was not found to be satisfactory, Arthur Wilkinson was asked to make a report. His recommendations were accepted and he was appointed consulting engineer, with T. L. Dawson as manager. Development work since has given encouraging results. Mr. Dawson gives the reserve at 109,000 tons averaging 9.8 dwt., and during the current year expects to increase the proved ore by 100,000 tons. The average content is gradually becoming higher. Recently only sufficient ore has been mined and treated to pay expenses. The construction of a new plant was delayed until the results of development warranted it. The time has now come for this work to be taken in hand, but before a final decision is made experiments are to be conducted with a view to improving the extraction by cyanide. The new plant will have a capacity of 6000 tons per month at first. Just recently 100,000 new shares of £1 were issued, bringing the total capital to £431,000. With the money thus raised £37,346 loans have been repaid, and the balance will prove ample for the construction of the plant.

CORDOVA, ALASKA

WOOD, WATER, AND FREIGHT RATES.—DEVELOPMENT COSTS.—NEW MILLS.—SOME GOOD MILL RUNS.—WORK IN THE DRIFT MINES.

Development of the quartz lodes in the Fairbanks district has been given a considerable impetus this season by the proposed legislation for a Government railroad from the coast to the Yukon and Tanana valleys. Wood is becoming scarce and a railroad which could lower the cost of freight and offer a supply of cheap fuel would materially assist in the development of the younger properties. The management at the Rhoads-Hall property at the mouth of Bedrock creek has recently completed a well to supply water for the 5-stamp mill, but the flow at present has not been sufficient for more than one shift per day, but it is expected that a considerable supply will be available from the shaft in a short time. In the mine the ore has been blocked out so that the mill will be assured of a continuous supply as soon as the source of additional water has been determined. At the Tolovana, in the same district, a Huntington mill has been erected, and at the Newsboy, on the divide between El Dorado and Cleary, five stamps have been recently installed. The shaft at the latter property is down over 250 ft. and a contract has been let to drive a 100-ft. drift on the vein from each side of the 215-ft. level. The vein at this point is about four feet in width and seems to be approximately the same value as on the levels above where ore was developed that bore the costs of shipping to the custom mill at Fairbanks. It is generally considered that the cost of wagon and train haul plus milling charges in this district amounts to $25 or $30 per ton. McGillivray & Fisher, who have a lease on the Cleary extension of the Newsboy, have placed an order for a 5-stamp mill with Brumbaugh & Hamilton. The stamps will be light, weighing only 500 lb. each. The shaft is down 90 ft. on a vein which averages 2 ft. in width and is said to assay $60 per ton.

In the drift mines winter dumps are being made on Ester, with its tributaries, Pedro, Goldstream, and Fairbanks creeks, while on the other creeks of the district work is largely confined to development for summer sluicing. 'Pay' has also been reported near the headwaters of the Salcha river, but reports from Ruby, which was filled with stampeders last summer, are discouraging.

TORONTO, CANADA

PRESENT CONDITIONS AT PORCUPINE. GOOD RESULTS AT THE DOME. SILVER ORES IN THE KEEWATIN AT COBALT.

Thirty-seven companies and syndicates are operating at Porcupine, giving employment to about 2600 men. There are, in addition, a number engaged in prospecting and development work in outlying districts, bringing the total working force of the region up to about 3000. This number will be very largely increased with the opening of the spring. Owing to the severity of the winter several mines had to close down or greatly curtail operations on account of the scarcity of water, all the smaller water courses being frozen solid. The extension of the electric power system to many of the properties at present dependent on the scanty and unsatisfactory timber supply of the locality for fuel, will give a great stimulus to operations. Every one interested in Porcupine is looking forward to the starting of the stamp-mills on the leading properties, the date for which has been so frequently postponed, owing to unforseen difficulties in the way of construction or delivery of machinery. These appear

HEAD-FRAME OF THE DOBIE MINE.

to have been successfully overcome and there is a reasonable prospect that several mills will be in operation within a few weeks.

The Dome mill, when in full operation, will require 250 tons of ore per day, and in order to keep this up and block out ore reserves, the number of drills employed for underground work has been increased from 12 to 24. To reserve the shafts for underground work an incline will be driven upon which to haul all ore extracted from above the 45-ft. level. At the Dome Extension a cross-cut from No. 4 shaft at the 100-ft. level has found a banded quartz vein 10 ft. wide, heavily mineralized with sulphides and carrying visible gold. A 15-in. vein of quartz assaying $50 per ton has been found by diamond-drilling at a depth of 227 ft. At the Dome Lake the vein on the surface between 3 and 4 ft. wide has been stripped for about 1000 ft. and two shafts put down for 60 ft., at which depth samples assay $23 per ton. Diamond-drilling to 100 ft., however, gives unsatisfactory results, showing the pay-streak diminished to one foot in width, with erratic mineralization. Work on the Success property has been resumed. The Crown Chartered Co. will complete its payments on the Davidson property and proceed with active development. Additional machinery is to be installed and the shaft sunk to the 200-ft. level. Sinking has been started on the Schumacher on the south side of Pearl lake. The property is stated to be rich in surface veins. The American Goldfields has found a 5-ft. quartz and schist vein, showing good gold content at 500 ft., by diamond-drilling. On the McEnany property of the Crown Reserve a new vein has been cut which shows about 3 ft. of quartz at the 100-ft. level, fairly rich and widening out somewhat at 200 feet.

An important discovery affecting the future of Cobalt has been made at the Coniagas mine. The general belief was that silver occurred only in the diabase and conglomerate, and that the veins pinched out on reaching the Keewatin formation. In driving on vein No. 9 of the Coniagas the Keewatin was found, but the vein proved to persist, and on being followed for 25 ft., widened to 5 in. of high grade ore. After being opened up for 85 ft. an assay was taken which gave 2622 oz. silver. C. W. Knight, of the Provincial Bureau of Mines, has made a careful examination of the mine, and states that the formation in which the vein occurs is undoubtedly Keewatin. The Coniagas will make further explorations of portions of its territory so far supposed to be hopelessly barren. The lease of a portion of the Peterson Lake property, held by the Little Nipissing company has been canceled under a clause which provides for its termination in case of work being discontinued for one month. The property is now being operated by the Peterson Lake.

It is officially announced that the Elk Lake branch of the Temiskaming & Northern Ontario railway will start from Earlton, a point 25 miles north of Cobalt, running west for about thirty miles, the greater part of the route passing through a good agricultural district. The proposed Charlton route has been abandoned. Tenders will be called for in a few days. J. P. Whitney, the Premier, has introduced in the Ontario Legislature an important amendment to the Mining Act, which provides that no miner shall be employed underground for more than eight hours in any twenty-four hours, including the time occupied in descending and ascending from the mine. For every violation of this provision the owner and the manager or superintendent of the mine are to be liable to a fine not exceeding $50.

NEW YORK

MORE MARKET ACTIVITY, ALTHOUGH COPPERS LAG.—BIG INTERESTS BACKING DEVELOPMENT.—COMPANY NEWS.

There has been a marked revival of activity in New York during the past week, and many operators have been trying to persuade themselves and their friends that the dark days are all past, and that the markets are once more on the way to sunshiny days of prosperity and activity. Just how far this is justified by the facts, and how much it is whistling to keep up courage, is to be seen.

The share market in copper shares lags and lags. It is quite apparent that the idea that the demand which has brought the world's visible supply to its present low figure, and American stocks to where they equal but one month's domestic deliveries, is not altogether a sound one, and that it has been aided by manipulation sticks in the mind of the public. It is one of the queer turns in the market that, barring Amalgamated and some of the leading Lake coppers that have developed rather sensationally within the past few months, the larger part of the copper list is selling lower than it was in December, notwithstanding the fact that producers and sellers of copper point to the price level of 14⅝c. as firmly established.

A few months ago one would have said that a 15-cent copper market, with a surplus reduced to fair working dimensions, would solve all the problems of the copper situation. It is yet too early to tell whether or not public impressions regarding copper at the present time are correct or not. If the public's part in copper prosperity could be put in some other form besides the purchase of shares, it would perhaps be easier to interest the outsider. There is no question but that a large part of the reluctant attitude of the public is due to recent educational campaigns in reference to stock watering, and holding-company devices, and other tricks of so-called 'high finance.' There is one underlying encouraging feature in the copper situation that should not be overlooked. The heavier interests which have become more and more closely affiliated, and which are in touch with unlimited capital, are continuing to pour funds into the development of properties, and this gives evidence of every faith in the future of the copper industry.

The International S. & R. Co. has completed its plans for the erection of a refinery at East Chicago, Indiana, a suburb of Chicago, lying at the south end of Lake Michigan. The International S. & R. Co.'s business is prin-

cipally copper, but the new plant is to handle lead and silver bullion, and, in a way, marks another step on the part of the Cole-Ryan interests to compete with the Guggenheims in their refining and selling of silver and lead. The new plant is to have a refining capacity of 3000 tons per month, and is to be completed by midsummer. The work is to begin immediately.

It is said that the capital stock of the Guggenheim Exploration Co. is to take a more prominent place among the big market traders. The shares have always been traded in on the New York Curb. It is now expected that the capital stock will be doubled, and the shares listed on the New York Stock Exchange, and that it will be placed on a 6% dividend basis. Among other holdings of the company is a big block of Utah Copper that is supposed to have cost $9 per share. The Guggenheim Exploration Co. was at one time in receipt of handsome dividends from its holdings in Esperanaza. Last year the company held over 60,000 shares. At the end of the last fiscal year the company had sold all but 3016 shares. It is understood that this stock has now been entirely liquidated.

A very interesting item has appeared, to the effect that E. A. Wall, of Salt Lake City, noted for his bitter fight against the present managers of the Utah Copper Co., is one of the largest individual holders of the shares of the Lake Copper Co. It is stated that Mr. Wall bought a large block of stock above 90. At the present time Lake shares are quoted around 37, and apparently are without any particular degree of support, though not offered freely, and it is seemingly impossible to accumulate any stock in the open market. Most of the present holders paid above 60, and can hardly afford to sell on the present level. The management of the Lake states that with a 14c. copper market they will in time be able to show a profit to all holders of the stock, even those who bought at the very top. Lake is still reckoned as one of the greatest possibilities of the Upper Peninsula.

While any ill effect due to increased production is minimized by copper authorities, there are, nevertheless, some new records being made. The Utah Copper Co. handled 18,300 tons of ore in one day in February, and was only prevented from making February a record month with 11,000,000 lb. output by an accident on the Denver & Rio Grande railroad. With the approach of better weather, the management is promising daily runs of 20,000 tons.

Chino shareholders are to authorize an increase in the company's capital to 100,000 shares, of which 70,000 shares are to be offered to the shareholders on a basis of 1 share for each 10 shares of new stock. The new management of the Davis-Daly has so far revamped the property as to break even in February, and hopes are entertained of making a little money in March. Financially, the company's condition has been improved by the collection of a large part of the debt owed to Davis-Daly by the Ohio Copper Co. and the collection of the cash that was invested in the property in Porcupine. The Davis-Daly market has not improved, as a loan in New York against 20,000 shares as collateral has been steadily pressing for the last month or two for liquidation.

Camp Bird shareholders in the United States have been much interested in the reports of the new discovery in the lower levels of the old property at Ouray, Colorado, but the improved conditions existing, according to these reports, have not been reflected in the market. The shares have been a little heavy in London, and most of the shareholders are now seeking information in reference to the new move of the company in taking over an interest in a copper property in Transvaal, South Africa.

The real seriousness of the situation in Mexico is beginning to be felt. The Mines Company of America, which controls properties at Minas Prietas, Sonora, and Chihuahua, is said to have complained to the Federal authorities of the confiscation of a part of its property in Mexico. The Rio Plata M. Co. has suspended dividends, and it is quite plain that all mining activity on the part of foreigners in Mexico will come to a standstill until there is a cessation of hostilities and a restoration of tranquility.

BOSTON

C. M. Turner Revives Calumet & Hecla Merger Litigation.—United Copper Forfeits Charter.

The irrepressible conflict between the Osceola and Calumet & Hecla interests broke out again recently when Charles M. Turner, of Houghton, Michigan, secured an injunction preventing the holding of the Osceola annual meeting on March 14. Mr. Turner is supposed to represent Godfrey M. Hyams in this move, and Mr. Hyams takes the history of the fight back to when A. S. Bigelow was president and brought suit against Calumet & Hecla to prevent it absorbing the control of Osceola. Mr. Hyams was associated with Mr. Bigelow in that fight. Calumet & Hecla bought out Mr. Bigelow's interest in Osceola and other Lake properties and the latter retired from the field. His mantle seems to have fallen upon Hyams, who last year with other interests was successful in blocking the Calumet & Hecla proposed merger. The present injunction is a repetition and scarcely in any sense a variation of the old Osceola fight against Calumet & Hecla. It is charged that the larger company, seeing extinction of its ore reserves in the not distant future, is anxious to absorb the Osceola and wipe out its identity as an independent company, the move being made to recruit the Calumet's ore reserves. When the Bigelow régime went out, Mr. Agassiz, vice-president of Calumet & Hecla, succeeded him as president, and Quincy A. Shaw, president of the Calumet, became the Osceola's vice-president. The Calumet people disclaim the alleged designs on Osceola, though the company and its associate interests are in control. The Calumet & Hecla company has been benevolent in its assimilation policy in the Lake—so much so that its acquisitions there have not been viewed with especial alarm. Something over a year ago the company engaged J. Parke Channing to make an examination and appraisement of the properties which it intended to include in its big merger. It was said afterward that Mr. Channing was retained for this purpose because, of course, of his high character and ability as an authority, and because of the mental reservation that he was associated with the Lewisohns and was considered close to Amalgamated interests, the latter being brought into the original suit of Bigelow in behalf of Osceola against Calumet & Hecla. The Calumet & Hecla company would undoubtedly conserve the copper resources of the Lake country by extending its control, but the Osceola protesting minority interests set forth in their case that it proposes to violate the Sherman anti-trust law by restraining trade.

The United Copper Co. forfeited its charter in New Jersey a few days ago because of the non-payment of taxes. This is the ambitious holding corporation which F. Augustus Heinze formed as a rival to Amalgamated. Mr. Heinze states that the non-payment of taxes was a clerical oversight and that the present charter will not be allowed to go by default. United Copper is said to have largely precipitated the panic in October 1907. The company owns 300,000 acres of timber land in British Columbia and the control of a number of copper companies.

A special meeting of the stockholders of the Chino Copper Co. will be held April 2 to authorize an increase of the company's authorized capital stock from 800,000 to 900,000 shares, par value $5. Of the new 100,000 shares, 70,000 shares have been underwritten and will be offered for subscription at $25, stockholders being entitled to subscribe *pro rata* on the basis of one share for each ten shares already held.

The Calumet & Hecla company issued simultaneously, on March 11, a bunch of reports on Isle Royale, Superior, Tamarack, Allouez, and Centennial, which are under its management. Calumet & Hecla is working hard to bring about a realignment of milling facilities affecting these properties and to operate them as a whole in the interest of economy and increased output.

The settlement of the Lawrence woolen mill strike will be a great help to market interests in Boston and New England. The direct financial loss is estimated at $3,000,000 at least.

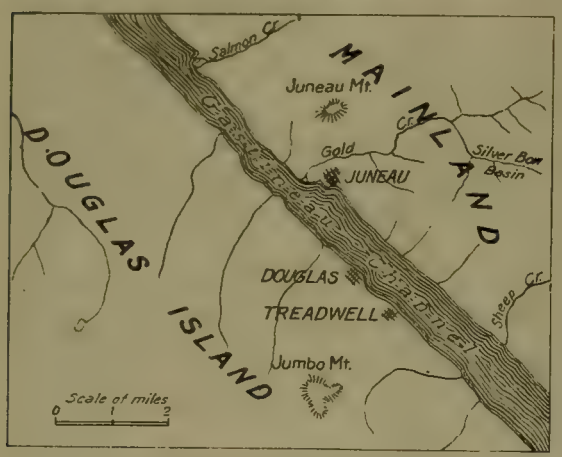
General Mining News

ALASKA

JUNEAU

The Alaska Mexican Gold M. Co. in January crushed 19,803 tons of ore, from which 474 tons of concentrate was saved. The realizable value of the total production was estimated at $65,802, including the gold production of $31,008. Operating expenses were $31,365 and construction expenses $3087, leaving an estimated net profit of $31,350. The yield per ton was $3.36. During the month 290 ft. of development work was done.

The Alaska United G. M. Co. in January produced, 'realizable value,' $42,735 from the Ready Bullion claim, and $46,338 from the 700 Foot Claim. Operating expenses amounted to $28,420 for the Ready Bullion and $29,629 for the 700 Foot Claim. Construction expenses were $1469 and $2508, respectively, the estimated net profit being $12,346 for the Ready Bullion and $14,202 for the 700 Foot Claim. The ore treated at the Ready Bullion amounted to 18,808 tons, and at the 700 Foot Claim to 20,266 tons.



PART OF DOUGLAS ISLAND.

Development work for the month amounted to 32 ft. and 365 ft. for the respective claims.

PRINCE WILLIAM SOUND

Rich ore was discovered recently on the 400-ft. level of the Cliff mine, says a Valdez report. The Midas Copper Co., according to a late report, has 100 tons of ore ready for shipment to the Tacoma smelter.

THE TANANA

A report from Fairbanks states that Utegaard & Nehrland, lessees on the Pioneer property on Chatham creek, have shipped to the Garden Island mill 60 sacks of picked ore estimated to average about $90 per ton. After this ore is disposed of, the mill will start on four tons of ore from the Anderson & Birch property in Granite gulch, near Pedro creek. The mill has just finished treating 12½ tons from L. J. McCarty's Pennsylvania claim on Wolf creek. Mr. McCarty stated that if better milling facilities were provided for that district, outside capital would not be required for developing the properties.

L. M. Drury, assayer, of Fairbanks, has received $209 for a shipment of 1234 lb. of placer tin ore obtained from the Hot Springs district. The ore was brought to Fairbanks by Joseph Eglar. There the schist and other impurities were removed. The ore was exhibited at the New York land show and was shipped to England, where assays gave returns of 55.49% tin, 4% sulphur, and a small amount of arsenic. Freight, porterage, and other charges for the ocean shipment amounted to $73, leaving a net balance of $208. Falcon Joslin, who had charge of the ore, has stated that the A. S. & R. Co. is willing to build a smelter at Tacoma for tin ore if the ore deposits are sufficiently large to justify continuous operation of the proposed smelter. Paul Hopkins intends soon to concentrate a large amount of ore from the district for shipment to Europe.

ARIZONA

COCHISE COUNTY

The Shattuck-Arizona Copper Co. has intersected ore assaying 4% copper and 34 oz. silver per ton in No. 9 cross-cut of the Shattuck mine at Bisbee, according to a report by Thomas Bardon, president of the company.

PINAL COUNTY

The U. S. Geological Survey has issued a topographic map of the Ray, or Mineral Creek, district, for which the topographic surveying was done by W. M. Beaman. The map is on the scale of 1:12,000, or more than five inches to the mile. The contour interval is 25 ft. Every topographic feature, as well as buildings, shafts, and adits, is shown. The maps are for sale by the Geological Survey at 5c. each or $3 per 100.

The Ray Con. Copper Co.'s actual January production, for which previous estimates have been published, was 2,476,944 lb. copper, as against 2,271,654 lb. in December. The production would have been larger had it not been for the blowing out of a motor. Since operation was started March 20, 1911, the company has produced 17,602,642 lb. copper. Since February 20 the concentrate has been shipped to the A. S. & R. Co.'s smelter at Hayden. It is officially announced that the cost of production is under 9c. per pound, but more exact figures are not obtainable. The monthly production of the company since last April has been as follows, the figures being for pounds:

April	704,261	October	2,069,287
May	1,006,922	November	2,507,000
June	1,167,463	December	2,271,654
July	1,689,124	January	2,476,944
August	1,833,083		
September	1,876,904	Total	17,602,642

YAVAPAI COUNTY

In Prescott, gravel reported by Mr. Robinson, city clerk, to assay 30c. per cubic yard has been used in street paving. The gravel will be used for the same purpose in the future, says a press report, unless some economical means of saving the gold is proposed.

Rumors from Prescott are to the effect that the management of the Climax property is planning to erect a plant for treating its ores and to obtain electrical equipment for the mine. The Bradshaw M. & S. Co. has been incorporated to develop the Nellis and Cleator groups of claims near Turkey. It is reported that Los Angeles investors back of the company plan operation on a large scale. The property recently was examined by Joseph Reese. The Tip Top-Heath M. Co. has secured a Denver roller mill for the Tip Top mine in the Bradshaw district, and on its erection will start treating ore on the dump.

CALIFORNIA

KERN COUNTY

Sidney Coburn, of Los Angeles, has secured an option on claims adjoining the Baltic property, where a valuable vein recently was found, says a Randsburg report. The shaft of the Good Hope, operated by the Consolidated Mines Co., is down 190 ft., and the vein persists in depth. A night shift will be added. A mill-run finished a few days ago yielded $3450. The Four Ace M. Co. has discovered unusually rich ore on its property.

Joseph Weringer, owner of the Greenback copper mine at Woody, is planning to organize a company to operate the property, which, with intermittent development, has in the last 22 years produced about $40,000, according to newspaper estimates. About $60,000 has been spent on the mine. There is 200 tons of ore on the dump.

MODOC COUNTY

(Special Correspondence.)—Deep snow covers the ground at the new district of High Grade, and little mining is

going on. Several companies are arranging for work as soon as weather conditions permit. At the Sunshine claim a streak of quartz and talc 10 to 12 in. wide is receiving attention. Miners recently coming in from High Grade state the Sunshine has a shipment of 800 sacks of rich ore about ready for treatment. Some of this assays about $1000 per ton. It is stated that N. E. Guyot has taken a lease on the Old Glory claim of the Fort Bidwell Con. group. In the Mountain View claim of this group rich ore is being taken from a seam about 8 in. wide. It is reported the Gold Peak and Klondike claims, adjoining the Fort Bidwell Con. estate, have been acquired by Denver people. It is understood the new interests will operate them under the name of the High Grade Gold Mines Co. The Modoc Mines Co. is sinking its shaft with hand power and is planning to buy a gasoline hoist. Chicago people are interested in this company. Every indication points to a rush into the district as soon as spring has set in, but it is doubtful if active development can be started before June. Several engineers from Denver, Salt Lake, Spokane, and other points have recently visited the district.

Fort Bidwell, March 15.

Nevada County

High-grade ore has been discovered on the Mizpah claim, located last fall by W. S. Gregory and John Lew.

Tuolumne County

The Humbug adit, Table mountain, near Jamestown, has been drained, and ore assaying $8 to $60 per ton is being mined.

The Melones M. Co., according to a report from Jamestown, which for years has operated one of the principal low-grade properties in the state, situated near the old Robinson ferry, has discovered ore assaying about $4000 per ton. Ten tons of the high-grade ore has been taken out, and the size of the vein, or possibly pocket, is not known. Some years ago a similar pocket of rich telluride ore was found, which assayed $28,000 per ton, and three-fourths of a ton of this was obtained.

COLORADO

Clear Creek County

(Special Correspondence.)—There is great activity at the Newhouse adit, a force of 200 men going to work through that bore. The principal work is being performed on the Gem, Saratoga, King Bee, and Dyke mines. On the Gem mine Von Tilborg & White are shipping from 50 to 60 tons of mill ore per day, and inside of 30 days the output will be doubled. Stoping has been started on a body of ore that is from 3 to 8 ft. wide. E. F. Fitzgerald has purchased the Octopus group of claims on Chicago creek from Texas owners. Development will be carried forward through the United States adit. Operations will be put under way March 1 at the P. T. mine on Chicago creek. H. B. Baker is manager.

Idaho Springs, March 13.

Mineral County

A topographic map of the Creede, or Sunnyside, district has been issued by the U. S. Geological Survey. The topographic surveying was done by R. H. Reinecke, under the direction of R. B. Marshall, chief geographer. The scale of the map is 1:24,000, or more than two and one-half inches to the mile, with a contour interval of 50 ft. The altitudes range from 9000 to 12,000 ft. above sea-level. In 1910 the district produced 62,956 tons of ore, valued at $1,036,286, of which $121,181 was in gold, $417,810 in silver, $3687 in copper, $362,824 in lead, and $130,784 in zinc. There were 9 producing mines in the district in 1910. The new maps are for sale by the Geological Survey at 5c. each or $3 per 100.

Ouray County

It is reported that operation will be resumed at once in the Revenue mine. Plans are being made for reorganizing the Red Mountain M. Co. If reorganization is effected, development is to be resumed on the property during the coming summer.

San Miguel County

Newspaper despatches state that four men were killed March 14 by a snowslide which swept away the mine buildings at the Black Bear property.

Teller County (Cripple Creek)

A late Cripple Creek report states that, according to the figures of T. R. Countryman, engineer in charge of the Roosevelt drainage adit, the flow is only 16,000 gal. per minute, as against 17,500 gal. the previous week. It is thought the reduction is due to clogging of the new water-course. A measuring weir probably will be constructed at once.

The New Pearl M. Co. is preparing to resume operation on its Mineral hill property. The Kittie M. property, on Gold hill, is ready to resume shipment. E. Riley and associates, lessees on block 16 of the El Paso Con. G. M. Co. estate on Beacon hill, recently discovered a rich new ore-shoot.

The Mary McKinney M. Co. is reported to be considering paying dividends at the rate of 3c. per share per quarter on the 1,309,252 shares issued. In February the company shipped seven cars of ore averaging $25 per ton. Lessees produced 18 cars of ore. Oscar Fogleman of Cripple Creek is planning to start the Old Gold mine in the near future. The regular meeting of the Jerry Johnson company will be held in August, instead of this month. The Gould M. Co. has been reorganized under the name of the Kitty Lane Gold M. Co. The corporation has acquired the Rhinoceros, Nil Desperandum, Kitty Lane, and Sitting Bull No. 1 and 2 claims. Sinking of the main Elkton shaft has been resumed.

It is rumored that the Portland mill at Victor will be increased to a capacity of 500 tons per day. There are ten agitation tanks in the mill, the last being added only a few weeks ago. There are 31 concentrating tables, an increase of 8 since the first 300-ton unit was put in operation. Thomas Crowe, superintendent for the company, has predicted that in March 14,000 tons of ore would be treated in the mill.

A report from Cripple Creek states that an electric hoist has been erected at the Cresson No. 2 shaft. The Blue Bird mine, Bull hill, in February shipped 20 cars of ore averaging about $30 per ton.

IDAHO

Idaho County

W. A. Edwards, manager for the Eagle M. Co. of Edwardsburg, has completed arrangements for the construction of a hydro-electric power and lighting system for the property.

Shoshone County

Reports from Wallace state that the first payment on the Alice mine, near Mullan, has been made by Eastern holders, and it is announced that operation will be resumed in a short time. The mine has been closed about a year, but pumps have been operating for several weeks, and the lower levels are now almost clear. The Bunker Hill & Sullivan M. & C. Co. has paid dividend No. 174, amounting to $49,050, for March. This makes the total amount of dividends paid $13,339,500. H. F. Samuels, manager for the Success M. Co., operating on Nine Mile, in the Wallace district, announces the directors have declared a dividend of $15,000, payable March 20. This dividend will be at the rate of 1c. per share.

W. A. Clark will expend $100,000 in the development of a group of claims on Sunset peak, north of Wallace, according to a Spokane report. Additional men will be put on as soon as weather permits. A winze is being sunk on the main vein.

MISSOURI

Jasper County

The once-famous Pumpkin Head mill, operated by the Chicago-Joplin Mining Co., west of Joplin, has been moved

to the lease of the Rich-in-Ore Mining Co. at the new district of Thoms Stations. In opening this mine, a rich pocket of blende assaying better than 20%, was opened, but was quickly worked out. Subsequent development revealed good ore, and the ground was opened sufficiently to warrant the erection of a mill. North of the Rich-in-Ore is the new mill of the Great Western Mining Co., which began running the latter part of February. The plant is entirely new, including framework and machinery. The ground has been opened. Also, a number of drill-holes have been sunk into ore-bearing dirt. Natural gas, supplied to the district from fields in southern Kansas and northern Oklahoma, has been so low during the cold weather of the winter that orders to discontinue its use beneath boilers were issued. Fuel oil is being substituted in many instances.

MONTANA

Jefferson County

The Grand View M. & D. Co., operating a group of nine claims in Goodrich gulch, 20 miles south of Whitehall and 10 miles east of Twin Bridges, reports that more than 1000 ft. of development work has been done, the No. 2 adit cutting the lodes at depth varying from 200 to 400 ft. The No. 3 adit is nearing the ore.

Park County

F. C. Byrne, while in Spokane a few days ago, said that the Cooke district has some of the best mineral land in the state. Sulphide ores taken from near the surface average 12% copper. On account of lack of railroad facilities it has been impossible to interest capital in the development of the properties. It is thought probable the district will receive connections from either the Northern Pacific or the C. M. & St. P. in the near future.

Lincoln County

(Special Correspondence.)—W. E. Williams and A. J. Williams have given a bond on the Mountain View group of claims to W. H. Graham of San Francisco for $90,000, and according to the terms of the contract, work must start within 60 days. The claims are at the head of Silver Butte creek, near the boundary line between Sanders and Lincoln counties, and are well known in this district because of the many rich specimens of ore that they have produced.

Libby, March 15.

Sanders County

J. C. Williams and Thomas Pendergrass and associates, says a report from Spokane, have located a group of five claims known as the Duston group, and have found ore in the adit assaying $30 to $80 copper per ton. An adit has been driven into the hill 50 ft. and is now in good ore. In addition to the copper, the ore is reported to average about $8 gold, with some silver.

Silverbow County

A new orebody has been opened on the 1600-ft. level of the Butte-Ballaklava mine. The Corbin Copper King M. Co. has taken over the property of the Montana Corbin Copper Co. and expects to start operation some time next month. A property which mining men predict will be in the producing class before the year closes is the Pilot Butte. The annual meeting of the company was held a few days ago. Edward Hickey was elected president; William P. John, vice-president; John W. Pratt, treasurer; and Jerry J. Harrington, secretary. The shaft is down 900 ft. and development work is being carried on with encouraging results.

NEVADA

Clark County

The Quartette M. Co., of Searchlight, has leased its accumulation of tailing to C. H. Jonas, who will add a slime-treatment department to the 150-ton leaching plant on the property. The enlarged plant will be in operation by the middle of April.

Esmeralda County

Plans are under way for the reorganization of the Blue Bull and Booth companies on the assessable stock plan. A. H. Lowe, secretary of both companies, has mailed letters to the stockholders telling of the proposed action.

The Commercial Association of Goldfield on March 16 decided to undertake reviving interest in the Goldfield mining stock exchange. Resolutions were passed protesting against the closing or suspension of the San Francisco mint.

Humboldt County

(Special Correspondence.) The Seven Troughs Coalition Co. is completing its cyanide plant and shortly will commence treatment of a large quantity of stored tailing. The plant will handle about 30 tons per day. The Friedman winze from the 10th level of the shaft is going down on a 6-in. shoot of rich ore. Between the 9th and 10th levels a 6-in. shoot of rich ore is being stoped. Portions of this assay over $200 per ton. National advices report the production of 100 sacks of bonanza quartz from a pocket in the vein of the National Mines Co. Some of the ore is said to have assayed $9000 per sack. A strong vein of gold-bearing ore is being opened in the Shively group, on the north slope of Winnemucca mountain. In places the vein shows a width of 18 ft., assaying on the average $8 per ton. The shaft has been sunk 30 ft. The mine is about five miles from this city.

Winnemucca, March 16.

G. O. Cole, a lessee on the Industry property, is reported to have recently discovered a stringer of hornsilver. This is the first discovery of hornsilver in the district, and is said to be one of the richest silver finds in its history. The Pompeii M. Co. has resumed operation on its property, near Searchlight, with John R. Mendenhall as superintendent. It is stated that after some prospecting work is done it is probable that a double-compartment shaft to tap the orebody at depth will be sunk.

The Comet Placer M. Co. has secured machinery for the development of its property near Sulphur, a station on the Western Pacific railroad. L. G. Burton, of Salt Lake City, is in charge of the property, which consists of 3520 acres of land.

Lyon County

Reports from Salt Lake City state that the second furnace of the Mason Valley smelter will not be blown in for two or three months. The first furnace, with a capacity of about 700 tons per day, is treating all the ore now being shipped.

George W. Knierim, of Yerington, has discovered on his Rescue claim, south of Yerington, a 10-ft. vein of bluish gray quartz resembling the Tonopah ores. The vein was found at a depth of 135 ft. A carload of ore will be shipped shortly to the smelter at Thompson.

The Mason Valley Mines Co.'s report for the year ended December 31 shows that 2268 ft. of development work was done during 1911. The main adit-level was equipped with an electric mine railroad, a crushing plant was erected, and an aerial tram 6250 ft. long and with a capacity of 100 tons per hour was built. Construction was completed during the year for the smelter, of which the first furnace was blown in January 6. Assets, December 31, 1911, amounted to $229,035, including $117,988 cash on hand. Liabilities were $147,449, leaving an excess of assets of $81,586.

Nye County

Charles Kirchen, manager of the Associated mill now being built at Manhattan, has announced that the plant should be ready for operation on schedule time, April 1. The adit of the Mineral Hill Con. is in over 600 ft., but it will take some time to reach the ore-shoot from which rich ore was taken on the surface last summer. The Manhattan M. & M. Co. is driving to intersect at depth a shoot from which last summer ore assaying $12 to $20 per ton was taken at the surface. Tarash, Glavnick & Varos are sinking a winze on a promising streak of ore on the Dexter 14 property, adjoining the Big Four property. On the Big Four property the Poak-Steen-Cicala lease is producing about 100 tons of ore per day, the ore averaging between $20 and $25 per ton.

The Tonopah Mining Co. in February made a net profit of $147,933, according to the regular report

just issued. The company treated 14,326 tons of ore which averaged $19.45 per ton. The gold and silver bullion shipped during the month amounted to 255,110 oz., and was valued at $202,807. During the month 86 tons of concentrate was shipped. The concentrate was valued at $45,826. The company has declared the regular quarterly dividend of 25c. per share and an extra dividend of 15c. per share, both payable April 20 to stockholders of record March 30.

The production of the Tonopah district for the week ended March 16 was 8870 tons of ore, valued at $221,750. The Tonopah Mining Co. led the list of producers with 3450 tons. The Tonopah Belmont reports cutting a new vein in a cross-cut on the 12th level of the mine.

STOREY COUNTY

J. D. Moore, E. G. Hummel, and T. J. Meagher, all of Virginia City, have incorporated the Clermont Con. Gold & Silver M. Co., under the Nevada laws. The company will take over the Clermont, Clermont No. 1, Clermont No. 2, and Clermont Fraction claims in the Flowery district, east of the Comstock. The Ophir company last week shipped a carload of concentrate, valued at $25,000, to the Selby smelter. The first shipment of pumps for the C. & C. shaft has been received at the property.

The Ophir company last week produced 222 tons of ore, valued at $8050. During the week 325 tons of second-class ore was shipped to the Kinkead mill. The Con. Virginia 3-compartment raise was carried 7 ft. during the week, and now is 16 ft. in length. In this work 67 cars of ore, valued at $1903, was saved. While work in the Crown Point was hampered through trouble with the motor for the Yellow Jacket hoist, about 380 cars of ore was mined, and 370 tons of ore was shipped. The Pumping Association reported last Saturday that the water was at the 2500-ft. level. Customary development was done in other Comstock properties. The Yellow Jacket mill ran on dump ore.

WHITE PINE COUNTY

Pumping will be started shortly in the Giroux company's Bunker Hill shaft, which now is 210 ft. deep. The Bunker Hill is close to the Butte & Ely property line, and it is thought that development there will serve to prospect in a measure that property.

NEW MEXICO

GRANT COUNTY

Twenty-one cars of ore was shipped last week from Lordsburg. The Apache Box mine is shipping ore, protected by armed men from 'high-graders', to the Clear Lake mill. Transportation is by burro.

The buildings for the fourth and fifth units of the Chino Copper Co.'s mill are practically completed, according to a statement by D. C. Jackling, general manager for the company. The company in February kept costs at about 7c. per pound. The mill averaged 1100 tons per day per unit for the month. The third unit will be put in commission by the end of the month. As the ore came from close to the surface, the recovery was not as large as otherwise would have been the case.

SOCORRO COUNTY

(Special Correspondence.)—The last bullion clean-up for February of the Ernestine M. Co. resulted in 6785 oz.; concentrate for the same period, 7000 lb. The total output for the month was 24,825 oz. gold and silver bullion and 15 tons concentrate. Much local interest is manifested in the proposed railroad route from Silver City to the Mogollons and north to the coalfields. Should the plan be carried out, the severest handicap of this district would be lifted, as the costly 90-mile wagon haul has been a barrier to the economical operation of many properties.

Mogollon, March 19.

OKLAHOMA

HASKELL COUNTY

Eighty-seven men were killed in an explosion at the San Bois M. Co.'s mine No. 2 on March 20. The mine had been closed a week for repairs to the boilers in the engine-house, and the explosion is attributed to supposed accumulation of gas in the workings. The state mine inspector, with rescue apparatus, is at the property.

UTAH

JUAB COUNTY (TINTIC DISTRICT)

During February the Chief Con. mine produced about 2250 tons of ore. The net profit for the month is estimated at $56,000. One car shipped during the month brought a return of $10,777. The previous richest car was valued at about $8000. For the 25 working days of February the Iron Blossom averaged a production of about 360 tons of ore per day. Last week 172 cars of ore was shipped from the district.

MINE RESCUE CAR.

SALT LAKE COUNTY

The Ohio Copper Co. in February earned $37,500, the largest amount since the new mill was started. The tonnage of ore treated was about the same as usual, but the ore was of higher grade, and a reduction in costs was effected.

SUMMIT COUNTY

The report of the Daly-Judge M. Co. for the year ended December 31 shows that the mill in that period treated 51,875 tons of ore, from which 12,237 tons of lead concentrate and 3919 tons of zinc middling were obtained. The company started the year with an available balance of $316,215, and closed it, after paying the dividend, with $431,120, showing a gain of $115,405. The surplus earned in interest $18,838; more than enough to pay drainage expenses. The Ontario drainage adit is so far advanced that cross-cutting may be started on the 2500-ft. level whenever desired.

TOOELE COUNTY

The first annual report of the Lion Hill Consolidated, from organization to December 31, 1911, shows total receipts of $44,653, of which $13,738 was from sales of ore and $30,915 from the underwriters. Expenses included $42,663 at the mine and $1941 general expense, a total of $44,604. Development work done amounts to 1859 feet.

WASHINGTON

FERRY COUNTY

The Anaconda Gold M. & R. Co., of Spokane, has been organized by Arthur L. Flagg, G. A. Collins, G. S. Bailey, George Kebel, and N. D. Walling. The capitalization is $2,000,000. The company has a bond on, and has made the first payment on the Ida, Lucky Fraction, Ruby, Last Shot, First Thought, Josephine, and Minnie claims, between Quilp and the old Republic mines in the Republic district.

CANADA

British Columbia

Seven men were killed and two injured in an explosion March 7 in the Diamond Vale colliery. The cause of the explosion is thought to have been the ignition of a pocket of gas by a naked light.

Ontario

The Nipissing company's production for February is estimated at $226,419, net value. During the month 578,943 oz. of silver was shipped.

A report from Elk Lake states that the owners of the Donaldson claim have purchased a new plant, brought to the district by the Diabase M. Co. The Donaldson shaft is down over 100 feet.

The Nova Scotia mill is temporarily closed, in order that repairs and additions may be made to the concentrating department. What is said to be the richest shipment ever made from the Montreal river district was recently sent out by the Mann mine, at Gowganda. The 15 tons of ore was valued at $40,000. The City of Cobalt M. Co., which has a lease on the King Edward mill, is erecting in the mill four new Deister and James tables.

The first annual report of the Northern Ontario Exploration Co., managed by the Bewick-Moreing company, shows a gross profit since the company was organized in January 1911 of £81,481. The directors have written off £40,000 from the cost price of the shares, as only a limited amount of development work has been done. The assets include cash on hand and receivable, £101,000, and other assets acquired at a cost of £103,000. The capital issued amounts to £119,000. The whole balance of profit is to be carried forward for important developments in Alaska and other places.

Recently organized mining companies in Ontario include the Porcupine Golden Quill M. Co., Ltd., capitalized at $1,500,000, with headquarters at Toronto; the South Bay Mines, of Gowganda, capitalized at $40,000, with headquarters at Toronto; the Lake Superior Basin M. Co., capitalized at $1,000,000, with headquarters at Fort Erie; the Kenroy Gold Mines, $1,000,000 capitalization; the W. S. M. K. Mining Co., $200,000 capitalization; the Porcupine Twins M. Co., capitalized at $1,950,000; the Ungava Exploration Co., Toronto, $1,000,000; the Dane M. Co., Haileybury, $500,000; and the Huronian Exploration Co., New Liskeard, $50,000.

Yukon

Recent reports from Sixtymile state that 40 holes have been sunk there, but that only 'Lone Swede' Matson, the original discoverer, has found pay-ore up to the present time. Over 50 men are said to be working along the creek and to be preparing for a long stay there. J. E. Barrett has reported in Cordova the discovery of large areas of bituminous coal at the head of White river, on the Canadian border.

MEXICO

Oaxaca

(Special Correspondence.)—The Cubilete company, in the Taviche district, has just placed its order for a 150-ton cyanidation mill with the Fraser & Chalmers Co. of London, and excavation will be started immediately in an effort to have the mill ready by October 1. This will be the first mill in the Taviche district, and the first modern cyanidation mill in the state. The machinery will include 1500-lb. stamps of the South African type, tube-mills, Paterson tanks, Oliver filter, and zinc-dust precipitation. Tables for concentration when required will be provided for. The district is producing now about ₱100,000 of shipping ore per week. The San Juan and San Martin properties will break ground shortly for cyanidation mills, and on the completion of the same the general district will be producing over ₱1,000,000 per month of silver and gold. Henry Valle is manager for the Cubilete company, and the consulting engineer is P. A. Babb.

Oaxaca, March 18.

Among the Copper Mines

The Quincy Mining Co.'s annual report will show a surplus, above the $4 dividends paid, of $60,000 for the year, on an average selling price of copper for the year of 12.93c. The $150,000 paid for new properties by Quincy in 1911 was taken out of surplus.

Tennessee Copper produced 13,808,940 lb. of copper during 1911, from its own ores, as compared with 12,429,009 lb. in 1910. From customs ores there was produced 3,832,972 lb., against 4,147,326 in the previous year. The total production of the Tennessee plant was 17,641,982 lb., compared with 16,576,335 lb. in 1910. With the exception of 1909, the Tennessee's yield from its own ores was the largest on record.—*Boston Commercial.*

The Lake Copper Co. has begun preliminary shipments from its stock pile to the Trimountain mill. These shipments are being made in order to get the ore out of the way and make room for additional trackage necessary for regular production, which is expected to begin in June. Lake now has one of the most conservative of mining managements, and if the early hopes regarding the property, which sent the stock up from $4 to $94¼ per share, are realized it may yet prove to be one of the best in the Lake Superior district.

The Copper Producers' report for April will show probably some increase in stocks, as refinery outputs will be somewhat larger and exports will be materially curtailed. The English coal strike, which has extended to Germany, intervenes at a time when the onward and upward march of the metal is checked. Before the coal strike situation became acute, 15-cent copper seemed probable at an early day. Now the prospect is much farther away. However, if the statistics and estimates given out by the Producers are correct, the metal situation was approaching a crisis, and the foreign disturbances may have come just at the time to prevent a congestion which might have resulted in much higher prices.

The British Columbia Copper Co. in January produced 558,190 lb. copper, as against 250,717 lb. in December. In precious metals, the production was 1746 oz. gold and 8405 oz. silver in January, as against 1216 oz. gold and 3811 oz. silver in December. Last year, owing to the miners' strike, only one furnace was kept in operation. On February 12 the full battery of three furnaces was blown in. At a depth of 100 ft. in the Voight property, on which the company secured an option last year, a crosscut intersected an 8-ft. vein assaying as high as 8% copper and $11 gold per ton. The company has driven 105 ft. on the vein, and it is believed that the ore will persist in depth. The ore from the British Columbia property is reported to average 1¼% copper and $1.10 gold per ton. The net profit for February is reported to be $36,500.

European stocks have decreased 4238 tons, and the visible supply 5600 tons, says the James Lewis & Son's report issued March 1. Shipments of refined copper from the United States to Europe continued on a large scale, 34,643 tons being taken from the northern ports, showing enormous consumption. Germany's consumption for the month was 17,648 tons, an increase of 6258 tons over that for February 1911. American wire bars have been sold at £66 15s. net c.i.f. for April shipment. The imports for the month were 23 tons and the deliveries 4239 tons greater than for the same month last year. Total arrivals in England and France amounted to 19,734 tons and deliveries 22,372 tons. Arrivals in England from Chile reached 1174 tons and deliveries 1239 tons. From other countries the figures were 10,096 and 13,157 tons, respectively. Arrivals in Liverpool and Swansea from the United States amounted to 3362 tons; in London, 1000 tons; and in France, 8064 tons.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

JOHN ROSS, JR., is here.

D. W. SHANKS is in town.

F. L. SIZER has gone to Arizona.

C. COLCOCK JONES is in Montana.

E. C. B. HEDEN is now at Sydney.

M. H. KURLYA is in San Francisco.

C. B. LAKENAN is in San Francisco.

THEO. J. HOOVER is at Broken Hill.

STEWART RAWLINGS is in San Francisco.

J. E. SPURR is on his way to Philadelphia.

WALTER HARVEY WEED has been in Cananea.

D'ARCY WEATHERBE has gone to Vladivostok.

ERNST LICHTENBERG is at Halifax, Nova Scotia.

A. P. WILSON expects to leave for Alaska shortly.

EDMUND JUESSEN was at Grass Valley last week.

W. J. LORING has returned to London from Burma.

MALCOLM MACLAREN has returned to San Francisco.

EDWARD M. RABB is confined to his bed by appendicitis.

T. G. PATTON and J. W. SHANKLIN are here from Placerville.

T. E. EVERHEART has gone to San Juan, Argentine Republic.

J. FORDYCE BALFOUR has gone to Naraguta, Northern Nigeria.

W. T. FARNHAM, of the Chicksan Mining Co. is in San Francisco.

HUXLEY ST. JOHN BROOKS is returning to London from the Philippines.

WILLIAM H. BLATCHLEY is now with the La Blanca y Anexas at Pachuca.

C. R. EASTMAN is chairman of the department of geology of the University of Pittsburg.

THOMAS J. LAWRENCE, manager for the Topia M. Co. of Durango, Mexico, is at Los Angeles.

C. S. HERZIG has gone to Nigeria. His permanent address is 419 Salisbury House, London, E.C.

C. S. HALEY is assistant superintendent at the Nash mine, Carrville, Trinity county, California.

HOWLAND BANCROFT is at Los Angeles and will go to Arizona, returning to Denver by April 1.

C. W. PURINGTON has terminated his connection with the Orsk Goldfields, Ltd., and is now in London.

EDGAR A. COLLINS will return from Africa shortly to take charge of the Commonwealth mine in Arizona.

TRACEY BARTHOLOMEW, formerly connected with the Nevada Consolidated Mining Co., has gone to Porto Rico.

A. W. GEIGER has returned from Colorado and sailed, March 21, for the Philippine Islands to examine the Major properties.

L. K. FLETCHER has charge of construction work upon a new mill at Pozos, Guanajuato, and is no longer connected with the Rincon mine.

GEORGE A. SCHROTER was at Los Angeles this week on his way to the Creston Colorado mine, returning from Dolores and El Rayo.

RALPH HOOVER, of the Dow-Willans Diesel Engine Co., has left San Francisco for London, where he will investigate factory and engineering practice with reference to the Diesel engine.

T. A. RICKARD will speak before the Mining Association of the University of California on Wednesday, March 27, at 8 p.m., in the Hearst Mining building.

The San Francisco section of the MINING AND METALLURGICAL SOCIETY OF AMERICA will meet on Monday, April 1, at the Palace hotel at 6:30 p.m.

Market Reports

LOCAL METAL PRICES

San Francisco March 21.

Antimony	11—11½c	Quicksilver (flask)	45.50
Electrolytic Copper	15¼—15½c	Tin	47—48¼c
Pig Lead	4.35—5.30c	Spelter	7¼—7⅜c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.60—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

Average daily prices in cents per pound, based on wholesale transactions, standard brands.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Mar. 14	14.43	4.00	6 70	58¼
" 15	14.45	4.00	6.65	58⅜
" 16	14.50	4.00	6.60	58¼
" 17	Sunday.	No market.		
" 18	14.58	4.00	6 60	58⅜
" 19	14.63	4.05	6.55	58¼
" 20	14.70	4.05	6.55	58¼

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, Mar. 21.		Closing Prices Mar. 21.
Adventure	7¼	Mohawk	$ 58¼
Allouez	42	North Butte	29⅜
Calumet & Arizona	67¼	Old Dominion	49¼
Calumet & Hecla	465	Osceola	116
Centennial	20	Quincy	81¼
Copper Range	58⅜	Shannon	12¼
Daly West	6¼	Superior & Boston	3⅛
Franklin	13½	Tamarack	29
Granby	87	Trinity	5⅜
Greene Cananea, ctf.	8¼	Utah Con	17
Isle-Royale	28⅜	Victoria	3⅛
La Salle	6⅜	Winona	6⅜
Mass Copper	7⅜	Wolverine	110

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, March 21.

Atlanta	$ .28	Mayflower	$ .02
Belcher	.72	Mexican	3.62
Belmont	10.50	Midway	35
B. & B.	.20	Montana-Tonopah	2 62
Booth	.11	Nevada Hills	2.45
Chollar	.10	Ophir	1.45
Combination Fraction	.24	Pittsburg Silver Peak	1.40
Con. Virgina	.77	Round Mountain	.43
Florence	.65	Savage	.30
Goldfield Con.	4.87	Tonopah Extension	1.95
Gould & Curry	.06	Tonopah of Nevada	7.75
Jim Butler	.64	Union	1.05
Jumbo Extension	.44	Vernal	.18
MacNamara	.25	West End	1.95

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, March 21.

Associated Oil	$46.0	Peerless	$ —
Brookshire	.60	Pinal	4.50
Caribou (New Stock)	1.40	Premier	.58
Claremont	.59	P. S. Petroleum	.18
Coalinga National	.15	Republic	.35
Con. Midway	.02	Silver Tip	.90
Empire	1.07	Sterling	1.47
Enos	.03	S. W. & B.	.25
Maricopa 36	.50	Turner	.60
Midway Premier	.28	Union	98.50
Monte Cristo	1.32	United Oil	.32
Palmer	.65	W. K. Oil	2.00

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. Mar. 21.		Closing Prices. Mar. 21.
Amalgamated Copper	$ 76	Miami Copper	$ 21¼
A. S. & R. Co.	79¼	Mines Co. of America	3⅛
Braden Copper	5½	Nevada Con	19⅜
B. C. Copper Co.	4¼	Nipissing	8⅝
Chino	27¼	Ohio Copper	1⅜
First National	2½	Ray Con	17⅛
Giroux	4¼	Tenn. Copper	38⅜
Goldfield Con.	5	Tonopah Belmont	10⅜
Greene-Cananea	8⅜	Tonopah Ex.	1⅞
Hollinger	12¼	Tonopah Mining	7⅞
Inspiration	19	Trinity	5⅜
Kerr Lake	3	Tuolumne Copper	4
La Rose	3¼	Utah Copper	59¼
Mason Valley	12⅜	West End	1⅛
McKinley-Darragh	1⅜	Yukon Gold	3⅛

Bullion Tax List, Nevada Mines

The laws of Nevada require that sworn quarterly statements be submitted by operating companies to the state bullion tax collector. The table given below shows the reports of the principal companies for the quarter ended September 30, 1911. The information is in some cases somewhat misleading, as the column 'expenses' comprises all expenditures on company account during the period under review, regardless of whether such payments are operating expenses or capital expenditure.

Mine.	Tons.	Total value.	Expenses.	Taxes.
Nevada Hills	1,138	$31,625.29	$47,876.62	None
Nevada Wonder	3,444	44,929.59	32,142.75	$478.23
Goldfield Consolidated	86,953	2,193,943.16	1,276,589.26	24,860.29
Pittsburg Silver Peak	46,717	242,914.86	190,462.04	None
Sandstorm K. lease	26	2,240.18	2,664.77	None
Sandstorm-K. Con. Co.	Royalty	389.91	3,456.00	None
Combination Fraction	47	682.34	925.15	None
Goldfield Belmont	130	13,002.72	7,847.99	116.50
Great Western Gold	293	5,797.60	6,642.55	None
Florence Goldfield	15,817	40,063.14	100,450.86	None
Eureka Windfall	6,317	48,846.60	42,302.99	143.95
West Eureka Mining Co.	11,593	45,287.02	43,973.94	28.88
'1910' Lease, Barrett	61	2,866.43	3,191.69	None
Adamson-Turner, Rexall	2	4,909.60	5,918.06	None
Seven Troughs Coalition lease	27	1,061.71	1,108.54	None
Federal Mines, Fitting	Placer	150.00	500.00	None
Western Gypsite Co.	1,218	1,828.08	1,901.09	None
Seven Troughs Coalition lease	44	5,357.59	3,980.00	23.14
Kent lease, Seven Troughs	16	2,527.07	2,204.02	7.11
Modeen lease, Barrett Springs	16	781.86	569.24	3.57
Olman lease, Seven Troughs	19	10,758.17	2,009.74	146.97
Smith, Barrett Springs	11	314.63	310.75	0.07
Seven Troughs Coalition	886	72,948.44	25,449.75	797.98
National Mines Co.	33	109,116.86	47,891.22	1,028.59
Austin-Manhattan	357	10,632.75	13,367.79	None
Comstock M. & M. Co.	2,224	3,840.00	3,424.96	8.72
Donovan-Silver City	2,100	5,888.49	4,029.00	None
Nevada Reduction Co., Dayton	658	1,633.00	5,005.48	None
Phillips, Silver City	1,625	4,668.57	4,088.25	12.18
Thos. Mayne, Silver City	19	300.00	669.50	None
Tonopah Belmont	29,656	829,522.06	567,126.82	9,315.03
Tonopah Mining Co.	49,971	822,640.24	745,049.64	2,754.47
Montana-Tonopah Co.	12,955	174,749.46	135,940.00	1,377.73
Tonopah Extension Co.	13,106	156,782.58	127,761.04	1,030.26
Tonopah Midway	678	18,575.27	22,302.85	None
West End Con.	853	23,420.08	25,725.28	None
Jim Butler	13	1,057.24	6,243.31	None
Litigation Hill lease	Royalty	487.52	487.52	15.60
Man-Rainbow lease	Royalty	338.36	338.36	10.82
Vucanovich lease	245	7,753.51	6,918.79	53.10
White Caps lease	389	16,516.46	11,567.57	174.22
Man. Union Ex. lease	78	11,022.67	5,663.37	193.19
Man. Big Four Co.	Royalty	3,832.16	3,832.16	442.62
Big Four lease	396	10,265.69	22,217.44	None
Manhattan Dexter	388	8,605.35	13,112.73	None
Round Mountain Mining	14,807	91,165.16	82,025.95	246.75
Johnnie M. & M. Co.	5,664	16,916.59	32,255.73	None
Yellow Jacket	10,930	14,413.29	14,168.64	None
Belcher Silver	313	879.87	7,093.99	None
Crown Point	2,115	26,655.53	17,696.96	349.77
Comstock-Phoenix	248	17,695.93	13,456.67	118.69
Chollar Lease Co.	14,234	81,751.17	84,006.43	None
Mexican Gold	1,099	87,547.29	76,284.13	478.68
Ophir Silver	3,721	134,547.00	73,712.10	2,577.48
Ophir (delayed)	3,602	99,744.03	58,509.18	1,752.48
Mexican (delayed)	1,126	94,002.74	68,658.78	1,077.11
Com. Phoenix (delayed)	50	10,347.28	9,662.16	19.18
Tohoqua-Leadville	20	3,813.94	5,671.98	None
Amalgamated Nevada	800	2,800.00	4,950.00	None
Nevada Consolidated	728,193	2,104,409.34	1,788,063.24	6,295.25
Wilson, Red Hills	163	5,776.82	7,020.00	None

GOLDFIELDS were recently discovered, according to a Reuter's report from Nikolaievsk, in the basin of the Lamur, a small tributary of the Amur, which at first were secretly worked by 300 Russians, Chinese, and Koreans. At present there are three gold-prospecting parties in the fields, representing various companies, who have reported further finds. A large number of gold finds have also been made on the right bank of the Lower Amur.

THE Bunker Hill & Sullivan Mining & Concentrating Co. paid dividend No. 174, on March 4, 1912, of $49,050. This makes the total amount of dividends paid $13,339,500.

Company Reports

VAN-ROI MINING CO., LTD.

This company was formed in 1908, as a subsidiary of the Le Roi No. 2, Ltd., to acquire the Vancouver group of silver-lead-zinc properties in the Slocan district of British Columbia, and has a capital of £34,500, in 30,000 preferred shares of £1 each, and 90,000 ordinary shares of 1s. each, of which 60,000 are held by the Le Roi No. 2. The report is for the year ended September 30, 1911, but the mill was only in operation half that time. Between March 15 and September 30, 22,427 tons of ore averaging 3.74% lead, 7.8% zinc, and 9.46 oz. silver was concentrated, producing 1214 tons of lead concentrate averaging 65.3% lead, 9.1% zinc, and 89.7 oz. silver, and 1598 tons of zinc concentrate averaging 45.5% zinc, 1.7% lead, and 29.6 oz. silver. The profit and loss account shows a loss of £2661 for the year.

CONIAGAS MINES, LTD.

This company was formed in 1906 and owns 40 acres of mining claims at Cobalt, Ontario, as well as the entire capital stock of the Coniagas Reduction Co., Ltd., which owns and operates a 60-stamp mill and smelter at Thorold. The capitalization is for $4,000,000, in shares of $5 each, all issued, and fully paid. The report for the year ended October 31, 1911, shows that during that period 52,939 tons of ore was hoisted, of which 619 tons, estimated to contain 2,142,536 oz. of silver, was shipped to the smelter and the remainder, averaging 36.3 oz. per ton concentrated, yielding 1418 of concentrate, containing 1,643,616 oz. of silver. The total production was 3,789,274 oz., as compared with 1,929,531 the preceding year. The dividends for the year were $1,440,000, or at the rate of 36%, a total since 1907 of 71% of the capitalization. The ore reserves on October 31, 1911, were estimated at 132,600 tons, containing 15,645,000 oz. of silver. The profits upon the year's operations were $1,614,102, making a total balance of $2,566,505. In addition to the dividends £1500 was paid in directors' fees, leaving a balance to be carried forward of $1,124,867.

LE ROI NO. 2, LTD.

This company was formed in 1900 with an authorized capital of £600,000, in shares of £5 each (all issued), to acquire the holdings of the West Le Roi Mining Co., Ltd., one-half mile from Rossland, B. C. Further claims were acquired in 1905, and in 1908 the company promoted the Van-Roi Mining Co., Ltd., to acquire an option on a silver-lead property at Silverton. The report for the year ended September 30, 1911, shows that during that period 27,028 tons of ore was smelted, having an estimated content of 1.6% copper, 0.83 oz. gold, and 0.7 oz. silver per ton, and of a net value, after deducting smelting charges, of $15 per ton. By concentration 1589 tons of concentrate was produced, containing 1.29% copper, 1.425 oz. gold, and 0.75 oz. silver, and of net value of $25.50 per ton. The receipts from ore and concentrate were £84,806; other receipts made a total of $91,474. The divisible profits was £30,176, and the balance brought forward £44,005. Of this, £1700 was paid as director's profits and £36,000 as dividends, or at the rate of 6%. It was announced at the annual meeting that henceforth dividends will be restricted to £12,000 per year, in order to accumulate a reserve. The £5 shares were quoted on January 15, 1912, at £3¼ to £7s.

TRETHEWEY SILVER-COBALT MINE, LTD.

This company was formed in 1906 and owns 40 acres in Coleman township, Ontario, adjoining the Coniagas. It is capitalized at $2,000,000, shares of $1 each, of which 1,000,000 have been issued, fully paid. The company owns and operates a 100-ton concentrator. The report for the year ended December 31, 1911, shows that 33,339 tons of ore was milled during the year, with a recovery of 486,431 oz., and a further 284,407 oz. was recovered from high-grade shipping ore, making a total for the year of 770,838 oz. of silver, as compared with 865,777 oz. in 1910. This decrease is explained as due to the greater tonnage of lower-grade ore milled, coming from workings from which the higher-grade ores have already been removed. The gross revenue of the company was $372,622 and, expenditures $212,316, leaving an operating profit of $160,306. Dividends amounting to $200,000 were paid during the year, making the total to date $761,998. The average price received for silver during the year was 52.87c. per ounce, which will probably be increased during 1912. This company has combined with the Coniagas, Buffalo, and Hudson Bay companies to construct, at a cost of $20,000, an auxiliary pumping station at Mud Lake. Electric power and compressed air are obtained from the Northern Ontario Light & Power Company.

Taylor Iron & Steel Company

At the annual meeting of the stockholders of the Taylor Iron & Steel Co., held at High Bridge, New Jersey, on March 5, the annual report showed that the earnings for the year 1911 were very satisfactory, although there had been a falling off of business as compared with 1910. Besides the regular 7% dividend on the preferred stock, 6% on the common stock is being paid, and in addition thereto, surplus and reserve accounts increased. The company reports its business as being in a prosperous condition, and its plant and equipment, through recent extensions and additions, in an excellent condition to handle a largely increased business. The following directors were elected: Henry M. Howe, Knox Taylor, L. H. Taylor, Jr., E. H. Earnshaw, H. J. Cochran, Edgar S. Cook, A. E. Borie, V. G. Simkhovitch, and James Imbrie. The officers elected were: Knox Taylor, president; A. E. Borie and H. M. Howe, vice-presidents, and W. A. Ingram, secretary and treasurer.

Recent Publications

The New Madrid Earthquake. By Myron L. Fuller. Bull. 494, U. S. Geol. Surv. Pp. 119. Index, ill., map. Washington, D. C., 1912.

Water-Powers of North Carolina (Supplement to Bulletin No. 8). Bull. No. 20, North Carolina Geological & Economic Survey. Pp. 383. Ill. Raleigh, 1911.

Forest Conditions in Western North Carolina. By J. S. Holmes. Bull. No. 23, North Carolina Geological & Economic Survey. Pp. 116. Ill., map. Raleigh, 1911.

Results of Triangulation and Primary Traverse for the Years 1909 and 1910. By R. B. Marshall. Bull. 496, U. S. Geol. Surv. Pp. 392. Index, map. Washington, D. C., 1912.

The Mining Industry in North Carolina During 1908, 1909, and 1910. By J. H. Pratt and Miss H. M. Berry. Economic Paper No. 23, North Carolina Geological & Economic Survey. Pp. 134. Ill. Raleigh, 1911.

Comparative Railway Statistics of the United States, the United Kingdom, France, and Germany. Bull. No. 24, Bureau of Railway Economics. 47 pp. Washington, D. C., 1911.

Geology and Mineral Resources of a Portion of Fremont County, Wyoming. By C. E. Jamison. Pp. 90. Map. Bull. 2, Series B, Geological Survey of Wyoming. Cheyenne, 1912. This report is well printed and illustrated, appears to be accurate, and gives due credit to other sources from which information has been taken. It is almost unnecessary, therefore, to add that it belongs to a new series of bulletins issued by the State Geologist of Wyoming. It is to be hoped that more will be issued.

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the Mining and Scientific Press

The World's Minerals. By L. J. Spencer. Pp. 272. Illustrations in color, index. Frederick A. Stokes Co., New York, 1911. For sale by the *Mining and Scientific Press*. Price $2.

In this work the author, who is editor of *The Mineralogical Magazine* and is connected with the British Museum, has essayed the difficult task of treating a scientific subject so as to attract the general public. He has been unusually successful, and by means of figures, colored plates, and accurate but entertaining text, has produced a book that may well serve to inform at the same time that it teaches the reader to like minerals. He is right in saying that no book can take the place of actual specimens, but this book is apt to result in the student building up that small collection which forms the best basis for the study of minerals. As a guide to one who has not had the benefit of training in mineralogy it is the best book available. An amateur using it will make mistakes, but at least he will be saved from many errors.

Works Management. By William Duane Ennis. Pp. 194. McGraw-Hill Book Co., New York, 1911. For sale by the *Mining and Scientific Press*. Price $2.

Mr. Ennis, who is professor of mechanical engineering in the Polytechnic Institute of Brooklyn, New York, has done good service in his presentation of the principles of works management. Engineers and managers have been deluged recently with a flood of publications upon efficiency and economy in works management. The author admires what he designates as 'Taylorism,' but has given it only incidental treatment in his work, which covers management in all its phases, and treats it in the light of the prevailing 'efficiency' obsession. The first chapter discusses management units, and is followed by a chapter on cost elements and classifications. Chapter III deals with statistical records, and the following chapter discusses labor. The three following chapters treat of material, burden, and depreciation, and the eighth chapter is an excellent discussion of industrial organization. Principles of accounting form the subject of the next chapter, and the book concludes with a discussion of the plant as the physical basis of the industry. The book is intended as a text for engineering students, and a series of useful problems forms an appendix to the text.

Petrographic Methods. By Ernest Weinschenk and Robert W. Clark. Pp. 386. Ill., index. McGraw-Hill Book Co., New York, 1912. For sale by the *Mining and Scientific Press*. Price $3.50.

Ever since Sorby applied the methods of grinding, developed in cutlery manufacture, to the making of thin sections of rock, the field of usefulness of the microscope in the study of rocks has been expanding. Accurate petrographic determinations are now a pre-requisite to successful determination of the nature of most orebodies, and in the solution of general scientific problems in geology, the help afforded by the microscope has been enormous. This is generally recognized, but it is not so universally understood that success in using the microscope must rest on long preliminary study. There are too many still in the position of the engineer who dropped into the study of a professor at the University of Chicago and announced that he had a couple of weeks of time to spare and wanted to learn how to recognize rocks under the microscope, but didn't care "to bother with the principles of petrography." As to this, the authors of this book say in the introduction: "Special emphasis must be laid upon the fact that simply knowing the appearance of certain minerals in some rocks, or in a large number of rocks, is not sufficient to give that confidence which is necessary in petrographic investigation. As the appearance of one and the same mineral varies greatly in different rocks, a continual source of error is thus introduced, and only general confusion results if the knowledge of minerals is purely superficial and not sufficiently based on microscopic optical methods. The microscopic optical methods necessary for petrographical investigation are discussed thoroughly in the first part of this book. A knowledge of these fundamental principles must precede all petrographic work." The book furnishes the student the material necessary to this preliminary study and the criteria for recognizing the various minerals when the underlying principles have been grasped. It is an excellent book, well prepared, well written, and well printed. The senior author is professor in the University of Munich, and the junior, who is also translator, instructor in petrology in the University of Michigan.

Faults and Dykes. By J. S. Olver. Pp. 298. Ill., no index. J. C. Juta & Co., Capetown, 1911. For sale by the *Mining and Scientific Press*. Price $7.50.

The title of this work is somewhat misleading, for it is not a general study of faults and dikes, but a minute and detailed study of those of the Witwatersrand, which can scarcely be considered as the only ones worth knowing about. There is, in addition, much in the book beyond a discussion of geological phenomena, notably a discussion of observation and solution of vein phenomena and a study of local sampling problems. The book is divided into two parts, the first general, the second specific. Beginning with simple faulting, Mr. Olver next discusses fault movements and their calculation, and next takes up 'slides,' by which term he designates faulting which coincides with a bedding plane in sedimentary rocks. The following chapter on relative ages of faults is general in its scope, and the whole first five chapters of the book form an interesting complement to C. F. Tolman's 'Graphic Solution of Fault Problems,' which is entirely general in its treatment of faulting. The chapter on observation somewhat overlaps the succeeding chapter on 'reef problems,' and the two were evidently written independently of each other, and without intention to make them chapters of a book. In both are interesting discussions of special problems and much collateral material, such as a condemnation of the 'diamond-drill habit.' Mr. Olver believes that the "use of the diamond-drill is only admissible under exceptional circumstances, and a constant recourse to it should be looked upon as a want of intelligence in the underground management of a mine." Unnecessary driving and drill prospecting to secure information readily obtainable by careful mapping and study of geological phenomena are all too common everywhere, and Mr. Olver's argument is of almost universal application. The first section concludes with a chapter on mine sampling which is lucidly written and full of practical suggestions. The second part of the book is a detailed discussion of the stratigraphy of the Rand. Having the benefit of the work of Messrs. Gibson, Hatch, Corstophine, and Mellor, Mr. Olver should be able to put his discussion upon a high level, and he appears to have done so. He is daring, and extends the Witportje and Orange Grove faults into ground where few will be prepared to concede their existence. His arguments are plausible, however, and students of Rand geology will read them with interest.

The Penhsihu coal mine is 48 miles southeast of Mukden and only second to the Fushun mine in importance. This colliery is now operated under joint Chinese and Japanese management, and when exploited in conjunction with a rich iron mine about 20 miles distant, is expected to blossom into a very lucrative enterprise.

The Miami Copper Co. anounces that no dividend action will be taken until the meeting for the quarter ending April 1. The concentrator is now handling 3000 tons of ore per day, and the mine is furnishing this amount of ore to the mill without difficulty.

The Old Dominion company of Maine has declared a quarterly dividend of 75c. per share. Three months ago it declared a quarterly disbursement of 50c. per share.

Commercial Paragraphs

George E. Dow, of the Geo. E. Dow Pumping Engine Co., has closed a contract with Willans & Robinson, of Rugby, England, for the right to manufacture the Willans Diesel engine in the United States, Hawaii, and Alaska. A new company, to be known as the Dow-Willans Diesel Engine Co., has been organized by San Francisco and London capitalists to manufacture under these patents, and shops are being erected at Alameda, near San Francisco. George E. Dow is president and O. H. Ohlant vice-president of the new concern.

The Joseph Dixon Crucible Co., of Jersey City, has just put on the market a new chain graphite, especially intended for lubricating the chains of motor trucks and pleasure cars. This preparation is put up in sticks, cylindrical shape, 2 by 8 in., encased in a neat cardboard carton, and weighing about one pound each. It is by far the most convenient chain lubricant on the market, for a bar may be carried on the car ready for use at any time. To apply, it is simply necessary to rub the bar against the sprocket side of the chain. The stick makes it easy to keep automobile driving chains in first-class condition. Unlike oils and greases, it will not collect dust and dirt.

The International Motor Co. announces that it has just acquired the properties of the Hewitt Motor Truck Co., and all the business of this concern was taken over on March 1. Sales and executive departments on that date became amalgamated with the International Motor Co., whose headquarters are at Broadway and Fifty-seventh street, New York, with works at Allentown, Pa., Plainfield, N. J., and New York City. The association of the Mack, Saurer, and Hewitt trucks makes the position of the International Motor Co. one of the most formidable, if not the most formidable, single factor in the motor-truck industry in this country. The range of sizes which this organization offers will include every varation in live-load capacity ranging from 1500 lb. up to 10 tons. The acquisitions of the Hewitt interests especially strengthens the line of heavy-duty trucks offered by this organization, as the Hewitt trucks have made a most enviable reputation in the past few years, being in the service of some of the largest wholesale coal dealers, lumber merchants, and engineering contracting firms.

The C. O. Bartlett & Snow Co., of Cleveland, Ohio, in order to keep pace with its remarkable growth, has just increased its capitalization to $500,000. About 25 years ago C. O. Bartlett, now the company's president and treasurer, laid the foundation of this business. Its operations during the earlier years were the manufacture of oatmeal, barley, pearling, and general mill machinery, but gradually through these years one line after another has been added, and the volume and importance of the business has increased to such an extent that the company now occupies a prominent position as engineers and manufacturers of all kinds of elevating and conveying machinery, complete coal tipples and coal-handling machinery at the mines and docks, as well as complete coal and ash handling machinery, and complete fueling scows for fueling lake vessels, mechanical driers, both direct heat and steam driers for rendering establishments; also crushed stone, gravel, and sand handling and washing plants, soft mud brick machinery, and complete equipment for the economical handling of nearly all kinds of materials. The company has a large export business, especially in Mexico, Canada, and South America. The increased capital will provide for some enlargements and extensions of the company's business, which may include a foundry. The offices of the company in addition to Mr. Bartlett are E. J. Neville, first vice-president and general manager; H. H. Bighouse, second vice-president; H. L. McKinnon, third vice-president, and I. M. Snow, secretary.

Superheat and high steam-pressures have created a demand for valves of greater strength and durability than those made of cast iron. Anticipating the requirements of the trade, The Lunkenheimer Co. has designed a complete line of globe, angle, gross, gate, check, non-return boiler stop, etc., made of cast steel, all of which will be found in use and giving satisfaction in a large number of high-pressure power-plants. With the exception of the largest sizes, the Lunkenheimer cast-steel valves are made of crucible steel and not open-hearth or converter steel. Crucible steel is made and melted in closed crucibles, out of all exposure to furnace gases, and solid castings free from blow-holes are insured. This is not true of the open-hearth and converter steels, the first of which is heated by blowing hot gases over the molten metal, and the second by blowing them sometimes through the metal. Aside from forming blow-holes, these gases form oxides which dissolve in the steel and thereby reduce its ductility and cause a low elastic limit. All of Lunkenheimer cast-steel valves are annealed, which relieves all internal stresses and makes a fine crystalline structure, which is very essential to strong steel. The Lunkenheimer Co. claims that its valves are the only ones which are made to meet the specifications of the American Society for Testing Materials, and that they are the only steel valves containing less than 0.05% of either phosphorus or sulphur. The tensile strength of Lunkenheimer cast steel is about 80,000 lb. per square inch, with a safe elastic limit and excellent elongation. For various pressures and degrees of superheat and to meet the requirements of engineers who differ as to the material used, Lunkenheimer cast-steel valves are made in two combinations of material as regards the trimmings. For lower pressures and degrees of superheat, the company manufactures a large and complete line of cast-iron and 'puddled' semi-steel valves. The Lunkenheimer Co., Cincinnati, Ohio, will send descriptive matter pertaining to its cast-steel valves to anyone interested.

Catalogues Received

'C-12,' the new catalogue of the Dodge Manufacturing Co., is now being distributed among the trade. It contains 413 pages, beautifully printed and illustrated, and describes and lists in complete form the goods the Dodge company makes at Mishawaka, Indiana. As an introduction, the first pages are devoted to interior views of Dodge foundries, machine-shops, power-plant, and branch houses; then follow tables for laying out shafting, horse-power of steel shafting, dimensions, etc. Every product of the company, a complete line of power-transmission machinery and appliances, elevating and conveying equipment, rope-driving system, and water-softener apparatus, is completely described and listed. Considerable space is devoted to the Dodge friction clutch as an accident-prevention device. Concluding pages give a little history of the transmission of power by manila rope with illustrations of a number of striking installations, heavy engineering work, and the Eureka water softener and purifier. This book marks the close of another year in the life of the company. Established in 1878 by Wallace H. Dodge, it has been an important factor in the industrial life of America. First incorporated under the laws of Indiana with a capital stock of $50,000, this has passed over the million mark. Since its inception, the Dodge Manufacturing Co. has never had an unprofitable year. Considerably more than $2,500,000 has been earned for shareholders, and of this more than $2,000,000 has been added by reinvestment to the company's resources. The business got its start through the invention by Mr. Dodge of the split-wood pulley with interchangeable bushings, a revolution in the pulley art. At that time the plant occupied only a few acres of ground in Mishawaka. Today there are 63 acres of ground space and over 21 acres of floor space. This great factory is equipped with every facility required in the economic and efficient operation of various departments, and this is supplemented by a vast selling organization, taking in branch houses at New York, Boston, Pittsburg, Philadelphia, Cincinnati, Minneapolis, Chicago, St. Louis, and Atlanta, and stock-carrying agents in every power-using community. The company enjoys a world-wide reputation both as to products and management.

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EDITORIAL

LARGE corporations seem to be doing very well in their disintegrated condition, and Standard Oil shares have risen in price considerably since the dissolution of the holding corporation.

IN the account of the Mineral Resources of Bolivia by Mr. Carlos Sanjines, that we published March 9, the pertenencia was defined as consisting of 100 square metres. This was an error, as readers familiar with land measure in Spanish American companies will have noticed. In Bolivia, as elsewhere in South America, the pertenencia is equivalent to one hectare and is 100 metres, or approximately 328 feet, square.

SHEEP, sunshine, and silence are giving way to the hum of industry in New Mexico, and we are glad to present this week an account of the great Chino mine, written by Mr. James O. Clifford, an engineer long familiar with the Southwest, and to supplement it with an authoritative account of the mill, written by Mr. John M. Sully, who has seen notable changes in New Mexico, though none more striking than at Santa Rita, and in which he has played so successful a part.

AN interesting comparison between the Yukon and Alaska is made this week by Mr. Guy A. R. Lewington, a well informed American living at Dawson. The marked contrast is not due to dissimilarity in the natural resources west of the international boundary from those east of it, but is wholly the result of difference in two legal codes. It is worth noting that at Dawson two attorneys handle all the litigation of the town, while at Fairbanks, which is of about the same size, there are about fifty.

MUCH of the loss of life in railroad accidents is due to faulty metallurgy, since many of the wrecks are due to broken rails. Unfortunately it is impracticable to entirely eliminate bad rails by even the most rigid system of inspection, since oftentimes a flaw is too deep seated to be detected by external examination. A recent counter proposal is the removing of fast trains from the schedules, but the disadvantage of this method of procedure is evident. The fastest trains in the world are operated in France and England, without the resulting losses of life we here sustain. Rather than pay for complete safety, both the public and the corporations are willing to take a chance.

INTERNATIONAL economic relationships are clearly shown by the collateral effects of the strike of coal miners in England. Shipping interests with South America are severely hampered by the lack of coal for steamships, and without steamships the supply of food products from South American countries ceases, and the same is true of trade with Denmark. The mineral industry can show its examples as well. Concentrate from mills in Korea is smelted at Tacoma, while California smelters operate on Australian, German, or Chinese coke. Antimony residues from China go to Belgium for re-treatment, and recently a carload lot of zinc ore was shipped from Africa to Denver for experimental purposes. The mining engineer is perforce cosmopolitan.

NOTABLE progress has been made by the United States Smelting, Refining & Mining Company since its formation in 1906, and its subsidiary companies in the United States and Mexico have done well. Its Utah subsidiary, the United States Smelting Company, is about to issue $10,000,000 in bonds to acquire coal properties and necessary railroad connections.

CONDITIONS in Mexico continue much disturbed, though the mineral industry is again doing remarkably well under adverse conditions of work. Mine-owners in Chihuahua are said to be worried over the payment of the tax on output, as the Federal tax office has been closed and the insurrectionary forces have opened another. Fearing lest if paid to the revolutionists the tax may be required to be paid again to the central government, and knowing that unless paid by April 1 a fine of 50 per cent of the total sum may be imposed, our neighbors to the south are in an unpleasant dilemma.

A CURIOUS feature of the practice of many technical journals is an apparent unwillingness to acknowledge the sources from which material is drawn, apparently from a belief that by crediting other journals with material taken from their columns the impression is conveyed that the journal according credit is unable to secure original material of value. Our own belief is that our subscribers wish to receive that which is important and interesting to them, regardless of whether or not it has previously been published elsewhere, and we do not believe that our columns lose dignity through the occasional line of acknowledgment. From time to time we have referred in vigorous terms to the practice of certain journals in reprinting material from our columns without according credit. An interesting variation of this practice is seen in the issue of the *South African Mining Journal* for February 17, which reprints our editorial of January 6, 'The Year Among the Gold Mines,' in the form of an original article, altering the wording sufficiently to make it appear that only the information regarding California had been obtained from our columns. When you are 'lifting' material, gentlemen, why not be wholehearted about it; or, better still, make full acknowledgment?

THAT more engineers are now being turned out yearly by the technical schools than the country can assimilate, is the view of Mr. H. S. Pritchett, in his annual report as president of the Carnegie Institution for the Advancement of Teaching. This is the case, if it is to be supposed that the young man of engineering training must necessarily remain in the work of his profession, but this is neither true nor desirable. The enormous fabric of modern industry hinges upon the mechanical and chemical arts in a multitude of ways, and no better training for a business vocation can well be imagined than a thorough grounding in the fundamental principles of physics and chemistry, with their applications. More significant is the fact that during 1910 thirty-eight different degrees were conferred upon 3713 students by 102 institutions. In Pennsylvania there are 13 engineering schools, of which 6 have less than 40 students each. No adequate reason for the continued existence of a multitude of small and ill-equipped schools can be advanced; nor should the rights of the student be ignored. With a limited amount of time and money to invest in his education he should not be subjected to pressure to invest it in a local institution, when a more adequate return can be secured elsewhere. Nor is such a variety of degrees necessary, and their multiplication is more likely to produce a crop of under-done specialists than to meet an industrial need. The Foundation has an excellent field for its activities in directing the lines of growth of secondary education, and the storm of protest which it occasionally evokes may be taken to indicate that it is making its influence felt. It is interesting to note, in passing, that the fifteen teachers whose deaths are recorded in this report, lived on the average less than three years after the receipt of a retiring allowance.

Government Bureaus and Potash

Much attention has been attracted recently by reports in the public press that the United States Geological Survey and the Bureau of Soils of the Department of Agriculture have jointly discovered immense resources in potash salts existing in the widely known Borax lake of San Bernardino county, California. There can be no question that the potash industry is an important one to the American people, since we annually import over five million dollars worth of chloride salts, kainit worth more than two millions, sulphate worth nearly two millions, and other potassium salts of considerable value, while the economic fact that no important sources of supply exist in this country, thus placing it at the mercy of the German producer, has been strongly emphasized by the market situation which developed last year. Under the circumstances it was highly proper for those bureaus whose function it is to foster the agricultural and mineral industries, to undertake to discover supplies of potash salts within the boundaries of the United States.

Purposes and methods are two different things, however, and while commending the one we beg to deprecate the other. The function of government bureaus is to disseminate accurate information, not to diffuse sensational statements. Five years ago members of the Geological Survey embarked on the latter course in connection with the investigations concerning black sands and their treatment, and the echoes of exaggeration based on 'preliminary statements' have scarcely yet completely subsided. At that time we expressed our opinion that the "researches into black sand are affording more ammunition to irresponsible promoters and to a sensational press than they are actually improving the treatment of a material, the existence of which was known long before the much-advertised experiments were made." On another page we give the text of a press bulletin sent out under the joint auspices of the Bureau of Soils and the Geological Survey. It announces that as a "conservative" estimate the amount of K_2O in the form of potash salts existing in solution in the waters of Borax lake is 4,000,000 tons, and it is possible that it may exceed 10,000,000. This has been "discovered" by representatives of these bureaus, who have analyzed samples of brine taken from six wells in an area of eleven square miles, from which, by facile leaps, the conclusion is reached that the brine contains an average of 6.78 per cent K_2O and constitutes 25 per cent of the salt body covering this area. In the prospectus of an irresponsible promoter this would be conservative; in a publication of a scientific bureau it is a disgrace. These remarkable results have all been obtained from "existing data" except the "discovery" of the potassium content of brine samples taken from wells put down by private individuals for the purpose of testing these salt bodies.. If this were in fact a discovery the original analyst might be severely condemned. Since it, however, is merely a public statement of what was previously known to those who spent money to determine the facts, its importance diminishes. Potassium occurs in nature in a variety of minerals; some of which are commercially valuable and others are not; which of these occur in these salt deposits? How may they be made available? Are the data given accurate or merely wild guesses? The Survey has said too much not to say more; it is 'up to it to make good.' In any event, such methods of self advertisement by government bureaus are at once unbecoming and productive of

to good results. Shares in irresponsible enterprise can be sold through newspaper publicity; economic development works through other channels.

The Balance Sheet in Smelting

One of the fundamental tenets of biology is that an individual organism in its life history roughly recapitulates the history of the development of the race or species to which it belongs. A similar conception is of great service in considering the development of an industry, which in many respects resembles an organism. A Goldfield Consolidated is preceded by shallow untimbered shafts, a whim or windlass, and crude milling tests to determine the worth of the ore. The relative importance of the primitive stages depends entirely upon the conditioning circumstances; some mines exist for years in the whim stage of development, and, indeed, never advance beyond it, while in others it may be so brief as to easily escape notice. But the economic history of an enterprise, whether it be a Goldfield Consolidated or Dick Smith's claim on Buck creek, consists in a series of adjustments to the governing circumstances. On another page, in the course of an admirable article upon the mineral losses in gases and fume which occur in smelting, Mr. F. G. Cottrell remarks that the copper blast-furnace is today one of the crudest appliances in engineering practice, and suggests that the reason for this backward stage of development can be found in the difficulty of interpreting small-scale smelting experiments in terms of full-scale working conditions, aided by the financial considerations that with a rich mine the natural desire has been to secure tonnage to increase profits, while with poor mines there existed an equally natural reluctance to undertake experiments which would surely be expensive and possibly unprofitable. Mr. Cottrell is a chemist of distinction, and consequently looks upon the art of smelting with a critical eye; in speaking to an association of chemists he may have thought it unnecessary to introduce other practical features which, when considered, do not indicate that metallurgists have been remiss in the development of their art. The most important of these is the state of flux in which a smelting industry constantly exists. In the case of a sugar factory, for example, the plant can be constructed and operating methods devised upon the basis of a fairly uniform raw material. A plant to make sugar from beets is a concrete problem which offers but slightly varying phases from year to year; minute studies are possible and the introduction of slight refinements and economies of practice are economically advantageous. But suppose a plant were required to make sugar from a mixture of beets, cornstalks, and alfalfa and the relative amount of each available varied from month to month and year to year. In the latter case the energies of both the management and the technical staff are largely absorbed in continuing operation at a profit, rather than in introducing refinements of practice. Surely the skill required in readjusting inexpensively a plant constructed for work of a certain character so that it will continue to work on material of radically different character, is of no less high order than the skill that devises the finer points of advanced practice. Scarcely a smelting plant in the United States, not of recent construction, is treating an ore like that for which it was constructed. In Colorado, copper smelting has been discontinued, the lead smelting plants are called upon to solve new problems arising from variations in the smelting charge, every year, and in other states there are cases of the metallurgist being called upon to construct a copper smelting plant for what afterward turns out to be a zinc mine. The differences in the chemical and metallurgical industries are fundamental; the former deals with raw materials of known composition and assured character, while next year's supply of ore is in the ground, and no one can tell exactly what it will be like until it has been taken out. In building a house in town it is practicable and desirable to put in open plumbing and electric light; in the construction camp dependence is placed on the tin washbasin and the tallow candle. A copper blast-furnace is admittedly a crude appliance; so is a shovel a crude tool, but both do the work they are required to do more cheaply and effectively than any substitute can.

Much in Mr. Cottrell's article is suggestive of thought, and may well be carefully considered. One point which deserves further attention is the question of reducing SO_2 to the form of sulphur, or else preventing the original oxidation of sulphur, eliminating it in the elementary form. Both chemical and mechanical factors enter into this problem. In the case of an ore carrying 40 per cent sulphur and 4 per cent copper, the sulphur which is burned furnishes the heat for the endothermic reactions of smelting, the coke employed chiefly acting mechanically in keeping the charge open. If no sulphur is to be burned, then sufficient coke must be used to furnish the heat necessary, with the result that the smelting cost is increased 75 cents per ton, or nearly 1 cent per pound of copper produced, even assuming that the variation from the standard method and type of construction does not otherwise increase the cost of operation. In the case of reducing SO_2 to elemental sulphur the economic result is the same; you are equally impoverished by paying out of the contents of the left pocket instead of the right. The manufacture of sulphuric acid, and its employment for the production of superphosphate fertilizers offers no such easy solution as many of the early hasty writers on this subject assumed. The total quantity of sulphuric acid produced in the United States in 1905 was 1,642,262 tons, or less than double the possible output of a single large smelting plant. Of this, less than 200,000 tons was employed to manufacture 1,670,978 tons of superphosphates and 781,354 tons of ammoniated superphosphates. Out of a total of 3,591,771 tons of fertilizer of all kinds produced in the whole United States in 1905, less than 57,000 tons was produced west of Nebraska. It is quite true that the consumption of fertilizers in the Western states will increase as agriculture is developed upon a more intensive scale, but when a single large smelting plant can furnish enough sulphuric acid to quadruple the present production of phosphate fertilizer, the outlook in that direction is not encouraging. Certain smelting plants will be able to produce acid profitably, the majority will not. The placing of plants so that the escaping SO_2 will not damage vegetation will be effective in other cases, and the perfecting of leaching processes has already been greatly stimulated. The solution of this problem is an economic one, and must be attacked on economic lines. It may well be asked whether it may not be better for the American commonwealth to have smelting industries flourish, even at the expense of neighboring agriculture, than to restrict metallurgy unduly. Farms exist everywhere, but smelters can only exist in the comparatively few places where the sum of governing conditions permit; it might be to the advantage of the commonwealth to give the smelter the right of way, just as railroads have been accorded the privilege of exercising the right of eminent domain. This may be a wrong view; it is at least a possible view. Political conditions, by which the great number with small interests at stake are able to outweigh the few with great interests at stake, ought not to supersede a clear-sighted view from the standpoint of economics. Questions such as these should not be approached from the standpoint of prejudice and self-interest, but from the standpoint of securing the greatest good to the greatest number. Meanwhile copper smelting lumbers in a stormy sea.

Lessons From Recent Mine Disasters

By Joseph A. Holmes

*It would be unfortunate, as well as unpardonable, if from the many American mine disasters of the past few years some lessons have not been learned that may help to prevent or minimize future disasters, or reduce the loss of life resulting from them. I shall endeavor to call attention to a few of these lessons that stand out most prominently. First of all, attention may be called to the fact that satisfactory progress is not yet made in reducing the loss of life in our mines; and this progress never will be made without getting away from the theory and down to actual practice, and developing that hearty determined coöperation between the mine-owner and the mine worker which is absolutely essential to success. Of the fatalities in coal mines for 1910, 47% were from falls of roof and coal; 16% were from mine-cars; 18% were from mine explosions; 4% were from explosives; 2½% were from electricity. Of the total fatalities, 90% were underground, and 10% above ground.

Lessons from Mine Fires

Mine disasters have resulted from mine fires, gas explosions, or dust explosions, or a combination of two or all of them. Two of the most notable recent disasters from mine fires are the Cherry disaster of November 13, 1909, where 259 men lost their lives (the fire having started from the burning of hay in the mine stable, and the Pencoast mine disaster, near Scranton, where 72 men lost their lives from a fire which appears to have started from the inflammable material at one of the underground power stations. In neither of these two mine-fire disasters does there appear to have been any accompanying gas or dust explosion. It is evident that the men were suffocated or poisoned by the gases generated from the fire (excepting, of course, the few who were killed by the heat of the fire itself).

The two most important lessons taught by these two disasters are: the risks that always attend the practice, which is entirely too common, of carrying into mines inflammable materials and keeping these materials in the mine; and second, the inadequacy of the methods and equipment for fighting and extinguishing mine fires. Of course, timber must be used in the mine, and no economical method is now known for fireproofing this material. As long as mules are kept in the mines, certain materials must be carried into the mines with which to feed them; but if baled hay must be taken into the mines for feeding purposes, it can be easily and superficially wet either by sprinkling or dipping it quickly into a tank of water, and it can be carried in closed cars. By all means the easiest way to prevent the risk of fires in mine stables is to keep these stables outside of the mine.

Lessons from Mine Explosions

Under the new system now being introduced, men wearing different types of breathing apparatus are expected to go into the mine in advance to investigate the condition of the mine, adopt the necessary steps toward ventilation, and find and extinguish smouldering mine fires; also find and rescue any persons who may still be living in the remoter portions of the mine. This modern type of rescue work is new; it is still imperfect and open to improvement. It frequently arouses criticism on the part of those who watch but do not take part in its progress; and under the circumstances this is not to be wondered at. The special breathing apparatus of today is heavy and cumbersome, and the oxygen supply that it carries does not last as long as it should. Nevertheless, progress is being made, and the results of each year's experience will prove more and more satisfactory and encouraging. Recent experience in this new type of mine-rescue work at Briceville and other mine disasters has taught some important lessons. One of these is that there should be at every mine or every group of mines a number of young men trained in the use of modern breathing and rescue equipment, who are familiar with the mines in that particular district; also that the men who are trained in this work should be actual miners, men thoroughly acquainted with the mining conditions. They should be sound in health, and they should be men who are not easily excited, but remain cool and thoughtful at the time of greatest risk.

Trained Rescue Men at Every Mine

There should be at every mine or group of mines a sufficiently large number of men, equipped with breathing apparatus, who can begin the rescue work in the mine as soon as the disaster occurs, expecting to be relieved or aided when other rescuers arrive.

The more training and experience a miner has in this new type of rescue work, the more efficient he becomes, and the more he can accomplish within a given space of time; and the less is the risk of losing his own life. But even after a week's training such as is given by the Government mine-rescue cars, a miner should be prepared to take part in the actual rescue work following a mine disaster. Under no ordinary circumstances should a man who has had no previous training in wearing the helmet outfit, make a trip to a remote part of the mine filled by poisonous gases; this should be done only by men who have already had such training for at least a week.

The number of men trained and supplied with modern rescue equipment should be rapidly and greatly increased in every important coalfield. Within a few years more it is hoped this system will be carried forward to such an extent that in the case of such a disaster as that at Briceville, and within a few hours after a disaster, there can be assembled promptly from 50 to 100 men, well trained and fully equipped with special breathing apparatus, and also fairly familiar with the immediate mining district. With a force of this kind it would be possible within a few hours to reach all the remoter parts of the mine. With the present limited number of trained men in different parts of the country, this is impossible. At no disaster previous to that at Briceville has it been possible to bring together within a short time as many as a dozen experienced and well equipped men. For a short time at Briceville, there were as many as 20 men who had some training with helmets, but one-half of these were without actual experience, and not one of them was familiar with the mining condition in that region. A week was therefore required to accomplish results which should have been accomplished in less than 24 hours.

With a general improvement of mining conditions and increased efforts to prevent or limit dust explosions through sprinkling, exhaust steam, stone-dust, or ashes, or otherwise, it is becoming more and more likely that explosions, which may occur in spite of such precautions, will be limited to certain portions of the mine. In such cases, the chances of men escaping through other openings, or living in the mine after the explosion for several days, by putting up barricades in remote parts of the mine, will be greatly increased. While, therefore, all will agree that the most important thing of all is to prevent mine disasters, it is also necessary to endeavor as rapidly as possible to improve facilities for rescue and first-aid work.

*Excerpt from an address delivered before the Southern Appalachian Coal Operators' Association, Knoxville, Tennessee, February 13, 1912.

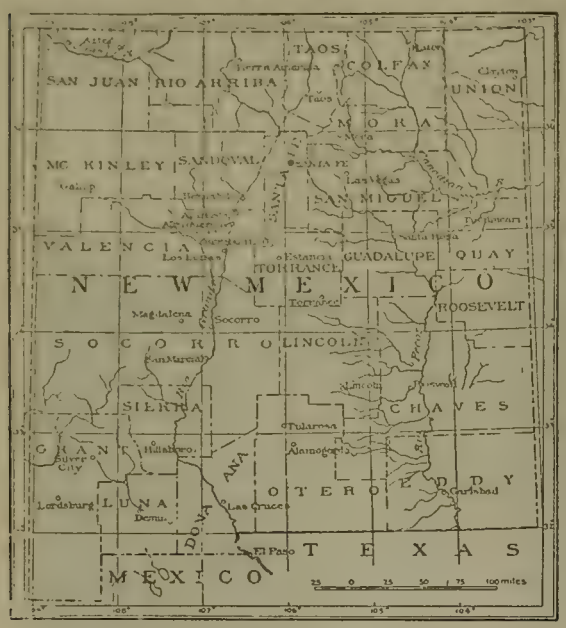
The East Rand Proprietary Mines operating results for January 1912 were: 820 stamps milled 164,550 tons; 57,340 oz. recovered from all sources; £67,108 profit for the month. The clean-up of the cyanide works commenced on the morning of January 26 and was completed on January 28; the clean-up of the mills commenced on the morning of January 30 and was completed the same day. Because of opinions expressed by shareholders, gold reserves have been abolished, and the estimated value of the reserve, namely, £74,638 has been transferred to profit and loss account for the year 1911.

Mining Copper Ore at Chino

By James O. Clifford

The Chino Copper Co. owns several extensive groups of mining claims at Santa Rita and a 3000-ton concentrator at Hurley, both in eastern Grant county, New Mexico. Santa Rita is on a branch line of the Atchison, Topeka & Santa Fé railroad, fifty miles north of Deming, New Mexico. With the possible exception of the Keweenaw peninsula, Santa Rita is the earliest known copper-producing district in the United States. About 1780 the copper mines at Santa Rita were acquired from the Indians and operated until 1840 by Spanish successors, to supply copper for the Mexican coinage. So far as known, only the high-grade seams of native copper that permeate the mineralized zone of the district were mined and shipped by pack-trains to Mexico City by way of Chihuahua.

From 1840 to 1900 the mines were worked only intermittently, and then chiefly by American and Mexican lessees. No authentic records exist giving the production during the period 1780 to 1900, but the value of the copper mined is estimated at $15,000,000. Three years ago the



MAP OF NEW MEXICO.

Chino Copper Co. acquired control of the principal mining properties in the Santa Rita basin, among which are the Romero, Montoya, Santa Rita, Hearst-Carrasco, Texas Flat, and Whim Hill groups of mining claims, together with several other groups of lesser importance. The total area of mineral ground controlled by the company is about 2000 acres, most of which is patented.

General Geology.—Santa Rita, although officially included in the Central mining district, is distinct geologically from the region about the town of Central, and is therefore considered independently. Santa Rita and Hanover, being in the same geological horizon, are considered together and referred to as the Hanover-Santa Rita mining district. Hanover adjoins Santa Rita on the northwest, being separated by the low divide between Hanover and Santa Rita creeks. The average elevation of the district is 6500 feet.

The geology of the Hanover-Santa Rita district is complex, and comprises rocks representative of sedimentary, metamorphic, intrusive, and effusive types. The sedimentary series consist mainly of Devonian limestones and shales and Carboniferous limestones, about 900 ft. thick. The metamorphic rocks are sediments altered by porphyritic intrusions, and are about 300 ft. thick. This contact-metamorphosed limestone, containing cupriferous sulphides, is believed to have originally overlain the region of the present orebodies, and that through thorough oxidation and degradation the contained copper was dissolved and precipitated in the underlying rocks. The area of these altered limestones was doubtless considerably greater than the existing one. The intrusive rocks comprise quartz monzonite and quartz-diorite porphyries. The former occurs as an elongated mass that has domed up the sedimentaries and then been partly exposed by their subsequent erosion; it also cuts the sedimentaries in the form of dikes and irregular intrusive projections from the main body. The quartz-diorite porphyry cuts the quartz-monzonite porphyry and the sedimentaries, and occurs as dikes and intrusive sills along the outer rim of Santa Rita basin. The effusive rock is represented by an extensive flow of reddish rhyolite to the north and south of Santa Rita, a remnant of which is a prominent feature of the eastern landscape and is called the 'Kneeling Nun.'

Santa Rita basin is merely a local widening of Santa Rita creek and is about a mile square. Quartz-monzonite porphyry, upon which rests a block of slightly altered Cambrian quartzite, 200 to 300 ft. thick, constitutes the floor of the basin. Altered limestones, porphyry, and rhyolite chiefly form the sides. The ore exists as veins in quartzite and porphyry, contact-metamorphic deposits, and deposits of secondary enrichment.

Chino Ore Deposit.—This occurs in the form of a horseshoe of mineralized quartz-diorite porphyry encircling a barren core of slightly altered quartzite. This mineralized quartz-diorite contains a great variety of copper minerals; chalcocite and native copper, however, predominating. Rich seams of native copper permeate the entire mineralized zone. The dissemination of the orebody is not so uniform as in the case of some of the other 'porphyries'; consequently the copper content of the ores mined will be subject to fluctuation. The average thickness of the orebody is said to be 110 ft., capped by overburden averaging 85 feet.

Prospecting and Development.—The ore deposit has been prospected by churn-drilling. In that manner 54,970,000 tons of ore is said to have been blocked out, having an average copper content of 2.24% per short ton.

Mining Operations.—The management states that at least 60% of the ore developed can be mined by steam-shovels. Stripping operations are several years in advance of mill requirements. The cost of stripping and mining is said to be about the same as at the Utah Copper and Nevada Consolidated properties.

Progress in Bolivia

The copper production of Peru increased last year by 142%, of Chile by 28.7%, and of Bolivia by 20%. The Rio Blanca smelter, in which a majority interest is in American hands, is at present under a receivership, owing to local litigation. The plant, which has been constructed for about three years, has remained practically idle. Railway construction in Bolivia progresses slowly. It is believed that the Rio Mulatos to Potosi line will be ready for the transportation of passengers and cargo in March or April. There is very little work now being done on the Oruro to Cochabamba line, and it is said that this line will never be finished any farther than Changolla, which is about on the border line between the departments of Oruro and Cochabamba. As far as the Arica-La Paz line is concerned, the date of its formal opening will probably be September 18, though there is much doubt whether any freight will be carried before the early part of 1913. There is still much to be done on this line. According to local reports, Señor Patiño, the owner of the Uncia and other large tin-mining properties, is endeavoring to arrange a tin trust, but details are wanting.—*The West Coast Leader.*

Reported discovery of large diamond deposits along the Rio das Garcas, in Matto Grasso, Brazil, have attracted great attention and the government has taken steps to protect its own interest in the deposits.

Milling the Ore of the Chino Mine

By John M. Sully

Water-Supply.—Water is obtained from four pumping stations; one at Apache Tejo, five miles south of Hurley; a second at B ranch, one mile northeast of the mill; a third on Whiskey creek, five miles west of the mill; and the fourth on Cameron creek, one mile east of Whiskey creek. The Whiskey creek and Cameron creek supplies use the same pipe-line. The Apache Tejo pumping station is equipped with one Aldrich quintuple-geared electric-driven pump, a second pump being on the ground for installation as a reserve. The B ranch, Whiskey creek, and Cameron creek stations are equipped with Aldrich triplex-geared pumps, motor-driven. The power is transmitted to each sub-station at 24,000 volts, and transformed to 480 volts. The water from these stations is pumped to a 3,000,000-gal. storage reservoir at Hurley.

Plant Buildings and Concentrator.—The site selected for the mill of the Chino Copper Co. at Hurley, $9\frac{1}{2}$ miles from the mine at Santa Rita, is on the edge of the mesa on the south bank of Whitewater creek at a point three-quarters of a mile distant from the Santa Fé railroad, and where favorable grades and ample room for yards could be found between the Santa Fé and the mill proper. The slope of the ground was such that a minimum amount of excavation was necessary to give the right slope through the mill building. The power plant is south and west of the mill, the coal bunkers being set on a line with the tracks over the crude-ore bins, permitting the placing of cars over the bunkers of the power-house.

Power Plant.—The power-plant building is 114 ft. 3 in. wide by 180 ft. long. The boiler-room occupies 48 ft. 3 in. of the width, and the engine-room 66 ft. The floor of the boiler-room is 16 ft. below the engine-room floor. A suitable material for the engine bases was found within a foot or two of the surface of the ground, and the foundations of the engines were brought up to such a height as to leave ample room under the engine-room floor for all auxiliaries without the necessity for excavation. A switch-board bay is provided on the east side of the building 54 ft. long by 16 ft. 7 in. wide. A bay has also been provided for the permanent oiling system.

The building is a steel structure, covered with galvanized iron. The structure in the engine-room portion has been designed for and provided with a traveling crane of 40,000 lb. capacity. The boiler-room is arranged with coal bunkers, into which the coal-cars can be directly dumped and the coal fed, without rehandling, to the Green stokers.

The steam-generating plant consists of eight 445-hp. (nominal rating) Heine water-tube boilers set in batteries of two boilers, carrying 175 lb. steam-pressure as a working load. One battery (two boilers) is equipped with Green chain-grate stokers. A second battery of boilers is now being equipped with stokers, and the remaining batteries will be equipped before July 1, 1912. These stokers have shown great efficiency in the burning of the cheapest grade of slack coal and insure ample boiler capacity for all anticipated needs, as well as a minimum consumption of coal and labor charge. Apparatus for the removal of ashes has been ordered (Green suction ash-handling system) and preparations are now in progress for its erection. The boiler-room costs for the generation of steam will be brought down to a minimum. The smoke-stack is of the self-supporting type, built of steel, 12 ft. in diameter, and erected on a reinforced-concrete base, its total height being 180 ft. Three compound duplex boiler feed-water pumps of the outside packed plunger type, together with necessary feed-water heaters, are provided.

CHINO SHOVEL PITS, SANTA RITA, NEW MEXICO.

Engine Generator Equipment.—The equipment of the electrical generation plant consists of three Nordberg double-expansion engines, operating at 100 r.p.m. The high-pressure cylinder is 27 inches in diameter, the low-pressure 60 inches in diameter, stroke 48 inches. The generator is an Allis-Chalmers, mounted on the crank shaft, of 1250 kw. output and of the 3-phase, 60-cycle type, generating at 480 volts. A full equipment of auxiliaries for running condensing is provided, the circulating pump equipment being in duplicate. For furnishing power to Santa

Rita and the various substations the current is stepped up to 24,000 volts, step-down transformers being provided at the points of use. The entire plant has been provided with the best of apparatus with a view to economy of operation and low power cost.

Plant Buildings.—The machine shop is placed in line with the concentrator to the south and at the most convenient place for the handling of the heavy machinery from the mill for repair, by the industrial railway, the town of Hurley lying back on the mesa, and to the west of the crude-ore bins. The carpenter-shop lies to the north of the concentrator building and within a convenient distance of the railroad tracks, the entire arrangement of the plant buildings being compact and convenient for all purposes.

The crude-ore bins and coarse-crushing plant form one structure, the crude-ore bins having a capacity of approximately 18,000 tons of crude ore. The coarse-crushing plant has been designed to permit of a duplicate set of machinery being installed if necessary at a future time. The present equipment consists of one No. 8 gyratory crusher and one set of 72 by 20-in. Garfield rolls, the rolls weighing 175,000 lb., together with the necessary elevator, the head sample after the ore has been crushed in the coarse-crushing plant. The head sampler, together with the sampling machinery, forms part of the structure to the west of the fine ore bins.

The fine-crushing department of each section is equipped with two 42 by 16-in. rolls, each weighing 65,000 lb. There are two elevators which receive the feed from the fine ore bins and elevate it to three impact screens each, the screened material from the rolls being fed over two impact screens for each set of rolls. The fine crushing department is so placed that the rolls can be readily dismounted and taken to a platform where the parts can be handled by the electric crane which occupies the next bay over the Chile mill floor. This crane is so placed that the Chile mills, of which there are three 6-ft. mills to each section, are easily accessible for handling for repair purposes. In this Chile mill bay and under the Chile mill floor is placed the main jack shaft from which the drives for the rolls, the Chile mills, and the necessary machinery for the fine-crushing department are taken. In the fourth bay are placed the wet elevator, the various classifiers, and the Garfield tables. The classifier equipment consists of four 4-spigot classifiers; four

CHINO POWER-PLANT, MILL, AND MACHINE SHOPS, HURLEY, NEW MEXICO.

conveyors, and grizzlies. The crude-ore bins are equipped with conveyor belts and automatic feeders, the bins being 300 ft. long by 35 ft. wide, and carrying two lines of tracks.

The coarse-crushing plant is connected with the fine-ore bins of the mill section by an inclined conveyor 184 ft. long between the edges of the buildings, the total length of the conveyor being approximately 262.5 ft. between centres.

Mill Building.—The mill building is a steel structure on concrete foundations, enclosed with galvanized iron. The floors are reinforced concrete. Each section of the mill is 50 ft. wide by 341 ft. long, between centres of the extreme column lines. The total size of the five sections will be 250 ft. wide by 341 ft. long.

The fine-ore bins are round steel tanks with reinforced-concrete bottoms, there being two to each section. Each bin has a capacity of 1000 tons, approximately, there being therefore 2000 tons of storage to each section. Each bin is equipped with two feeders and one conveyor-belt. At the head of the inclined conveyor, at its discharge, there is being installed an automatic sampler for the taking of 5-spigot classifiers, and two 3-spigot classifiers, all of the Richards-Janney type. The Garfield table equipment consists of four 6-ft. Garfield tables and ten 4-ft. Garfield tables. In the fifth bay are placed the first set of cones, 10 to each section, which takes the overflow from the four 4-spigot classifiers; and six Wilfley tables.

The rest of the various floors in the mill are occupied by the Isbell vanners, of which there are 96 to each section, the remaining 30 cones being so placed as to take the overflow from the four 5-spigot classifiers and the two 3-spigot classifiers and give the proper distribution to the vanners which they feed; there being 72 smooth-belt vanners and 24 sand vanners.

The mill is further equipped with two concentrate pumps for handling the concentrate from the sumps under the mill and with duplicate circulating pumps for the overflow water from the cone settling tanks. Each section of the mill is operated by a transmission circuit and motors separate from every other section of the mill; everything being designed to permit of one portion of each section being shut down without interfering with the whole section of the mill or any one class of machines. All of the launders throughout the

mill are placed with the same object in view, namely, in such a manner that switches of feed may be made from one portion of a section to another. In case of accident or necessity for repairs in one portion or one part of it, the feed can be diverted so as not to necessitate the entire shutting down of all of any class of machines. It is also so arranged that ore in each section can be sampled separately, there being at the same time an automatic tailing sampler for the whole mill.

Flow-Sheet.—The mine-run ore is delivered on top of the coarse-ore bins, where it is dumped on grizzlies made of rail, having an opening 14 by 16 in. From the coarse-ore bins this mine-run ore is fed through any necessary number of feeders of the caterpillar type to a traveling belt-conveyor which delivers the ore to a bar grizzly of 1 in. spacing, the undersize going immediately to a belt-conveyor for delivery to the fine-ore bins, and the oversize going through the gyratory crusher and being crushed to approximately $2^1/_4$ in. This crushed material is then elevated to another bar grizzly, the undersize going at once to the belt-conveyor for the fine-ore bins, the oversize passing through the 72 by 20-in. rolls. This crushed material drops immediately upon a coarse grizzly for the taking out of any native copper that may have been flattened in the rolls, the undersize being delivered to a screen grizzly having a 1¼-in. opening. The oversize goes back to the elevator and the undersize is delivered upon a conveyor. The crushed ore, therefore, has a maximum size of between a $^3/_4$ and 1-in. cube. This plant has operated up to a capacity of 450 tons per hour without difficulty.

The conveyor to the fine-ore bins delivers upon a cross-conveyor for the distribution to two bins of each section. From each fine bin there are two caterpillar-type feeders delivering upon a belt-conveyor. These caterpillar feeders are so arranged that the feed can be varied. The conveyors under the fine-ore bins deliver to two elevators, No. 1 and 2. They in turn deliver at the top of the mill to six impact screens having an opening of approximately 0.1 in. The oversize goes to two 42 by 16-in. rolls, the product of these rolls going to four impact screens having an opening of approximately 0.1 in. The oversize is returned to elevators No. 1 and 2. The fine-crushing plant of one section has handled 1300 tons without difficulty.

The undersize of the above set of impact screens is delivered to Garfield tables. These Garfield tables make a middling product which is treated on the 8 Wilfley tables, yielding a concentrate and a middling. The tailing from the Garfield and the middling from the Wilfley tables is returned to No. 3 elevator, whence it is delivered to four primary 4-spigot classifiers. The coarser sizes from No. 1 and 2 spigots are delivered to the feed tanks for the Chile mills. The third spigot product of the primary classifiers is delivered to two secondary 5-spigot classifiers; the fourth spigot of the primary classifiers being delivered to the other set of two secondary 5-spigot classifiers. The overflow from the 4-spigot primary classifiers is sent to the first set of 10 cone settling tanks, whence the thickened pulp is delivered to the smooth-belt vanners.

The product of the first four spigots of the set of secondary classifiers treating the third-spigot product of the primary classifiers is sent back to the proper Garfield tables. The fifth-spigot product is sent to corrugated-belt vanners, these yielding a tailing and a concentrate, the overflow going to a second and third set of cone settling tanks. The two secondary 5-spigot classifiers treating the fourth-spigot product of the primary classifiers deliver to separate corrugated-belt vanners, the overflow joining the other overflow from the 5-spigot classifiers and being taken to cone settling tanks, the thickened pulp being treated on smooth-belt vanners.

The material from the first and second spigot of the primary classifiers is re-ground in the Chile mills, which are equipped with ton-cap screens having a width of opening of approximately 0.04 in. This re-ground material is then delivered to two 3-spigot classifiers, known as mill classifiers. The first spigot of these classifiers delivers to the proper Garfield tables, yielding a middling and a tailing, as described above, the middling being re-treated on Wilfleys and the tailing being returned to the system previously described. The second and third-spigot products are combined and treated on the proper Garfield tables, following the same circuit. The overflow from the mill classifiers is taken to a fourth set of cone settling tanks and the thickened pulp treated on vanners, making a concentrate and a tailing. Thus it will be seen that there is a closed circuit on the roughing system, the outlets being simply through the overflow from the classifiers, cone settling tanks, and through the fifth spigot of the set of secondary classifiers and five spigots of the second set of secondary classifiers through the corrugated-belt vanners, thus giving opportunity for the removal of the free mineral without unnecessary grinding.

The daily capacity of each unit of the mill has been demonstrated to be fully equal to that estimated in the beginning, namely, 1000 tons per day. While the present recoveries on the most oxidized ores lying immediately under the soil have not been high, the cost for the production of copper for the month of January was but slightly over 8c. per pound, with every probability that as additional sections of the mill come into operation and fresher ore is mined, this cost will be reduced.

Murex Process at Cordoba

The Cordoba Copper Co. was formed in 1908 as a consolidation of the companies operating the Cerro Muriano and North Cerro Muriano copper mines, 10 miles northeast of the city of Cordoba, in the south of Spain. John Taylor & Sons are the managers. The ore deposit is difficult to follow and work, and the smelting and concentration are not simple problems. The operations have been substantially extended during the past year or so, and much better results have been obtained. The amount of ore raised during the year ended September 30 last was 86,285 tons, as compared with 61,887 tons the year before, and the reserve has been increased by 66,495 tons, standing on September 30 at 199,398 tons, containing 3.59% copper; an increase in grade of 0.31%. The erection of converters designed by W. A. Heywood has been completed, and since September the output has been in the form of blister copper. Of the ore raised and treated at the company's own plant, 6630 tons was hand picked and sent direct to the smelter, 2240 tons of rich fine was screened and sent to the sintering pots, and 63,609 tons sent to the concentrators. The last produced 8238 tons of concentrate assaying 11.1% copper, which was sent to the sintering pots and briquetting machines; and 9455 tons of middling, assaying 1.47%, which was sent to the Murex plant, where 936 tons of concentrate was obtained averaging 12.2% copper. The remaining ore was hand picked and dressed by contract, and the products sent to the smelter and sintering departments. Owing to the sintering pots being worked to their maximum, other fine had to be treated by briquetting, the binding material being slime. The smelting plant treated 10,122 tons of picked ore, 7886 tons of sintered material, and 2427 tons of briquettes, and yielded 3439 tons of matte averaging 57% copper. By means of the wet concentrators and the Murex plant, the percentage of recovery is 75; the coarse tailing averages 0.65%, the fine tailing 1.17%, and the slime 1.53% copper. The magnetite used in the Murex process is not subsequently eliminated, because iron is required in smelting, and the magnetite in this case costs no more than hematite, which would have to be purchased in any case. The oil used is a thick coal-tar product, which, if any tar refinery were a customer for it, would be more valuable for that purpose than for selling to the Cordoba company. The tailing will be treated by the process in the course of a short time, and the recovery will then be greatly improved. The engineers of the Cordoba company express their appreciation of the process as applied.

PLATINUM DEPOSITS are said to have been discovered in Rio Grande del Sul, Brazil, but no definite information as to their value is yet available.

Mineral Losses in Gases and Fume

By F. G. Cottrell

*In considering the mineral wastes passing out of the stacks of our smelters and metal refineries, distinction must be clearly made between the gases themselves and the clouds of suspended solid and liquid particles which they mechanically carry along with them. In which class a material belongs often depends, to be sure, on temperature. Many metallic compounds are actually vaporized in the furnaces and gradually condense from gases into clouds of solid particles with the progressive cooling of the gas streaming through the flues. Arsenic in the form of the trioxide is usually the last of these materials to condense, since even down to 150°C. its vapor tension is sufficient to permit the loss, in the gaseous state, of several tons per day for the largest plants. But below, say 125°C., for ordinary technical purposes it may be considered that the only important element in the gaseous state is sulphur, in the form of dioxide.

For many centuries the material nature of gases and the fact that they actually possess weight escaped the chemist. Even today a distinct effort of mind is required to sense the vast tonnage of the clouds to be seen floating away so lightly from smelter and power-house stacks. There are many single stacks in this country, from each of which over five tons of gas issued per minute, while in isolated instances this is exceeded several-fold.

Aside from carbon, the element which is lost in the greatest tonnage is unquestionably sulphur. Many of our Western ores will run from 25 to nearly 40% sulphur, and a plant smelting 1000 tons of ore per day is at present considered to have a very moderate capacity. The largest plants will easily touch the 1000 mark in tons of sulphur passing up their stacks when at full capacity. On stopping to think that this represents three thousand tons of concentrated sulphuric acid, were it made into such, and that one such plant could have supplied all the acid used in the whole phosphate industry of the United States a year ago, it is easier to appreciate the skepticism of the smelter companies regarding acid manufacture as a general solution of the sulphur fume problem. The disposal of this sulphur presents unquestionably the gravest problem confronting the metallurgical industry today.

Suggestions have not been wanting for methods of direct absorption of this gaseous sulphur dioxide by water, limestone, lime, or charcoal, either as a means of final disposal, or as a step in its concentration and final liquefaction under cold or pressure. One of the most ingenious and attractive is that it be used for decomposing fine granulated and moistened slag,[1] thus fixing the sulphur in harmless compounds and, at the same time, leaching out any metal still held in the slag. While many of these are perfectly practicable on a laboratory scale, the tonnage to be handled and the cost, either in first installation or operation, have prevented them from producing any practical results up to the present.

From a chemical standpoint, the other obvious alternatives consist either in oxidation to sulphuric acid or reduction to elementary sulphur. Of these two, the first has the advantage of requiring no additional substance save the oxygen of the air, and of running itself, when properly catalyzed, without need of external energy, but unless an immediate market is at hand for the sulphuric acid, its disposal in turn becomes difficult and often impossible.

The greatest consumption of sulphuric acid in this country today is in the manufacture of superphosphate fertilizer, but, until very recently, the chief demand for fertilizer has been in the Southern and Atlantic states: here, too, were the chief known deposits of phosphate rock, while, on the other hand, the great smelting industry is for the most part in the far West, and cut off by high transportation costs. The recent discovery and description in Idaho, Wyoming, and Montana, of what promises to be the largest phosphate deposits in the world, will, it is hoped, materially change this condition.

Much of the land in the West is still practically virgin soil; where crops are falling off, the reason for this and their relations to different kinds of fertilizers to tillage and crop rotation, are still so much in dispute that in trying to build a rational and permanently helpful phosphate industry, the facts must first be thoroughly established from the standpoint of agriculture, manufacture, and transportation. At present, these are not available to any extent justifying an immediate general development of the phosphate industry in the West; but coöperative work, aimed at a broad and practical study of these conditions, is already well under way between the U. S. Department of Agriculture, the Agricultural Experiment Stations of various Western states, the U. S. Bureau of Mines, and the large metallurgical interests of the West, and it is hoped that the results may soon justify and lead to a healthy development of the industry.

An encouraging example is before us in the work already accomplished by the Tennessee Copper Co. at its plant at Copper Hill, Tennessee. This company is successfully treating the weak gases from copper blast-furnaces on a scale for which many predicted failure, and which certainly did require time, courage, ability, and indefatigable effort to perfect. The very difficulties and delays which the work had to encounter have in one sense been a help to the industry, as the present annual capacity of 250,000 tons of chamber acid has been gradually reached over a period of some years, and while it has materially reduced the price of acid in the South, the market has had a chance to adapt itself with the minimum of hardship to those already in the field, and with great gain to both the metallurgical and agricultural communities. Although much may undoubtedly be done, not only to increase the consumption of sulphuric acid in superphosphate manufacture, but also in developing other and newer uses, still the chemist should not rest content with this.

I have considered so far only the results of oxidation of the sulphur to dioxide. On the other hand, it may also be reduced to elementary sulphur, for which purpose a number of methods have been proposed, some depending on the action of solid carbon or of carbonaceous reducing gases, while others use hydrogen sulphide generated by the action of steam or acids on alkaline or metallic sulphides. An interesting general discussion both of the possibilities and the limitations of these methods together with some very suggestive new facts[2] has recently been attracting considerable attention and may not improbably lead to practical results, at least in certain special cases.

This naturally leads to the inquiry: "Why should all the sulphur of the ores be oxidized in the first place?" This question comes home still more forcibly on looking through the charge doors of a pyritic copper blast-furnace shortly after a fresh charge of ore has been dropped on the column and seeing the great clouds of unburned sulphur subliming out from the charge itself and burning above it, while all the heat thus produced is wasted. If copper blast-furnaces could be run with gas-tight tops, as is the case with iron blast-furnaces, and full utilization of the air blown in the lower part of the charge column, it certainly seems as though a far better thermal efficiency should be attainable, besides the possibility of delivering a very considerable proportion

*Abstract from the *Journal of Industrial Engineering & Chemistry.*

[1] 'The Westby-Sorensen Process,' E. P. Jennings, *Eng. and Min. Jour.*, 86, 418-19, August 1908.

[2] 'The Thiogen Process for Reduction of SO_2 in Smelter Fume,' S. W. Young, *Mining and Scientific Press*, 103, 386-387, Sept. 23, 1911.

of the sulphur of the ore to the flue in unburned form, either as a gas or cloud of flowers of sulphur, depending on how cool the top of the ore column could be maintained.

That such a mode of operation is not entirely impossible is curiously evidenced by the fact that the first pyritic copper blast-furnace ever run[3] was operated under these very conditions, the run finally terminating, after a few hours, by so much free sulphur accumulating in the flues as to stop the furnace. In this classic article of John Hollaway's, particular stress was laid upon the recovery of the sulphur, but the development of smelting practice soon began to follow other aims. It was naturally in the hands of the copper men, and sulphur did not so directly interest them. Then, too, in the far West, where pyritic smelting was first carried on successfully on the large scale and where even today probably 90% of it is still practised, the limited market for sulphur and the high cost of transportation and low value per ton, as compared with copper, have naturally influenced metallurgical development to strain for the greatest degree of economy in copper production, with absolute disregard for sulphur as a by-product.

In working the vast tonnage of low-grade sulphide ores of the West, effort is concentrated on burning out and slagging off the maximum amount of iron in the blast-furnace in order to produce as high a percentage of copper as possible in the resulting matte, as it is much more expensive to burn out a pound of iron in the converter than it is in the blast-furnace. This greater cost is due chiefly to two items: the cost of the refractory linings, and the greater power-consumption due to the higher pressure of air in the converter. Hollaway looked on his blast-furnace simply as a means of melting the ore into low-grade matte, the remaining iron of which might then be burned off in some of the then well-known processes or in a converter, which he was also the first to use in copper metallurgy.

In copper smelting, it has been the cost of converter practice which has led to crowding as much of the work of oxidation upon the blast-furnace as possible, and this insures the burning up of all the sulphur instead of recovering a good portion of it. Within the last few years, one of the two items of converter cost, that of linings, has been greatly reduced by the practical development of basic linings, so that today this factor is rapidly becoming almost negligible, and all that stands in the way of shifting most of the work of oxidation from the blast-furnace to the converter is the cost of the high-pressure air (10 to 15 lb. per square inch as against 3 lb. for blast-furnace) required to force its way in against the hydrostatic pressure of the deep liquid bath in the converter. If a mechanically more efficient way of mixing this air with the molten matte in the converter could be secured, it would mean the opening of a new chapter in metallurgy.

Even with the greater cost for air, the relation between blast-furnace and converter operations is already steadily changing in the sense of taking a lower-grade matte to the converters, and this in turn may be expected to react in a study of the blast-furnace from a somewhat different point of view than has hitherto obtained.

The copper blast-furnace is today confessedly one of the crudest appliances of engineering practice, and we know with less certainty the mechanics and chemistry of its inner workings than of almost any other apparatus of equal industrial importance. The slow development of a really fundamental scientific basis for this field of metallurgical engineering has undoubtedly been due in great part to the exceptional difficulty, if not impossibility, in this particular subject, of interpreting small-scale experiments in terms of full-scale operation, and the great expense of full-scale experiments.

Another reason for metallurgy having lagged behind other engineering branches is perhaps to be found in the fact that commercially it has usually been pursued as an adjunct to the private ownership of some natural resource. If the mine were a rich one, the ultimate economies of smelting practice were apt to be overshadowed by the more immediately attractive study of increasing tonnage; if, on the contrary, the low grade of the ore made careful smelting necessary, the company felt it could seldom afford to go into expensive experiments for radical developments of the art, but must stay close to standard practice and make its improvements on minor details.

Even if elementary sulphur were produced, its present consumption outside of sulphuric acid manufacture is too small to be at all significant, but it at least has the advantage over acid of permitting safe accumulation and storage to an unlimited extent, as illustrated by the practice in Louisiana, where it is cast into blocks some 200 ft. square and 50 ft. high. What is really most needed for the solution of the sulphur fume problem is the discovery of new uses and a wider extension of existing uses for both elementary sulphur and sulphuric acid. Chemists have become accustomed to looking at sulphur almost exclusively from its chemical aspect, but if it is ever to be utilized in anything like the proportions in which it is now being thrown away, it would be well to consider possible mechanical uses, as, for example, a binder for sand or wood fibre. Experiments on the manufacture and use of drain tile made of such material are at present being carried out in the West, where the recent rapid development of irrigation is constantly bringing new and special demands for material of construction.

If metallic sulphides are dissolved in molten sulphur, its toughness and other mechanical properties are greatly improved, as first pointed out by J. B. Spence.[4] A detailed study of this product from the standpoint of structural materials has long awaited the investigators and seems much to be desired. If a sufficiently large and permanent outlet for sulphuric acid, on the one hand, and elementary sulphur on the other, can be assured reasonably near the sources of supply, the metallurgical industry itself can be safely relied upon to meet the demands and find the way to supply them.

[3] John Hollaway, 'A New Application of a Process of Rapid Oxidation by which Sulphides Are Used for Fuel.' *Jour. Soc. Arts, London*, 27, 248-270, 292-295, 488-495, 606-607, 728-730.

[4] 'A New Metallic Compound' (Spence's Metal), Granville Cole. *Jour. Soc. Arts, London*, 28, 225-229 and 279, Feb. 13, 1880. See also Thurston's 'Materials of Engineering,' Vol. III, p. 205.

'Gopher-Holes' in Open-Cut Excavation

For economically excavating surface soil and hardpan in stripping operations, 'gopher-holes' have proved satisfactory. These holes were formerly made large enough for a man to crawl into and were dug by that manner. It was the custom to drive the hole into the side of a bank for perhaps 15 ft. and to turn two short cross-cuts at the end; black powder was then tamped in a depression in the end of each cross-cut. On account of the large amount of explosive which could be used, a very great lifting force was exerted and huge masses of the bank were broken.

On the Mesabi iron range in Minnesota, where stripping operations are conducted on a large scale, it has been found possible to dig these gopher-holes with a long-handled shovel similar to that used in digging telephone-post holes. By this means a smaller hole is dug and a saving effected in the cost per foot. Instead of the cross-cuts, a single depression is made at the end of the hole, in which the powder is securely tamped. Two styles of shovel are used in the process, one for the gopher-hole proper and one for making the depression at the end. Surprisingly low costs have resulted when the men became accustomed to manipulating the shovels.

COPPER REFINING in Australia is only performed at the plant of the Port Kembla Electrolytic Refining & Smelting Works, which is capable of treating 80 to 90 tons of copper per day. Since the smelting industry in Australia is not very extensive, much of the ore going abroad for treatment, it has been proposed to impose an export duty on ore, or to give a bonus on ore smelted in the Commonwealth.

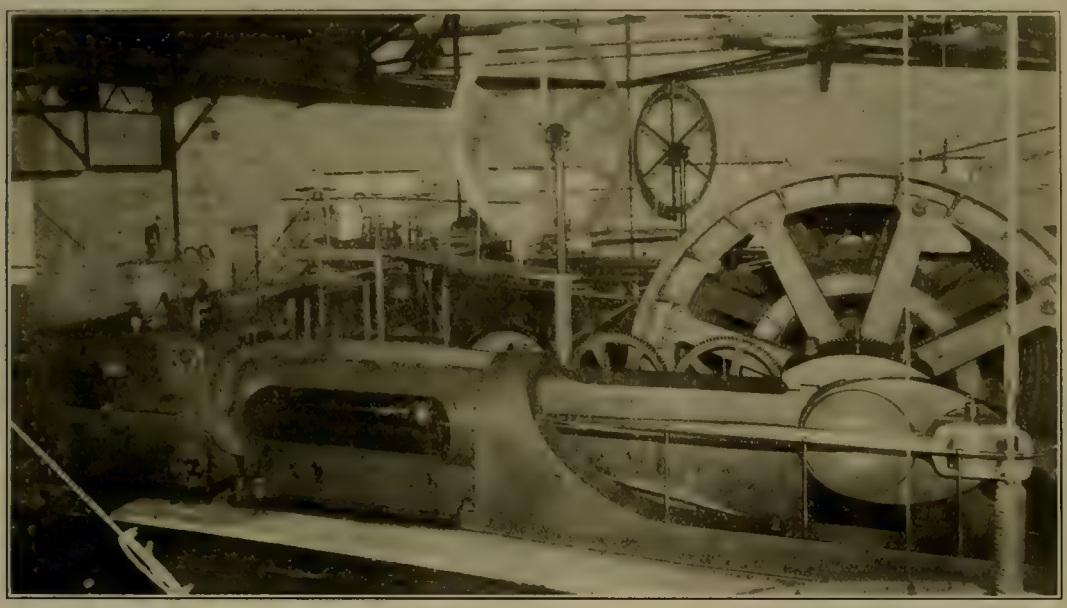
The Surface Equipment of the Hancock Consolidated

By W. P. Perkins

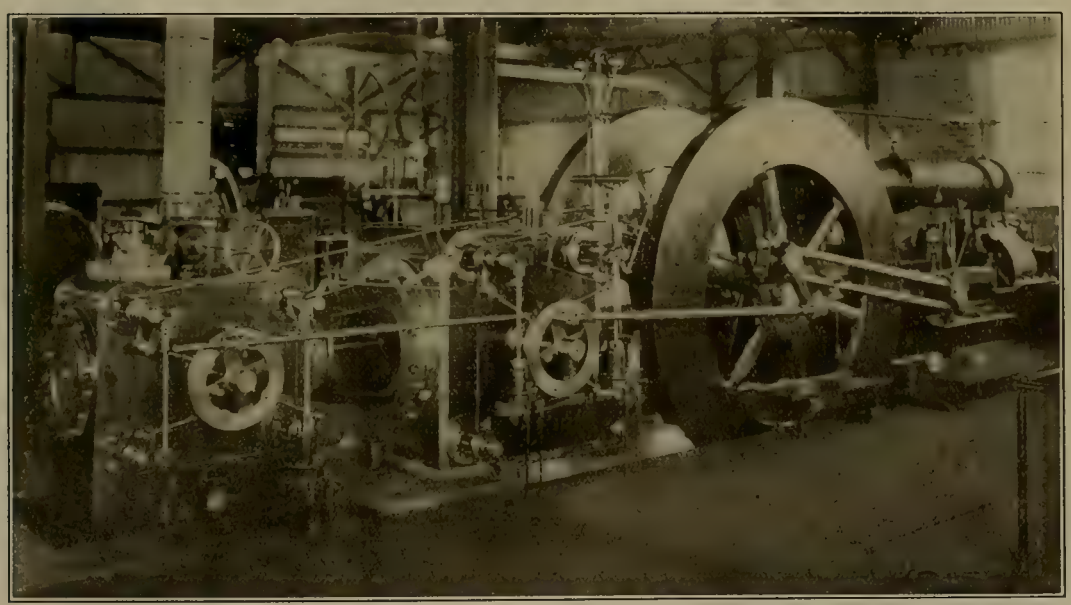
*The Hancock Consolidated Mining Co., of Hancock, Michigan, has had in operation since March of 1911 what is in many respects the most complete and modern surface equipment in the copper-mining district of northern Michigan.

The old Hancock mine was opened in 1859, in what is now the centre of the city of Hancock. These early workings, now known as shaft No. 1, extended to a depth of a little over 1000 ft. in the Sumner amygdaloidal beds. Work in this mine was carried on until 1886, and about 6,000,000 lb. of copper was produced. At that time the mine was closed, owing to the low price then prevailing for copper. Twenty years later, in 1906, the Hancock Consolidated M. Co. was organized, with John D. Cuddihy as president, John L. Harris as general manager, and F. G. Schubert as superintendent. Operations were renewed in the old or No. 1 haft, and in December 1906 ground was broken for shaft No. 2. This is a 5-compartment vertical shaft. Its outside dimensions are 9 by 30 ft., and it is the second largest shaft in the Lake Superior district. It is now completed to a depth of 3300 ft., and its present objective point is the Pewabic lode, which it is expected will be found at a depth of 3600 ft. The shaft has a collar of solid concrete extending 40 ft. below the surface. This concrete is 24 in. thick at the top and 30 in. thick at the bottom.

The head-frame is a modern structure of steel, 128 ft. high, with the working-floor 64 ft. above the ground. There are two steel ore-bins 38 ft. in diameter, holding 900 tons



SULLIVAN HOIST, HANCOCK CONSOLIDATED MINING CO.



STRAIGHT-LINE TWO-STAGE AIR-COMPRESSOR, HANCOCK CONSO LIDATED MINING CO.

*Prepared with the assistance of F. G. Schubert and published also in *Mine and Quarry*.

of rock each. There are two crushers with a capacity of 1200 tons of ore per day. These crushers have jaws 24 by 36 in., and each is fed by a steel belt-conveyor 5 ft. wide and 17 ft. between the sprockets. The conveyors have a section with slots and cross-bars, giving an opening of 2 in. square to form a grizzly for small rock to pass through. The crushers are driven by 50-hp. motors and the conveyors by 10-hp. motors.

The boiler-house is built of steel and is 56 by 98 ft. floor space. It contains two batteries each, of four 150-hp. return tubular fire-tube boilers, each 72 in. diameter by 18 ft. long. Standard-gauge railroad coal-cars are run into the building and the coal dumped into bins directly in front of the boilers. The capacity of the bins is 250 tons. The stack is built of reinforced concrete and is 125 ft. high and 12 ft. 8 in. diam. at the base. The engine-house is also of steel, with a ground area of 60 by 94 ft., and contains the two hoisting plants. The three air-compressors are installed in a wing 50 by 50 ft. in area.

The first hoist installed for sinking purposes was a Sullivan first-motion double-drum Corliss plant, and has been in operation since 1906. This plant consists of two 24 by 48 reversible Corliss engines, operating through friction clutches two drums, each 8 ft. diameter by 6 ft. long. The drums are machine threaded. This plant has a capacity of hoisting from a depth of 4000 ft. at a speed of from 2000 to 2500 ft. per minute. Each drum handles two Kimberly skips in balance. The net load, exclusive of the weight of the rope, is 10,000 lb. This plant is now used as an auxiliary to the main plant, and ordinarily handles men and timbers only.

In 1910 a second or permanent hoisting plant was installed, also of Sullivan design and construction. This consists of two 36 by 72-in. simple Corliss reversing engines, which are keyed to the shaft of a 15 by 15-ft. straight-faced drum, machine threaded. This hoist operates two skips in balance and has a capacity of lifting eight tons of rock from a depth of 4000 ft. at a speed of 3500 ft. per minute. The cages have Kimberly skips swung under and weighing five tons. Both of these hoists exhaust into a 3000-hp. feed-water heater, which heats water to 190°; they take steam from the boiler plant at 150 lb. pressure.

Both hoists are equipped with safety appliances of the most improved pattern. These consist of an automatic throttle-closing device, by means of which the main throttles are closed automatically at a point in hoisting, previously determined, at which the mechanism is set to act. After this device goes into effect it is impossible for the engineer to open the main throttles until the engines have been reversed for the down trip. This mechanism relieves the engineer entirely of judgment as to the point in hoisting at which the throttles should be closed. For short movements of the skip, or in case varying load should cause the skip to come to a stop before reaching the dump or the level desired, small by-pass throttles are provided which enable the engines to be turned over and bring the skip slowly to the desired point. In case the engineer should neglect to apply his brake at the proper point, after the throttles have been closed, an automatic brake is provided which goes into effect at a predetermined point before the landing is reached. This device absolutely prevents an over-wind, with the serious consequences which such an accident would entail. When this automatic brake goes into action it is impossible to release the brake or to move the hoist until the reverse lever has been thrown for the return trip. In the double-drum hoist there is a separate automatic throttle-closing device and automatic brake for each drum, so that each can act and be governed independently of the other. In this hoist the automatic brake is locked in position when set, by means of a blocking mechanism which must be released by hand before the engineer can move the hoist.

When operations were resumed in 1906 the company installed a Sullivan straight-line two-stage air-compressor with simple slide-valve steam cylinder controlled by Meyer adjustable cut-off. The steam cylinders are 22 by 24 inches in size, and the air cylinders 24 by 14½ by 24 in. The rated capacity is 1500 cu. ft. of free air per minute. This was used for shaft-sinking and development until 1910, when the company installed a Sullivan tandem Corliss compound two-stage air unit with a capacity of 2450 cu. ft. of free air per minute. The steam cylinders are 20 and 34 by 30 in.; air cylinders, 18 and 30 in., and have a 30-in. stroke.

The high and low-pressure steam cylinders of this compressor are equipped with full Corliss valve-gear, actuated by dash-pots, the point of cut-off being under the control of a speed and pressure regulator of simple design, which depends for its action on both the steam and terminal air-pressure. The air-inlet valves on both these units are of the semi-rotary Corliss pattern, actuated by independent eccentries on the ends of the shaft. The air-discharge valves are of special automatic poppet design and are placed in the cylinder-head. They are simple in construction and easily moved. They can be removed for inspection and cleaning, together with their removable cages. The intercooling area in these machines is unusually large.

The compressor-house also contains a cross-compound Meyer valve-gear compressor with two-stage air cylinders, having a capacity of 1700 cu. ft. of free air per minute. All of these compressors are operated condensing. The Corliss tandem unit is connected to a jet condenser and the cross-compound machines with barometric condensers.

Canadian Silver Production

The silver production of Canada, which has been rapidly increasing during the past few years, will probably show but little change in 1911. Returns so far received appear to indicate a falling off of about 128,516 oz. The total production of the year is estimated at 32,740,748 oz., valued at $17,452,128, of which 30,761,690 oz. was from Ontario, 1,910,323 oz. from British Columbia, 50,300 oz. from the Yukon, and 18,435 oz. from Quebec. The production in Ontario was slightly greater than that of the previous year, and in British Columbia a falling off of nearly half a million ounces is shown. For British Columbia the figures represent the recovery as silver bullion or silver contained in smelter products, while for Ontario the figures represent the total silver content of ore and concentrate shipped, less 5% allowed for smelter losses, together with bullion shipments.

The total shipments of ore and concentrate from the Cobalt district and adjacent mines were about 16,234 tons, containing approximately 28,817,198 oz., in addition to which 3,334,052 oz. was shipped as bullion. The average silver content of ore and concentrate shipped was thus about 1744 oz., or $929.62 per ton, as compared with an average of 867 oz. in 1910 and 840 oz. in 1909. The 1911 shipments were chiefly high-grade ore averaging over 3400 oz. and concentrate averaging over 850 oz. The shipments in 1910 were 28,684 tons of ore containing 23,797,111 oz. of silver, or an average of 830 oz. per ton; 6943 tons of concentrate containing 7,111,579 oz., or an average of 1024 oz. per ton and bullion containing 1,003,111 fine ounces.

The exports of silver in ore, etc., as reported by the Customs Department were 31,216,725 oz., valued at $15,807,366. There was also an importation of silver in bars, blocks, sheets, etc., valued at $847,645.

GOLD-DREDGING in the Amur region is likely to show considerable expansion this season, following the recent discoveries along the Lyamur, according to a Russian report given in *The Mining Journal*. According to this report the Orsk Goldfields, Ltd., which has leased the properties of the Ochotsk company near Nikolaievsk, will build a power plant on the shore of Lake Shlya, about eight miles from the mining property, and will operate its dredges by electricity. Much interest is also exhibited in the Udyl and Orel lake systems, and it is said that negotiations are under way for the sale of properties there to English firms.

The Nikko Copper Works

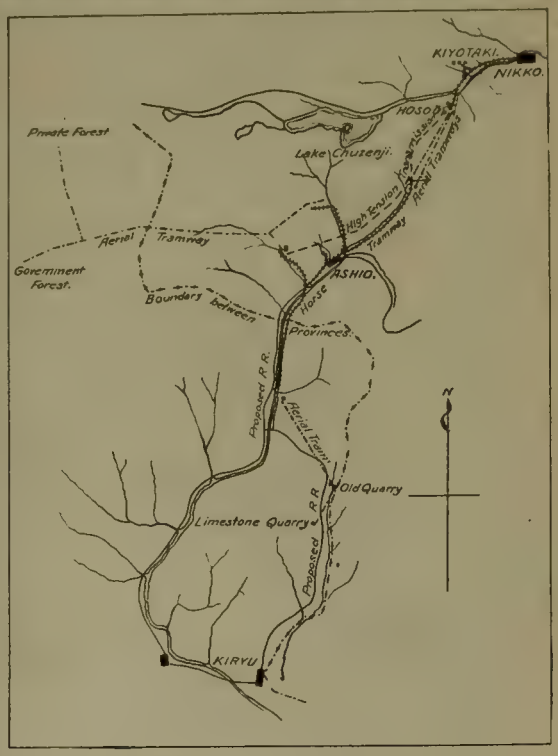
Among metallurgical plants in Japan visited by the American engineers last fall, none was more interesting than the copper refinery and wire works of the Furukawa company at Nikko. At this plant 1000 tons per month of wire is made, 600 from copper contained in the ore from the mines of the Furukawa company, of which the Ashio is the largest and best known,* and 400 from purchased ore. There is a rapidly growing market for copper wire in Japan, where interurban electric lines are beginning to be built, and where the dense population makes them certain of profit. Japan as yet produces a surplus of copper and this has been marketed in Europe and China principally. The Furukawa company, however, has been investigating the markets of Australia and India, where tariff laws favor importation of wire, with a view to exporting the finished material, and it is not to be expected that unfinished products will continue to be shipped.

At the time of the visit of the American mining engineers, November 16, they were elaborately entertained at a luncheon at which M. Otagawa, managing director of the Furukawa company, in a felicitous speech, gave interesting details about the works and the copper industry of Japan. A copy of this speech having recently come to hand, it is printed, slightly condensed, below. Mr. Otagawa will be remembered in America as one of the commissioners from Japan at the Louisiana Purchase Exposition, where, as on the occasion of other visits to the United States, he made many friends among American engineers.

"Captain Hunt, Ladies, and Gentlemen: It is with much pleasure that I welcome you here on behalf of the Furukawa Mining Co., although I confess I am scarcely prepared to receive you in such a manner as I could wish, having been constantly on the pilgrimage with you since your arrival in Japan. It is a great satisfaction to us that you have ventured to come up to this part of the country when your departure is so near at hand. You are now in the heart of Japan, and you have already touched the hearts of the Japanese people. I trust you may find some attraction to compensate you for your journey here. As you already know, Nikko is renowned for its beautiful temples with majestic cryptomeria trees and romantic scenery, and I feel that our copper works are not worthy to be included in the category of Nikko's attractions.

"It is a pleasure to say that in copper mining and metallurgy we owe a vast deal to you Americans and particularly to your American Institute of Mining Engineers. Our copper works and copper mines are modeled after the gigantic works in your country. Dr. Raymond was kind enough to remark in his eloquent address at the luncheon given by the Mayor of Tokyo, that the bessemer converters adopted at Ashio were perhaps second only to those of Butte in date of introduction. Again, the plant for the series process of electrolytic refining here is one of the only three at present existing in the world; namely, one at the Nichols copper works, Laurel Hill, New York; another at the Baltimore copper works; and the third at our own works here. Another interesting fact may be mentioned in this connection, that the Nichols and the Baltimore copper works produce one-third of the total output of the world's electrolytic copper, while the Nikko copper works is credited with one-third of the electrolytic copper production of Japan. Japan ranks third after the United States and Mexico in copper production, and it is most gratifying to have here as our guests the representatives of the two greatest copper-producing countries in the world. We have followed the American way, and I assure you we are proud to be called the 'Yankees of the East.' The success of our copper works, however, has not been attained by mere imitation, but also by individual achievement. It is built on men. Besides trying to adopt things suitable for our purpose from America and Europe, we have made it our aim to originate, or at any rate to adapt things to meet our own conditions. We have always had competent men at the helm; men who have received a systematic education and training. K. Yamaguchi, former general manager, is an American product, being a graduate of Johns Hopkins University at Baltimore. He built the copper works. K. Okumura, present general manager, expects soon to double the output by the completion of a multiple-process plant.

"Copper mining in Japan is an ancient industry, and the metallurgy of copper reached a state of remarkable advancement in Japan in the old days. As early as the year 708, copper coins were minted in Japan, and our people have been acquainted, from time almost immemorial, with a smelting process called *mabuki* which presents an



SURFACE MAP, ASHIO MINE.

interesting analogy to the present bessemer process. During my stay in New York in 1906, when I was asked to write an article on Japanese copper in 'Mineral Industry,' I think I started it with *Roshana-Butsu*, that huge image of Buddha we saw last week at Nara. This gigantic bronze statue was erected between 743 and 752. The finish and workmanship may serve as an illustration of the advanced state of our copper industry over twelve centuries ago. Moreover, Japan seems to have given a considerable amount of attention to mining even earlier. In the days of Marco Polo, Japan was known in Europe as 'the Island of Gold and Silver,' and the famous voyager informed the West that there was a palace in Japan, roofed with golden tiles, the ceilings made of the precious metal and spangled with gold and silver ornaments. So valuable, indeed, the riches of the palace were supposed to be, that it was one of the attractions to Christopher Columbus, who desired to reach *Zipangu* (Japan) on his voyage of discovery. While this report was greatly exaggerated, you will see tomorrow the Toshogu temples, in the decoration of which silver and gold are lavishly employed. The copper tiles, with which the temples as well as the castle in Tokyo are roofed, all came from the Ashio mines. Japan's copper industry has always been in a prosperous condition, and over 300 years ago Japanese copper was exported to Europe through the agency of the Dutch."

*"The Ashio Copper Mine,' T. T. Read, *Mining and Scientific Press*, October 14, 1911.

Titanium and Its Uses

By H. M. Henton

*Titanium belongs to the fourth group in the periodic system, next after carbon in the sub-group with zirconium, cerium, and thorium. In many of its properties it is closely allied to silicon, in the other division of the same group. It unites with oxygen and the haloges like silicon, and is more active than carbon in its reaction with nitrogen. The proportions in these combinations vary, corresponding to valences 2, 3, and 4, according to the oxidizing or reducing quality of the surrounding bath. Titanium and carbon also react to form the carbide and, together with nitrogen, form the cyanide. These are the properties which make the element of such importance to the iron and steel world. It never occurs in the free state and is only reduced to the metallic state under the most exacting conditions.

The ores of titanium are rutile; brookite; octahedrite (all different forms of the oxide); titanite, or $CaTiSiO_5$; ilmenite; titaniferous magnetite; and various iron and calcium silicates of minor importance. As a constituent of rocks it is one of the most widely distributed elements of the earth's surface. The titaniferous iron ores occur in all parts of the world, great masses being present in Norway, Sweden, and Canada, in North Carolina, and the Adirondack mountains in New York. Rutile occurs mainly in Virginia, Norway, and Australia. Georgia, North Carolina, Maine, and New York have smaller deposits.

The production of rutile is limited to two districts, one in Norway, and the other in Nelson county, Virginia. The Kragerö, Norway, deposit produces 50 tons of pure titanium oxide annually. The Virginia rutile beds are worked by the General Electric Co. and the American Rutile Co., and produced 86 tons of concentrate in 1910. A 95% concentrate sells for about $190 per ton, and the 75 to 80% for $80 per ton. Ilmenite, containing 14 to 45% TiO_2, when concentrated to 60% brings $40 per ton. The alloy ferro-titanium, containing 10 to 14% of the element, is now used extensively in the manufacture of the best grades of iron and steel for all purposes and sells for $365 per ton. The most of this alloy used is made by the Titanium Alloy Co. of Pittsburg under patents of A. J. Rossi, who was a pioneer in the long struggle for the recognition of titanium as a slag-former and remover of impurities in the making of iron and steel.

High-titanium ilmenites are reduced with carbon in the electric furnace, producing a high-carbon alloy useful in the cleansing of pig iron. An ore containing 15% TiO_2 can be treated with a small amount of carbon, just enough to reduce the iron, and limestone, yielding a slag concentrated in titanium to 56 to 58%, and a pig iron of best quality. The slag concentrate can be reduced in an aluminum bath in the furnace, utilizing the heat of formation of Al_2O_3. Here the iron is reduced first, then the titanium. The latter, though of higher melting point, dissolves in the molten iron, forming a true alloy of 10 to 75% titanium and 12 to 75% carbon. This product is diluted with iron according to the percentage desired, and is practically carbon free.

These ores were once discarded, and as late as 1907 it was thought by the conservative metallurgists that as low as 2% titanium was objectionable. All the trouble with pasty slag, aggregations of nitrides and cyanides, and excessive fuel required, have vanished as fast as the operators have been induced to figure on the TiO in the charge. An excessive quantity of lime, formerly used, threw the titanium all to the calcium titanate, an infusible compound. Now, a much smaller quantity of flux is used, causing instead the formation of calcium titano-silicate. This is easily fusible at blast-furnace temperatures, making possible a good pig iron and a fluid slag from ores containing 20% TiO_2.

The pig iron in which titanium was originally present or introduced during the making, has a much greater crushing strength on account of the removal of occluded gases and the prevention of segregation. The titanium, when introduced, cannot be used in the form of the element because the melting point is too high, the specific gravity too low, and the cost of the metal prohibitive. As only a small amount is needed, generally the addition comes to about 0.5% in the form of the ferro-titanium alloy. It meets the requirements in every particular, actually increasing the fluidity of the slag instead of decreasing it, as was formerly supposed. Used in machinery pig iron, tire castings become closer-grained and stronger. In car-wheels the depth of chill is greatly increased. In copper castings there is a similar beneficial action. The copper-titanium alloy is not as cheap as the iron alloy, however.

In steel making, titanium fills a varied sphere of usefulness. It is used in bessemer and open-hearth processes, acid and basic, and in the crucible process. The general practice is to add the pulverized cold alloy, just as the steel runs into the ladle, after the recarburization and introduction of spiegel and ferro-silicon, allowing time enough for its complete dissemination through the whole mass. The nitrogen, of which 0.03% renders a hard steel brittle and useless, is taken up as Ti_2N_3 and TiN, which form at a temperature of 800°C. Carbon, phosphorus, and sulphur are removed, to a large extent, partly by chemical combination and partly by a sort of physical concentration of the occluded gases around the pipe cavity of the ingot. The dreaded blow-holes are eliminated entirely from the body of the steel if the heat has been normally treated in the blowing. The titanium compounds have a lower specific gravity than the steel, so rise to the surface in a slag, all the oxides being reduced by the active titanium. It is claimed by some that the latter adds the toughening and hardening qualities noticed in titanium steel by virtue of constituent titanium retained in the steel, but the consensus of opinion seems to be that its only effect is due to its purifying action upon the metal.

The rail steel thus treated works better in the rolling mill, wears better, and the output includes less second grade. All steels, up to the most refined, used for instruments and tools, are profitably improved by the addition of this cleanser. When silicon can be added a very serviceable alloy, titano-silicon, is available. It is made by melting together in the electric furnace suitable proportions of TiO_2 and clean white sand. Over 97% of the special steel rails manufactured in 1910 were titanium steel. This is largely because of the successful abrasion, ductility, endurance, corrosion, tensile, and drop tests made in 1909. There is some demand for titanium in electrodes for arc lamps. Two forms are efficient, copper-plated titanium carbide, and the magnesite-titanium modification. Patents have been issued to cover its use in electric glow lamps, claiming a high candle-power efficiency. A little is used in pottery and for coloring glass.

*Abstract from *The Pahasapa Quarterly.*

Great Britain is much further along in organization of mine-rescue work than is the United States. It was recently announced that plans now in the making involved a mine-rescue station not farther than 15 miles from any colliery in Great Britain. Men trained in rescue work receive certificates and when they have been 'under fire' receive medals. For each accident at which they have been on duty they are given service bars. Recently more than 40 bars were presented as a result of one explosion. While at Briceville, Tennessee, not more than 20, only in part trained men, were available for the new rescue work.

Refined copper is not produced in Canada to any extent, and the output is represented by the copper content of smelter products, matte, and blister copper produced, together with the amount of copper contained in ores exported estimated as recoverable. The total production on this basis in 1911 was 55,848,665 lb., valued at $6,911,831, as compared with 55,692,369 lb., valued at $7,094,094 in 1910.

Alaska and the Yukon

By Guy A. R. Lewington

At this time when so much interest is manifested in Alaska and there are such wide differences of opinion as to what its needs really are, it may not be amiss to make better known the conditions that exist just across the boundary line in the Yukon Territory, which many believe is a part of Alaska. Conditions in general in central Alaska and the Klondike are practically the same. The Klondike region, with Dawson as the central point, is under Canadian authority, while all Alaska is governed by the United States Congress without actual representation. The Yukon has its regular member of Parliament, its own wholly elective local council, and to all intents

MAP OF ALASKA.

governs itself. The Government long ago realized that a territory larger by far than any other in Canada could not be satisfactorily administered from Ottawa, and it wisely placed the reins in the hands of the people who work and live in the Territory. The mining code which has been in operation since 1907 cannot be amended except by act of Parliament, which means that before the code can be altered in any way, the people will have time to express their opinions either for or against such a change. It is difficult to conceive a more liberal law than the one in force in the Yukon. Regardless of nationality, and without restriction, any man or woman over 18 years of age may locate either placer, quartz, coal, or any other mineral claim, and may hold it as securely as may native-born Canadians. Placer claims are leased by the Government to the applicant for the sum of $10 per annum, payable in advance, which insures absolute title, since only one grant can be issued for the same piece of ground for the year in which it is in force, and upon compulsory affidavit covering necessary assessment work made at the expiration of the grant, or annual lease, a renewal is issued for another year.

Under this system the litigation which has been, and still is, the curse of Alaska is not possible; 'jumping' is unknown, and no suit can be brought against the holder of a grant, except on authority of the Attorney General of Canada, representing the lessor, and to secure his consent to begin such suit he must be clearly shown that the contestant has sound legal reasons. Such suits are practically unknown. Quartz and other mineral claims (placer and coal excepted) may be 'Crown granted', or patented as in the States, and are under the leasing system until such time as the required amount of work has been accomplished to entitle them to patent. To secure patent to a mineral claim it must be conclusively shown that at least $500 has been expended in improvements and that the claim has been properly surveyed and advertised for a period of 60 days in the nearest newspaper. The required annual assessment work is $100, and upon affidavit to the effect that the work has been done, which work is subjected to Governmental inspection, a certificate of work is issued which entitles the holder to an extension of his lease for one year. The survey of the claim may be sworn in as assessment work for the year in which it is done. The lessee of a mineral claim, upon securing five certificates of work representing $500, one of which may be for surveying, may apply for a patent by submitting the five certificates of work to the proper authority. An order is then issued by the Government permitting the holder or lessee to have his claim advertised, and, upon completion of the advertising and payment of $1 for each acre contained in the claim, also some minor office fees, and in case no adverse claim has been recorded prior to the expiration of the advertising period, a certificate of improvements is given. This certificate is equivalent to a patent, and the claim is then withdrawn from the public lands. No further work on the part of the owner is necessary, and the patent itself is issued in due time. The whole operation is simplicity itself, and makes the 'red tape' necessary in Alaska seem ridiculous.

Coal may be located by the placing of one stake, which may hold from 1 to 2560 acres for each individual applicant, who secured his lease in much the same manner as a placer miner. If his location is open for entry, he is given a lease for 21 years with the privilege of renewal if he has lived up to the requirements of his lease. The Government charges him $1 per annum rental for each

acre in his claim. He is also compelled to mine from 1 to 10 tons of coal per acre per annum (number of tons at the discretion of the Minister of the Interior), and when he begins to market his coal 5 cents per ton royalty is collected for all merchantable coal. Under this law it is not feasible to hold large tracts indefinitely for speculation. The law is doubtless hard in some respects, but it prevents grabbing, which is one of the principal aims.

Those who are planning for Alaska's future needs may well study the laws in force in the Yukon Territory. Alaska needs laws adaptable to Alaska, not to Arizona or any other part of the United States. Why not give Alaska a code of her own, just as Yukon has one of her own? During the past summer, delegations of United States senators and other influential Government officials paid hurried visits to the southeastern coast, or fringe, of Alaska, and went away with the idea that they were in possession of facts covering the country. As a matter of fact, they saw only the extreme edge and listened to the wants of the people there. The information they secured was purely local and not valuable when the requirements of all Alaska are considered. From personal experience, I know that one visiting the southern coast line only can have no conception of the magnificent country lying behind the great barrier range for hundreds of miles straight north. The climate of the south coast is the most disagreeable in Alaska, not even excepting Point Barrow, the northernmost point of the continent.

The Yukon Territory is now (February) having what is usually the most severe weather, but there is nothing disagreeable about it. Citizens of Dawson read reports of extreme cold at outside points, of people freezing to death, while there they go about whatever has to be done without particular discomfort. Toronto reports 25° below zero, which degree of cold at Dawson is considered by all delightful weather. Children of all ages may be seen rolling around in the snow, having the time of their lives. They are of course warmly dressed, but they can be out, play, thrive, and come to no harm, even at 35° below zero. They continue going to school even in the coldest weather. On the night of February 15 an open-air dance was held on the public school grounds at which 1500 people of Dawson were present, and they enjoyed every minute of it. Onlookers wore their fur coats, but the dancers wore sweaters, short skirts, and moccasins. The dancing was on the snow, packed hard by the feet of the school-children in their various games. At the same moment the people of Toronto and other cities in Canada and the States were closely housed on account of the extremely severe weather. It must not be supposed that the winters are for the most part moderate. On the contrary, it is probable that no colder weather is experienced anywhere. Temperatures as low as 60° and even 70° below zero occur with striking regularity for short periods of each winter; this, however, causes no great hardship, as it is expected and provided for. People remain a little closer at home, realizing no discomfort, much as they do in stormy weather outside. A study of the isothermal lines will be found most interesting.

The foregoing, it is hoped, will give some idea of the interior of Alaska, as well as that of the Klondike, as a place where people live in comfort carrying on their daily vocations much as they do in other cold climates which are closer in touch with the Great Outside, and consequently better understood. Alaska needs immediate, adequate, and radical legislation. It is not reasonable to suppose that laws adapted to the States will apply equally well to a country so far removed from the seat of government, where practically all conditions are different. No man can know Alaska or its needs by a journey along its coast. He must traverse it and bump up against some of its difficulties, which are not met during a pleasant summer tour on comparatively comfortable river steamers and at equally good hotels. If Alaska's law-makers were better versed in the requirements of the country, judicious legislation might be expected, and Alaska would soon come into her own and develop beyond belief. Give her just and applicable laws, allowing her to pass judgment on them before becoming final, and she will do the rest. As before mentioned, a study of what Canada has done for the Yukon Territory and a close examination into the leasing system in vogue here, which practically eliminates litigation, the greatest curse of Alaska, cannot fail to help those who have the welfare of Alaska at heart.

Taviche

By An Occasional Contributor

The mining district of Taviche is near the southern end of the National Railways of Mexico, about 35 miles south of the city of Oaxaca, capital of the state of the same name. The altitude is about 6000 feet and the climate probably the best on the continent. The rainfall last year was 17 inches, but this is probably less than usual. Rains begin in May and last until October. The country rock is andesite, occurring in at least three flows, and in some places brecciated. No sedimentary rock is in evidence.

The veins have a general northwest direction, and a variable dip, from vertical, as in the San Juan mine, to 30° southeast, as in the San Francisco mine. The vein filling is quartz, but in some instances the country rock has been crushed, silicified, and mineralized. Sometimes the veins have a selvage, varying from a few inches to two or more feet, and barren. A vertical and horizontal movement has taken place along the vein, and great pressure is shown, but there appears to have been but little displacement. Some cross-faulting is shown, but in no case so far discovered has this exceeded 20 ft. Ore occurs from the surface and, so far as present evidence shows, the best ore is passed at 400 ft. and the content gradually decreases from this point until at about 700 ft. the vein becomes too poor to work. The latest developments in the San Juan mine would tend to disprove this theory, but this is the one exception so far discovered. The veins vary in width from a few inches, as in the Baldomero, to 50 ft. in the Conejo Blanco. The ore throughout the district will average about 5 ft. in width. With the exception of the Conejo Blanco mine, the assay values are more in silver than gold; in the Escuadra the ore will carry 3 parts gold to 1000 silver; in the San Juan, 12 parts gold to 1000 silver, and in the San Francisco, 10 parts gold to 1000 silver, all by weight. The Conejo Blanco mine is the richest in gold and will average 30 gold to 1000 silver. The entire ore of the district is very silicious, an average analysis being about 75% insoluble, with small amounts of sulphur and iron, and in some cases as high as 10% zinc. The silver occurs as both the light and dark ruby silver, with some brittle silver, and the gold is in some way associated with these minerals. Free gold seldom occurs.

The economic conditions, with the exception of the great distance from supplies, are good. A fair grade of oak wood costs $3 to $5 per cord. American coal $16 per ton, and native charcoal can be had for $7, delivered at the mine. Wood and charcoal can only be had in limited quantities, and the price will vary with the season. For operation on a large scale, coal or oil is the only fuel that could be considered. Water is scarce, and within the district the total surface flow will not exceed 20,000 gal. per day during the dry season. Most of the mines are comparatively dry; the three produce, when working, over 35,000 gal. per day. The great disadvantage is the long haul and the necessary high freight rate to the smelters. The present freight and treatment at Aguascalientes is $20. The only solution to the low-grade ore problem appears to be the erection of a suitable plant on the ground, and, from numerous tests, fine grinding and cyaniding alone will produce satisfactory results. Labor is inefficient but cheap, and the cost per ton of operating is, if anything, lower than elsewhere in Mexico. To get the best results, all work should be done by contract. Miners will average 50c. to 75c., timbermen 75c., engineers $1, and laborers 32c. per day. The production of the district has been in the neighborhood of $10,000 gross, and while reliable data are lacking, this figure appears a safe estimate.

Potash Salts in Southern California

Press Bulletin of the U. S. Geological Survey.

The two Federal bureaus engaged in the search for potash salts, the Bureau of Soils of the Department of Agriculture and the Geological Survey of the Department of the Interior, have received promising telegraphic news from their field representatives. A potash deposit of apparently great importance has been discovered in Borax or Searles lake, in the northwestern corner of San Bernardino county, California. This lake or *playa* is the last remaining pocket of a once much greater lake which has almost dried up, and its central depression contains a large body of crystalline salts known to consist of common salt and sulphate and carbonate of soda, with small quantities of borax. This salt body is saturated with brine, and interested persons, stimulated by the governmental search for potash, recently secured an analysis of old sample material from this brine. The result being significant, the lake was visited jointly by representatives of the Geological Survey and of the Bureau of Soils who took brine samples from six wells distributed over the salt flat. Analyses of these samples have been made by the coöperative laboratory at the Mackay School of Mines, at Reno, Nevada, and show an average of 6.78% of potassium oxide (K_2O) contained. The average salinity of the brine is 43.82 grams of solids per 100 c.c. Comparison of the results indicates that the brines are nearly uniform throughout the flat. The probable importance of the deposit is due to the occurrence of the potassium salts in soluble form in a natural saturated brine, and under climatic and other conditions especially favorable to its separation and recovery by solar evaporation. Existing data give reasonable assurance that the brine-saturated salt body is at least 60 ft. thick and covers an area of at least eleven square miles. Assuming the salt body to contain 25% by volume of the brine, the total amount of potassium oxide is estimated at over 4,000,000 short tons. This estimate is believed to be conservative, and the available tonnage may well be expected to exceed 10,000,000 tons, which would supply the country, at the present rate of consumption of potash, for thirty years. At any rate, it appears that this locality constitutes a very important source of potash in probably readily available commercial form. Methods of separating potash from brines are now under investigation by the Bureau of Soils.

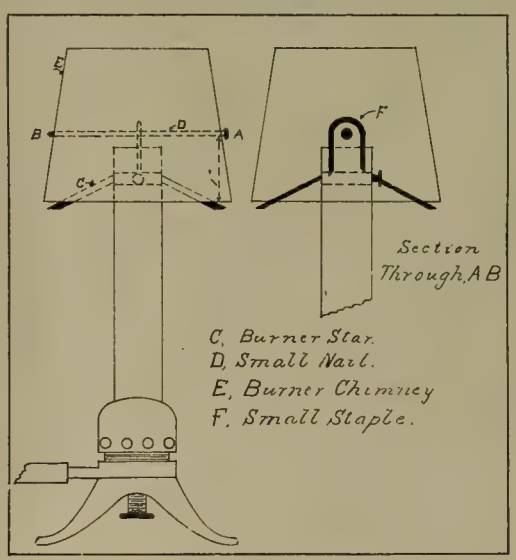
Borax lake or Searles lake is one of the many *playas* or intermittently wet and dry lakes common throughout the arid regions of the West. It lies between the Argus and Slate ranges, in the Mohave desert of southern California. Borax lake was the original scene of the famous '20-mule-team' borax mine, the borax being hauled in great wagons drawn by 20 to 28 big mules to the Southern Pacific railroad at Mohave, a distance of 80 miles. The lake or flat is about 10 miles long and 5 miles wide and has received the drainage from the surrounding hills for many thousands of years, vast quantities of dissolved minerals being thus concentrated in it. The water has been evaporated under the intense heat of the long hot seasons, but the salts have remained, so that for most of the year—in fact, often throughout the year—the bed is a glistening plain of white salts, in attempting to cross which men have lost their lives. Borings have been made through the mud and water underlying the lake to a depth of some hundreds of feet, the deepest borings made bringing up hot mud.

Many useful and curious minerals are found in the muds and other deposits of Borax lake, including, of course, borax. Among them are gypsum, glauberite, carbonate and sulphate of soda, salt, thenardite, and hanskite. The last carries as much as 2.33% of potassium, equivalent to 4.44% of potassium chloride. The salts are not evenly distributed over the surface of the lake. Borax was found plentifully over about three square miles, common salt is everywhere, and sodium carbonate and sodium sulphate are widely distributed. One boring is said to have passed through 28 ft. of solid trona (hydrous carbonate of soda) of great purity. At other places there is 25 ft. of solid mixed sulphate and carbonate of soda, with smaller quantities of other salts. Although the lake bed is dry most of the time, a few inches under the outer crust there is always water a battern heavily impregnated with salts. Several years ago an English company attempted to work the soda deposits on an extensive scale, but for some reason the work has not been pushed. This company sunk a number of wells, casing them through the soda deposits. It was found that a heavy stream of water could be pumped continuously without perceptibly lowering the water-level. Potassium chloride and sulphate, the forms in which potash salts are most likely to be found in such deposits, are among the most soluble of salts and are likely to be much more generally diffused than salts less easily soluble. That the entire body of water and mud in the lake contains potash in a more or less uniform degree, is indicated by the results thus far attained. However, there are modifying agencies, such as springs and streams, that bring in fresh water, for the movement of water through the lake will be slow, owing to the presence of the sand and salts.

A Substitute for the Blast-Lamp

By W. A. Ernst

The chemist often requires a flame which is hotter than the flame from an ordinary bunsen burner. He can, of course, resort to the blast-lamp, but blast-lamps are not available in many laboratories, and the chemist is obliged to make use of the foot bellows, which is inconvenient and cumbersome. On looking around for some method by which a hotter flame could be produced by the ordinary



SUBSTITUTE FOR A BLAST-LAMP.

bunsen burner, I discovered that by making a simple change in the chimney for a bunsen burner, an intensely hot flame, almost equal to the blast-lamp, could be produced. This flame will be found sufficient for all ordinary purposes, such as making fusions and ignitions. The accompanying diagram is self-explanatory. A small wire nail is inserted one inch above the bottom of the burner chimney, and a small wire or staple hung over the nail; this is allowed to go part way into the burner. The height which the nail and staple must be from the burner must be found for each individual lamp, but can be regulated by moving the chimney up or down by the aid of the burner star. When once the proper height is obtained, all that is necessary to convert the bunsen into a blast-lamp is to turn on the full force of the gas. An ordinary flame can be maintained with the chimney in position, by simply reducing the flow of gas. The best results will be obtained if the nail and staple are kept well within the inner cone of the flame.—*Jour. Ind. & Eng. Chem.*

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Is 'Cheap' Labor Economical?

The Editor:

Sir—Having had nearly seven years of continuous experience with Filipino labor in connection with mining and milling in the Philippine Islands, I venture to offer the following remarks regarding its efficiency and possibilities, in response to the invitation extended in your editorial on cheap labor. I quite agree with Wickham Quinian that the mass of untrained Filipinos are essentially children, and that they have the possibility inherent in them of becoming good workmen. In lines requiring manual dexterity they rapidly become efficient under proper supervision.

Practically all of my experience has been with the Filipino of the provinces. During the early days there were practically no natives outside of Manila that had any training in mining work, as, previous to the American occupation, very little mining had been done in the Islands. The use of powder in mining was practically unknown, except in a limited way in the Camarines. In the Benguet district the Igorotes had 'gophered' for many years. When the Americans came, the Igorotes were employed (and are still) in prospecting and assessment work, their pay being 50c. conant* per day and 'chow'. When given contracts for assessment work they were paid from ₱5 to ₱7 per *chipa* (this being the span from finger-tip to finger-tip of a fair-sized native). I have had adits in rock hard enough to stand up safely, but not requiring powder, driven for ₱80 for the first 100 ft. When it came to regular operations, the Igorotes were found to be too undependable, however, and it became necessary to bring in Filipinos from the neighboring coast provinces of Pangasanan, La Union, and others. Some of these had had previous experience in powder and rock work on the Benguet road, and quickly became fairly good miners. They brought their families along, and settled down at the mines, and proved to be steady and reliable. When there was any scarcity in labor, these people sent for their friends and relatives, so the supply was kept up, and I can only say that after the first importation there were never any but temporary shortages in labor while I was in this district. The wages paid (₱1 per day with rations, or ₱1.20 without) proved sufficiently attractive to bring the best class of labor from the lowlands to the mines.

One mine in this district employed a few experienced Japanese miners to good advantage, using them mostly as timbermen and hard rock men, and paying them from ₱2 to ₱2.50 per day. Native timbermen were paid ₱1.20 per day with 'chow', and *capitases* ₱1.40 to ₱1.50. Since I left here two years ago, the rates have gone up about 20c. conant all around, but are not high, considering that the men receiving them have become more experienced. The rates paid in the Camarines have, I believe, been somewhat higher than those given above, but the grade of the labor there was better to begin with. In the Aroroy district, Island of Masbate, the base rate for miners is a peso per day without chow; that of common labor being 80c. conant. Timbermen receive ₱1.20 and *capitases* ₱1.50 without chow. The efficiency of the labor there is not nearly so high as in Benguet, owing largely to the fact that it is recruited mostly from the Visayans of the surrounding country, and partly to difference in climatic conditions. The best men in that district have been brought in from Benguet and the Camarines. These imported men come to mine, and have no other interests to interfere. The local laborer works at the mines at times when crops have been planted and fishing is poor, or when he needs a little ready money.

I have found, both in Benguet and Aroroy, that one of the best incentives to work for the native is to run a well stocked company store where he can get rid of his money and at the same time get something that adds to his comfort and welfare—in other words, to increase his wants by providing what he needs. When the native once gets a start he is very fond of good clothes, and will buy the best. It has often been remarked in Baguio that a man who has been at the mines very long can be picked out by the superiority of his dress. A tailor was employed in connection with the company store at one mine in the district.

It is a very difficult matter to establish any exact ratio of efficiency between men of different races working under such different conditions as exist here and at home, but I shall nevertheless try to fix such approximate ratios as appear to me to exist, using that of an average miner in the West as 100%. On this basis, I would regard that of a native miner in Benguet, after having had six months experience, at 33⅓% and that of a miner of similar experience at Aroroy at 25%. In timber work, their percentages would drop somewhat, owing to lack of previous training of the natives and their comparatively small stature (average height being about 5 ft. 4 in., weight about 130 lb.). The efficiency of a common laborer in Benguet I would put at 25% and in Aroroy at 20%. In all cases, it must be understood that the labor has proper and capable supervision, and that no comparison is attempted between the native and the white working under the same conditions. The white man could not do the work of a native in this climate and stand up under it, so it is fortunate that it is not necessary.

In milling work, where quickness and dexterity come more into play, I have found that native boys break in quickly, and in this work I would place the relative efficiency at 40% as compared with the average mill-hand without special training. For this work the smaller and younger men are the best, being more alert. It is necessary to avoid giving each boy too much to look after and to have good supervision to keep them up to the mark. Granting these, I would as soon operate with a good bunch of native boys as the average lot of millmen of equivalent experience at home. When it comes to lines requiring special mechanical training, it as yet necessary to draw on Manila. Good native machinists can be hired for provincial work at from ₱75 to ₱90 per month, and in efficiency the work of these men would be from 40 to 50% of that of white machinists. Engineers get from ₱50 to ₱60 per month, and firemen from ₱35 to ₱40, all without chow. The efficiency of the latter is about the same as with machinists.

The general conclusion may be drawn with respect to labor in these Islands that the *efficiency increases with proper training faster than the rate of wages.* This makes the outlook, with a liberal supply of raw material to draw upon, very promising, provided that the people are not misled by agitators. I regard the policy of the present Government in providing liberally for the education of the native, especially in industrial lines, a very wise one. It has been my experience that the boys who have been to school and speak English are quicker to learn and more ambitious than those fresh from the *bosque.* For timber construction and mine-timber framing I have always employed Japanese carpenters, for the reason that they are very efficient and accurate. The Filipino is as yet lacking in skill in carpentering and smithing, but the schools are giving instruction along these lines, and the natives working with the Japanese as helpers are learning slowly, so it may be possible to eliminate the Japanese carpenter after a while, except for the finer work on construction.

Altogether, the labor situation (upon which everything here depends) is not so bad as has been painted, and it will continue to improve, if those in charge of industries here will do the right thing and make the necessary effort to improve the quality of the work and look out for the

*50c. conant = 25c. gold.

personal welfare of their employees. Nowhere is scientific management more necessary.

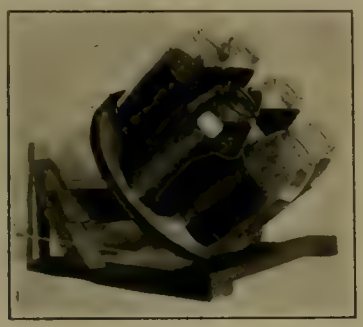
C. M. Eve.

Baguio, Philippine Islands, February 4.

Laboratory Cyanide Tests

The Editor:

Sir:—The question of long-pipe percolators in making cyanide extraction tests, as discussed by George A. James in your issue of December 30, 1911, and by A. W. Allen, February 17, 1912, is interesting. As more and more rebellious ores are being treated by the cyanide process, the question of laboratory tests and the appliances for making them becomes of increasing importance. The tall iron-pipe percolator has been used in this country, but I have never seen it so conveniently arranged as Mr. Allen sug-



CONVENIENT AGITATION APPARATUS.

gests, with the easily separated flange couplings. It seems to me that it is not alone the determination of the leaching rate that makes the pipe percolator useful. For instance, if the leaching rate is so rapid that an unnecessarily large amount of solution would have to be passed to the zinc-boxes, the leaching rate can be cut down at the valve and the effect on the solution noted. An examination of the effluent solution from a deep charge of ore often reveals important facts. If the effluent solution is in proper condition, little uneasiness need be felt as to the extraction in the lower portion of the vat. I have always considered it quite important to keep a percolation test leaching continuously where there is the least danger of the solution becoming too low in protective alkali or picking up alkaline sulphides to a considerable extent during its passage through the charge. The test can conveniently be kept leaching through the entire night by filling a can with solution and inverting it over the percolator after the manner of the flask suggested by Mr. James. However, the greater part of the work can usually be done by agitation tests, and on account of the large number that may be run simultaneously with little outlay for equipment, I think they are to be preferred, using the percolator tests as a final check rather than the principal method. Of course, everybody makes 'bottle tests,' but they are too often regarded as a rather unimportant preliminary. In making the so-called bottle tests, too small a quantity of material is usually taken.

The agitation apparatus I prefer to use consists of a wooden disc rotating at a speed of not more than 5 to 8 r.p.m., the shaft being set at such an angle that the axis of rotation will coincide with the hypothenuse of a right triangle whose vertical altitude is 1 and its base 2. The top of the disc is provided with sheet-steel clips to removably hold six or more two-quart (half-gallon) Mason fruit jars, the bottoms of the jars resting flat upon the disc. Enough solution can be used in this apparatus to make zinc-dust precipitation practicable, and in case separate treatment of sand and slime is contemplated they need not be separated in the earlier stages of the work. The tests can be put on the agitator near the close of the day, run during the night, and will generally be ready for assay in the morning, thus making it possible to turn off a considerable amount of work in a short time and with little labor. By means of this apparatus I once determined with a fair degree of accuracy what might be expected to happen in the bottom of a deep, slowly leaching charge, by filling the jar full, sealing it with the cap, and titrating the solution at intervals. Of course, in making a test of this kind, due account must be taken of the relatively large amount of solution in the agitator. For instance, if the ratio of solution to ore is 5 to 1, and the voids between the grains of sand in the leaching-vat would allow the vat charge to consist of 50% solution (a ratio of 1 to 1), then whatever changes are found in the solution at the end of the test should be multiplied by 5. I do not know how I could have determined this point by means of the usual quart percolators used in this class of work.

It is perhaps needless to add that in making tests upon coarsely crushed material, either the half-gallon jars or ordinary glass percolators are liable to lead one considerably astray on account of the poor sampling which inevitably results. A convenient and easily remembered rule for the size of test samples is to square the diameter of the largest grains, measured in sixteenths of an inch. The result will be the number of pounds of ordinary mill rock that should be taken to accord with good sampling practice. For instance, if the stuff is crushed to a $^{5}/_{16}$-in. screen opening, 25 lb. would be sufficient, but if the screen opening is $^{7}/_{16}$, the amount required would be, in round numbers, 50 pounds.

Boulder, Colorado, March 8. John Randall.

Gold Deposited by Magnetic Electric Currents

The Editor:

Sir—The letter from F. J. Martin and your comments thereon in the *Mining and Scientific Press*, February 24, are quite interesting.

Since magnetic effects are static, Mr. Martin evidently means electric currents rather than 'magnetic currents.' In practical electrical work the earth is conceived to be always at zero potential and to have infinite conductivity. However, that applies only to parts near the surface and is not always true under desert conditions. Below the water-level, where the rocks are dry, the electrical resistance is high except along such lines of conducting material as are found in the water channels in fissures. It does not seem likely that deep-seated earth movements would be able to produce sufficient differences of potential over large areas to allow appreciable electric currents to flow to the surface. The movement of conducting solutions across the earth's magnetic field would produce local currents. These would be very small, because their potential would depend on the velocity of movement, which is comparatively slow.

A more important electrical effect would be found in the galvanic action taking place between dissimilar metals after they begin to deposit. Thus if a particle of gold and a particle of pyrite be precipitated in such a way that they touch at some point, a current will at once flow from gold to pyrite and back through the solution to gold. Gold would be deposited on the gold particle and pyrite would be redissolved. Since pyrite is nearly always in excess, the tendency would be to precipitate all the gold in the adjacent solution. Hence Mr. Martin's idea that electric currents have something to do with the coarseness of the gold is probably right. Experiments along these lines would be interesting.

Holland, Oregon, March 8. John B. Platts.

Tin Dredging in Alaska

The Editor:

Sir—In your issue of January 6, T. M. Gibson, in discussing 'Tin Dredging on Cape York, Alaska', states that W. W. Johnson and his associates have all of the property on Buck creek. This is not strictly true, as I, myself, have No. 5 on this creek and have not leased it to anyone.

Lydia R. Clements.

Brookline, Massachusetts, March 14.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

ANTIMONY is not produced commercially in the United States at present, except in the form of hard lead, and about 5000 tons of the metal is imported annually. China and France are the chief producing countries.

SMALL dams to store water should be provided with a gate through which accumulated silt and sand may be flushed out from time to time, otherwise the area back of the dam may become almost completely filled by it.

ANCIENT river beds in California sometimes lie as much as 3000 ft. above the modern streams which have cut their channels below. This is especially true along the American river, near the eastern end of Forest Hill divide, near Canada hill, and at Bald mountain.

TAILING which runs upon the land of another may be claimed by the owner of the land; or he may claim damages, if injured by it. Near Bodie, California, ranch-owners allow the working of old tailing which has accumulated upon their land, upon a royalty basis.

ORE-BINS with inclined bottoms give a smaller angle of repose to the contained ore, which therefore runs more freely when the gate is opened. An angle of 45° is the most convenient to construct and approximates the angle theoretically deduced for ordinary classes of ore.

DITCH-OWNERS are responsible for damages due to washouts, even though they are not due to negligence. An 'act of God,' such as a storm, does not free the ditch-owner from responsibility for the damage sustained by another from the overflow of a ditch from such a cause.

THERE is a general impression that Japan is a large producer of antimony, probably derived from the remarkable crystallized specimens of stibnite from Shikoku, which can be seen in almost every mineralogical museum. But the commercial production of antimony in Japan is not large.

BLACK-PRINT papers have recently come into use. They show black lines on a white ground and are printed and washed just as blue-print papers are. These papers cost from two to three times as much as ordinary blue-print paper. A direct blue-line paper is also made, but it requires three washings like brown-print paper.

TIMBER for a two-compartment shaft, 5 by 11 ft. in the clear, will amount to about 1000 board feet per set. This includes heavy timbers and all blocking and lagging as well. The length of time required to put a set in place depends on the character and condition of the ground and the experience of the men. Ordinarily a set can be erected quicker in an inclined than in a vertical shaft.

EXPERIMENTS undertaken for measuring the temperature on the inner surface of the cylinder of a small gas-engine have shown that the temperature is about 465° F., and that the variation from cycle to cycle is usually less than 18°F. The steady conditions of low temperature at the wall surface are caused by the jacket water, while great changes of temperature take place at a short distance from the walls.

THE most efficient grade for tables and sluices is considered to be 1½ in. per foot. The quantity of water used in washing gravel varies considerably and depends a great deal upon the amount and character of the material washed, as well as on the personal judgment of the operator. There are, probably, few cases in which the exact quantity of water used has been determined. Some operators claim they do not use more than 100 in., while others claim to use an average of 300 inches.

LITMUS paper, when used to detect the acidity or alkalinity of solutions, may give variable results, according to the method of its preparation, the amount of salts present in the paper, and the character of the paper itself. To make a good blue paper 1.4% of chemically pure litmus is dissolved in distilled water with continued shaking for about one hour. The solution is allowed to stand over night, is carefully decanted from the sediment, and H_2SO_4 added, drop by drop, until the alkalinity is reduced to the point where a piece of paper made from the solution will assume a perceptible red color when placed for a half minute in N/2000 HCl. To make red litmus a 10% solution is required, and H_2SO_4 is added until paper made from the solution will show a distinct blue color with N/4000 caustic soda solution.

UNUSUAL elements present in gold and silver ores can often be detected by the colors which they impart to the cupel near the finished button. When bismuth is present the place which the silver button occupies is brown, surrounded by concentric rings of yellow and blackish green. Copper colors the cupel a dirty green to black, according to the amount present. Nickel leaves a greenish ring of scoria, while arsenic, antimony, zinc, and tin give a light colored ring of scoria if present in large amounts. Ruthenium imparts a peculiar greenish tinge to the cupel, and the other metals of platinum also color the cupel, but as usually several of the group are present at the same time, it is difficult to determine whether the color observed is due to a single element, or the combined effect of several. These metals may carry iron into the lead bullion, with the resulting formation of a great variety of colors on the cupel. Where appreciable amounts of the platinum group metals are present their presence can often be detected by the appearance of the silver button, to which platinum gives a rough and pitted look, while palladium makes the surface appear raised and embossed. Osmium makes the button have a rough surface and break up, ruthenium produces a black film, while iridosmium makes the surface of the bead look as though it were covered with bright, flat, silvery plates or crystals.

APPLICATION for permit to cut timber without charge in accordance with the Act of Congress providing for the reasonable use of timber on public land, must be presented or mailed to the register and receiver of the local land office, or the Chief of Field Division having jurisdiction over the land, who will supply application forms upon request. The application must set forth the names and legal residences of persons applying to fell and remove timber, names and residences of persons who are to use the timber, amount of timber required for each person, and the use to be made thereof, date it is desired to begin cutting, and description of land to be cut over. No timber may be cut for sale or transported from or used out of the state in which it is cut. Persons who commence cutting before their permits receive the final approval of the Commissioner of the General Land Office, will be liable for a reasonable stumpage if the permits are not approved. Where permits are secured by fraud, or immature trees are taken, or timber is not used or taken in accordance with the terms of the law, the Government will enforce civil and criminal liabilities as in other cases of timber trespass upon public land. These may range from the stumpage value of the timber cut in the case of an unintentional trespass to the value of the timber where found, and a fine not exceeding $500; to which may be added imprisonment for six months, in case of wilful and malicious timber trespass. There is no authorization to cut any small or limited amount of timber under this act without a permit. The Government, of course, has not jurisdiction over the timber on patented claims or land.

Special Correspondence

NEW YORK

THE COPPER MARKET, PRESENT AND FUTURE. GREENE-CANANEA EXPANSION. OHIO COPPER. INCREASE IN LA ROSE DIVIDENDS. THE ELIMINATION OF STILLWELL.

So far as the copper market is concerned, there is no doubt as to its strengthened position, at least of the controlling interests. There is much more concentrated financial strength behind the copper-metal market than there was five years ago. John D. Ryan and his co-workers, who have been prophesying and working for a 15c. copper market, have found themselves so far successful as to see copper, May and June deliveries, sold at this price this week. The war clouds have saved the copper situation, and the new production, which threatened to increase an already overgrown surplus, can be absorbed now for a time without creating any burden. It is unquestionably true that many ordinary demands for copper are not being supplied now, and these accumulated requirements will, when conditions permit, take a vast quantity of copper, in much the same manner as an accumulated short interest takes stock out of a market when covering begins. As to the new production and its proportions, the next ninety days should reveal about what may be expected. Old properties have been rebuilt and ore reserves developed during the period of depression; the Lake country has been making some new mines, in the Ahmeek, the Lake, and others; Greene-Cananea and the old Arizona Copper Co. have been rebuilding; the Granby is ready to make a new start; and what may be done by these and properties in similar position, together with the porphyries, will be the controlling factor in copper during the next half-year.

With all of the upbuilding of the copper-metal market, there is a concerted movement to distribute stocks. Amalgamated Copper is probably to increase its dividend, hitherto $2 per year, to $3 or $4 per year. The distribution of Anaconda shares in the Butte Coalition treasury is just being made, and as Amalgamated was a large holder of Coalition, it now receives a large block of Anaconda stock and a large amount of cash. The public is to be coaxed into 'Copper' again, if possible. In Wall Street slang, 'Copper' is the term for Amalgamated. With the exception, however, of this one issue, the copper-share list does not reflect the improved conditions in the metal market. The Greene-Cananea company evidently is not seriously disturbed by the Mexican uprisings. The company has recently secured control of the Superior Bonanza Mining Co., a property lying about 35 miles south of Nogales, in Sonora. The reason for the purchase is to secure a supply of oxide ores and so get a better flux.

It is thought that there is some deal afoot for the Ohio Copper Co. Henry Krumb has been spending the past two weeks in making an examination of the property, but in whose behalf is not yet known. The Utah Copper people deny that they are interested in any way—a denial which might be reasonably expected so long as E. A. Wall has anything to do with Ohio. Ohio is showing a small profit now from its operations. The United Copper Co. and the La France Copper Co., both Heinze organizations, are evidently approaching reorganization. The stockholders are being solicited for proxies. The Lexington Mines Co. is to be formed to take over the La France by purchase of its properties at foreclosure sale. The charter of the United Copper Co., which is organized under the laws of the state of New Jersey, has been forfeited for non-payment of taxes and, while the statement has been made that shareholders would be fully protected against any consequences, the conditions are cited as additional reasons for the shareholders to come to the rescue.

The Palmer Mountain Tunnel & Power Co. is to be reorganized. This company was floated throughout New England, and has thousands of small shareholders. The properties are at Loomis, Washington, and the project was a rather large one. The shares were at one time sold above par, but dwindled to practically nothing. The reorganization will be, perforce, a very drastic one, and the company will practically make a new start. One bank in the far Northwest was wrecked by loans made to the company, and the president of that institution avoided a ten-year sentence in the penitentiary by 'jumping bail' and remaining outside of the jurisdiction.

The attention directed to the La Rose company by the resignation of E. P. Earle, because his associates on the Board refused to distribute the company's surplus in dividends, evidently had its effect upon the remaining members, as the dividend has been increased from 2% quarterly to 2½% quarterly. The stock is now upon a 10% basis. The new directors elected to the Board are: Edwin Hanson, of Montreal, and W. M. Dobell, of Quebec. It is said that A. E. Stillwell is to be eliminated from the Kansas City, Mexico & Orient railroad, which is about to go through reorganization. Mr. Stillwell has been an energetic and efficient promoter throughout the Southwest, but has apparently never been admitted to the inner circle of financiers in New York. His recent book on the so-called 'Money Trusts' is thought to have placed him outside the pale. It may be taken as certain that New York banking interests will not assist him. Samuel Untermyer has charge of the reorganization plans, acting in behalf of the bondholders committee.

OHIO COPPER CO. MILL.

GLOBE, ARIZONA

SIXTEEN-INCH CHURN-DRILL TO BE TRIED IN DISTRICT.—BARNEY HOLE NO. 1 DOWN 1355 FEET.

The South Live Oak Development Co., holding under option the Schultze group of 16 claims adjoining the Montezuma and Needles groups, is preparing to begin exploration with churn-drills. Harry Millard, who will have charge of the drilling, has gone to St. Louis to purchase a 'St. Louis' churn-drill, made by the St. Louis Machine & Tool Co. It will have a 58-ft. derrick, with boiler and engine separate from the rig, and is designed for deep drilling. Holes will be started with a 16-in. bit, which is two inches larger than the largest size now in use in the district.

Hole No. 2, of the Southwestern Miami Development Co., cut chalcocite ore at a depth of 945 ft. and penetrated it 40 ft., being 985 ft. deep. Assay returns are not available. The 4½-in. tools and casing are now being used, and chances are considered favorable to reaching the bottom of the orebody with this hole. Hole No. 1 had to be abandoned while still in ore, after passing through 175 ft. of it. Hole No. 3 is 305 ft. deep, and still in the schist formation. Hole No. 1, on the Barney group, is down 1355 ft. and is still in the heavily iron-stained silicified schist in which it has been for the last 255 ft. This is the deepest hole ever drilled in the district, breaking the record of 1285 ft. made in Hole No. 1 at the Southwestern Miami. The 3-in. casing is being put in, and E. B. Tinker, the superintendent, expects to attain a depth of at least 1500 ft. Hole No. 2 is 300 ft. deep.

At the Inspiration mine, the experimental mill has been temporarily closed down to make some changes preparatory to starting another series of tests. The work on the dam across Pinal creek has been delayed by the recent rains and consequent high water. The Sho Me group of seven claims, south of and adjoining the claims of the Inspiration company, is being developed by Cleve W. Van Dyke, president of the Miami Townsite Co. A shaft 165 ft. deep is reported to have from two to four feet of ore carrying native copper. The shaft is now being cleaned out and repaired. A second shaft has been started on the Sho Me No. 2 claim, but has been delayed by the recent rains. The retimbering of the Copper Hill shaft of the Arizona Commercial company has been completed for a distance of 210 ft. below the collar. The Duquesne group is being worked by John Shaw with a force of five men. The last shipment, of 36 tons, assayed 1.02 oz. in gold and about 10% lead, and netted over $17 per ton above freight and smelter charges.

BUTTE, MONTANA

TUOLUMNE SHOWS LARGE SURPLUS.—WASHOE SMELTER BREAKS RECORD.—GENERAL NOTES.

The Tuolumne Copper M. Co., listed on the Boston exchange a short time ago, which is among the independent companies of this city making an excellent showing, held its annual meeting a short while ago. The reports submitted were of a gratifying character, both as to the condition of the mine and of the treasury. Edward Hickey, president of the company, stated that there was no indebtedness and that there was a balance in the treasury at the end of the year of $63,345, although the company has erected a complete new surface equipment and constructed a spur from the mine to connect with the Butte, Anaconda & Pacific railroad. The amount milled during the year was 30,499,009 tons of ore, containing 4,261,705 lb. copper, 96,373.15 oz. silver, and 145.52 oz. gold. The average copper content of the ore for the year was 7.157%, and the average silver content 3.237 oz. The gross value of these metals was $472,943, and the net value was $261,448. During the past year the working shaft of three compartments was sunk 177 ft., cross-cuts were run on the various levels a total distance of 1362 ft., and raises have been sunk totaling a depth of 866 ft. altogether. The shaft was sunk from the 1600-ft. level to a depth of about 1800 ft. On this level one of the finest orebodies yet found in the mine was uncovered. Samples recently taken show that four feet of this vein assays 12.7% copper, 13.4 oz. silver, and 60c. gold. Six feet of the vein shows assays of 5.95% copper, 5.8 oz. silver, and 14c. gold per ton, while two feet shows 3.75% copper, 2.6 oz. silver, and 8c. gold, with 13 ft. of lower-grade ore. No shipments have yet been made from this body of ore, and the reason for this is that the ventilation is bad on that level, and in order to remedy this, arrangements have been made with the North Butte company to connect with openings of the latter company.

The La France company does not want to again have to redeem its Basin Reduction Works property, if there is any way out of it. The Jefferson county authorities assessed the property last year at what was considered a fair valuation, but which the company considered too high. The taxes were unpaid at the close of the fiscal year, and the county officials took steps to enforce the collection through the courts. A stipulation has been filed in the Federal court that if the company pays $17,500 in full settlement by May 1, no further proceedings will be taken, but if not paid by that date, a judgment will be taken in favor of the county. The Washoe smelter of the Anaconda company is making record work just now in turning out copper, and extra ore-trains are being run from this city to Anaconda to keep the works supplied. The production last month was the heaviest by the Anaconda company in the past two years, notwithstanding that it was the shortest month in the year. This month probably will exceed February by fully 1,000,000 lb. It was thought when the official figures for January showed 26,350,000 lb., that the limit had been reached, but the February figures were announced at 27,450,000 lb. In the figures mentioned, the North Butte and Tuolumne productions are included, but the latter do not amount to over 2,750,000 lb. copper.

SALT LAKE CITY, UTAH

ANNUAL REPORT OF THE DALY-JUDGE.—SMELTING AT TINTIC.—PETROLEUM POSSIBILITIES OF UTAH.—WORK OF THE ASSAY OFFICE.

Among the grist of annual reports coming out at this time, that of the Daly-Judge Mining Co. of Park City is especially interesting as showing financial methods which might well become more popular among mining companies. The Daly-Judge is carrying a reserve of $431,620, all of which is bearing interest. Instead of paying out dividends close to the margin of profit or keeping an idle reserve, this company has been steadily building up a large reserve and has been investing most of it in first-class securities. The greater part is invested in bonds and mortgages which bear a good rate of interest and can be realized upon at any time. In 1911 the surplus earned $18,838 in interest; more than enough to pay the drainage expenses. This fund was increased $115,404 in 1911, although regular dividends were resumed at the close of the year. The mine is now paying regularly at the rate of $180,000 per year. The Daly-Judge has always had a zinc problem and a drainage problem. The latter was solved by making a connection with the Ontario drainage adit within the past year, so that development at depth is now under way, the workings being extended to the 2300-ft. level. The zinc problem has been handled satisfactorily for several years.

Plans are being made to resume operation at the Knight smelter at Tintic by summer. Whether or not Jesse Knight will be able to carry out his purpose successfully remains undetermined, but he is anxious to get some returns on his investment of about $1,000,000, which has been idle for some time. The Knight interests control the Colorado, Iron Blossom, Swansea Consolidated, and other properties in the Tintic district. A few years ago, as a result of a dispute with the Guggenheims over smelting contracts, they decided to build a smelter of their own near Silver City. Other interests joined them at the outset, but eventually practically everybody dropped out except the Knights. The construction and operation of the plant were beset with vicissitudes. The operations were never profitable. This was attributable to various causes, among them the difficulty of getting fuel to the plant at a low enough figure. After several changes of management, the plant was shut down and the Knights contracted their ores to the United States and American plants. When the International entered the field, negotiations were undertaken for the Knight smelter, but no agreement as to price could be reached, so the million dollars' worth of buildings and machinery have lain idle. Now it is understood that better fuel conditions exist, and another effort is contemplated to get the plant into operation again.

Utah has been trembling on the verge of an oil boom at intervals for many years, although it has never had a genuine excitement, and now there is another set of preliminary symptoms. In many parts of the state there are unusually favorable oil indications, but only in the San Juan region, in the extreme southeastern part of the state, has there been anything like thorough prospecting. There the drilling has resulted in bringing in several wells, but the distance from a railroad and the limited amount of flow have kept the district from coming forward as much as it might under favorable transportation conditions. Drilling near Salt Lake City at two different periods has resulted in opening up numerous gas pockets, but the formation has been found to be too badly broken to offer great encouragement for petroleum in quantities. Drilling in the Virgin river region and elsewhere in the southern part of the state resulted similarly. The region south of Green River, Utah, especially in the San Rafael country in Emery county, has recently begun to attract the atten-

tion of experienced oil men, and several drilling operations are under way. Interests represented by Charles P. Tasker of Philadelphia have secured a large area in this district, have built a road 25 miles from Green River to the site of their first well, and are now shipping in a standard rig to begin drilling.

The Salt Lake U. S. Assay Office has shown a slight but steady increase in business since it was established. From February 1, 1909, to February 1, 1910, the receipts were $1,151,000, and for 1911 the bullion handled amounted to $1,300,000. The placing of an assay office here has made a material saving for the gold producers of the region, who would otherwise have to ship to Denver or San Francisco.

JOPLIN, MISSOURI

Price of Zinc Ore Highest Since 1905.—New Smelter to Be Built by Granby Mining & Smelting Co.—Miami Drainage Problem Troublesome.—Zinc and Lead Notes.

March 1912 saw the highest prices paid for zinc ore since 1905, when the basis figure for lots carrying 60% metallic zinc rose to $57 per ton, meaning a top price of $60 for choicer lots. The 1912 price went to $55.50 basis, with a top price of $58.50 for choice lots, the highest price ever paid, with the single exception of 1905. As a result, production jumped, within a week, from 3400 tons to 5000 tons, and a week later the district was turning out 5600 tons of zincblende concentrate weekly. Several circumstances combined to strengthen the market. Locally the production was at low ebb, due chiefly to an unusually severe winter which caused many mines to close. Roads had been in bad condition and isolated producers found it difficult to transport their output to the railroads. Bad weather in other districts, especially in those of the Far West, caused a curtailment of zinc ores from other districts; in Mexico the revolution resulted in an almost total discontinuance of zinc-ore importations to the United States; so, in the face of this combination of features, smelters were forced to strengthen their offerings materially. In a single week, zinc ore went from $49 to $55.50 basis. Spelter, East St. Louis quotations, reached the highest price on record, going to $7, although in 1907 metal went to $7.25, New York quotations. East St. Louis spelter at that time, however, went only to $6.90. Following the high prices, offerings weakened slowly. Blende dropped to a $50 level toward the close of the month; metal, East St. Louis, fell to $6.50. So far the aggregate valuation of the 1912 ore shipments is much greater than that of 1911, and, despite the fact that it is election year, the chances seem bright for 1912 eclipsing all previous years in total ore valuation.

One of the most modern zinc-smelting plants in the United States is to be built by the Granby Mining & Smelting Co. at Rose Lake, Illinois, a suburb of East St. Louis. Ground for this plant was purchased several years ago, but it was not until the recent meeting of the board of directors of the company that final decision concerning the size and cost of the plant was reached. Work is to be rushed. At the meeting, the financial report was submitted, showing a year of great prosperity, both in the smelting and mining departments. The company operates mines and leases lands for mining purposes in Joplin, Oronogo, Granby, and Spring City, all in Missouri. Elias S. Gatch was reëlected president.

Water is being lowered at the rate of one foot per week at the L. C. Church mines, Miami, Oklahoma, and this means that the water-level throughout the greater portion of the Miami district is being lowered at a proportionate rate. The pumps are working at a depth of 250 ft. Enormous pumps, installed in the deep mine of Chapman & Lennan, adjoining the Church property, will soon be running and will aid materially in the draining of the deeper ore-levels. With the opening of the lower ore-levels, Miami has taken a new lease on life. No less than 12 shafts have reached the new deep-ore formation, and when the water problem is satisfactorily solved, extensive development of this lower run may be looked for. Already the Church mill is working on the deep ore. Chapman & Lennan are moving the Red Dog plant from the Rochester Zinc & Lead Co.'s lease, north of Webb City, Missouri, to Miami, and other new mills are contemplated. In addition to these plants, more than a dozen mills of the district, now handling shallow ores, may eventually be expected to work on the deeper deposits, as the opening and blocking out of the formation has been general, both with shafts and drill-holes.

North of Carl Junction, Missouri, in a region heretofore given over exclusively to farming and stock raising, extensive development is following in the wake of the mineral development at the Weaver mine, which is turning out as high as 350,000 lb. of high-grade concentrate weekly. A shaft is being started on an adjoining lease by E. M. Bennett and others who have put down a number of drill-holes and found ore. Half a dozen other drill rigs are working within a radius of two miles. About two years ago, workmen, in blasting holes for the concrete pillars of a bridge to span a small stream, unearthed specimens of pure galena. Immediately several gougers took leases on neighboring lands, and shallow shafts were sunk into rich pockets of lead ore, found at varying depths. The McFeran mine was the first producer, galena being the only ore turned out. Deeper work revealed big deposits of sphalerite, the present workings of the Weaver mine being at 172 feet.

To work thin ground profitably is the problem which the Diplomat Mining Co., of Galena, Kansas, is solving. The company believes in heavy milling capacity, and will double the present capacity of 500 tons per shift. The old Cimarron mill has been bought and will be moved to the Diplomat lease, where it will be re-erected and remodeled.

JOHANNESBURG, TRANSVAAL

Fictitious High Record for January.—Power Supply Problems.—Resumption of Work at Private Plants.—Increased Supply.

Although the declared output of gold for the Transvaal for January by the Chamber of Mines constitutes another record and one probably that it will take some time to surpass, there are several outstanding features which may perhaps be regarded as detracting somewhat from its merits. The figures declared were 737,060 oz. of gold of a value of £3,130,830. The previous best output declared was that for the month of November, amounting to 719,729 oz. of a value of £3,057,213, so that the month of January apparently exceeds that of November by 17,331 oz. and £73,617 in value. As a matter of fact, the actual production of gold was less in January than that declared for November, as the East Rand Proprietary Mines and the New Kleinfontein discontinued, at the wish of shareholders, the policy of keeping a gold reserve and by this means added 18,764 oz. of gold belonging to previous months to the output declared for January, while several other companies also took liberally from their gold reserve to include in the January output. When this reserve gold is deducted from the January output as declared, it is only 715,459 oz., of a value of $3,039,500. Another disappointing feature is the reduction in the estimated working profits, those for January being less than for a long time past, despite the increased declaration of gold for that month. All the groups except the Barnato & Consolidated Mines Selection show a fall in the estimated profits from a total of £864,758 to £809,649, the latter being the lowest reached for a good many months if the short month of February is not taken into consideration. This decline of working profits accompanying a growing total output of gold has been a noticeable feature in connection with the Rand gold-mining industry for some time past, and only a drastic reduction in the working costs would appear capable of bringing about the much-needed improvement in this respect.

There is no marked improvement in the condition of affairs regarding the supply of power in uniform and ample quantities to the mines by the Victoria Falls & Transvaal Power Co. Some surprise seems to be expressed that in face of the fact that the power company has got all its generating stations at work on the Rand, the consumption of coal should continue to increase in the same normal manner as before electrical power was introduced in the gold mines. There would appear to be two explanations for this; firstly, the power stations themselves use large quantities of coal; and secondly, the failure of the Victoria Falls Power company to keep up the supply of power, more especially compressed air, has caused many of the steam plants to be again put to work. Owing to the scarcity of native labor, the use of compressed air in the mines has considerably increased of late, and of course any failure of the Power company to supply the power stipulated according to its contract has to be made up by the mines at the expense of the Power company. For instance, one of the groups here used power in its mines during January costing £32,000, but in the shape of penalties and extra cost incurred in obtaining the necessary power, the group had a contra account of practically one-half that amount to deduct, so that for the power supplied, only one-half would be paid to the company for the power used. Supposing we take the cost per unit at 0.56d., it means that the Power company would receive payment at the rate of 0.28d. per unit, which under the local conditions can scarcely be considered a remunerative figure. Still, that is the position, and it would be interesting to know when affairs may be expected to be put on a better footing. The Victoria Falls Power company is at present engaged in erecting an additional generating station at Vereeniging, some thirty miles to the south of Johannesburg, which when completed will be on a much larger scale than the others, in the hope that along with other extensions to existing stations it will enable the Power company to fulfill its obligations to the mines. It may be that these troubles will explain the delay in starting operations in connection with the proposed station at Tweefontein, and it is to be hoped that the steps now being taken to increase the supply of power to the mines will be successful. Otherwise it may become necessary for the whole business to undergo some important changes, as it becomes increasingly difficult to see how, if operated on present lines, it can become a success.

LONDON

SUBSTITUTES FOR COAL.—DIESEL OIL ENGINES FOR MARINE USE.—PROSPEROUS NUNDYDROOG AND ITS ROSY OUTLOOK.—A SLUMP IN NIGERIAN SHARES.—IMPROVED TONE OF MARKET.

The present coal strike affords promoters an opportunity of offering investors a speculation in some sort of fuel, and the daily press has advertised several such. One company is called Coal Substitute, Ltd. The capital is £100,000 and 140,000 shares of 10s. each are being offered for subscription. The purchase price paid to the vendors is £65,000 in shares and cash. No mention is made in the prospectus as to the actual nature of the fuel, but it is stated to be produced in the form of briquettes that have been made in brick-making presses and kiln dried. The raw material comes from Portugal and 30,000,000 tons per annum can be delivered at Lisbon. No coal or peat is contained in the fuel. Sulman & Picard report that it contains 45.8% fixed carbon, 45.65% volatile hydrocarbons and combined moisture, and 7.55% ash. The sulphur content is 0.69%, contained partly in the fixed carbon and partly in the volatile constituents. The calorific power is reported to compare well with coal of average quality. H. Brian Pearson, who is on the board of directors, estimates that the fuel can be sold for 13s. per ton. There is no good reason why the nature of the raw material and the patent process of manufacture should be kept secret.

But a much more serious item in the coal-substitute line is the epoch-making event signalized by the departure on its first voyage of the ocean-going *Selandia*. This ship is propelled by Diesel oil-engines of 2500 indicated horsepower, which will drive it at 11 knots. Its dimensions are: length 370 ft., beam 53 ft., depth 30 ft., registered tonnage 4964, and cargo capacity 7400 tons. The vessel has been built by Burmeister & Wain, of Copenhagen, the owners are the East Asiatic Petroleum Co., and the route to be served will be between Copenhagen and Bangkok, with variations at each end acording to requirements. It is stated that the first voyage, which commenced on February 26, will be prolonged to Japan. The small amount of space required for the oil fuel makes it possible to perform a round trip without refilling, and the fuel will naturally be taken aboard in the East, where it is cheapest. There are no funnels, and the exhaust from the engines is carried up the masts. In addition to the main oil-engines there are others which are used for producing the compressed air required for the starting and reversing apparatus and for generating electric current. Practically all the auxiliary machinery on board is driven by electric motors, namely, the ballast, sanitary, and bilge pumps, the refrigerating plant, the winches, windlasses, and steering gear, and the lubricating-oil pumps. A small boiler is provided, burning oil fuel, for the purpose of heating the ship. A sister ship, the *Jutlandia*, similar in every detail, is being built for the same company by Barclay, Curle & Co. of Glasgow. Burmeister & Wain have another ship of the same type and size nearing completion, and also two larger and two smaller ones. During the last few days it has been reported that the East Asiatic Petroleum Co. has given a further order for two 10,000-ton cargo boats of 3000 i.h.p., and that the Swedish Northstar company has placed orders at Copenhagen for two large steamers. It is hardly necessary to say that the success of the Diesel oil-engine for marine and other purposes will have a far-reaching effect in many industries. They will spread the use of the internal-combustion motor in many directions where continuity of running for lengthy periods is an indispensable feature.

In writing a year ago of the performance of the Nundydroog gold mine, belonging to the Kolar group in India, operated by John Taylor & Sons, I mentioned that the year 1910 was a record one as regards yield and profit. The results for 1911 now published show a still further increase in prosperity. The company was originally formed in 1882, but it was not until 1888 that success was won. Since then the output has steadily advanced, except during the years 1898-1910, when the workings passed through a lean zone. During 1911 the stamps crushed 102,873 short tons of ore, yielding 81,629 oz. bullion by amalgamation, and 8544 oz. by cyaniding, making a total of 90,173 oz., worth £339,243. The amount of ore crushed was greater by 952 tons and the value of the yield greater by £4494 than during 1910. The working cost was £140,002, as compared with £153,812. In addition £21,870 was paid as royalties, and £8252 as income tax; £10,000 has been added to the reserve fund, £10,251 written off for depreciation of plant, £14,475 spent on additional machinery, £3820 paid as percentage of profit to the directors and managers, and £50,000 placed to the 'shares appropriation account.' The dividend absorbed £127,350, being at the rate of 45%, as compared with £117,916, and 41⅔% for 1910. During the year, 12,096 ft. of development work was done, and on December 31 the reserve was estimated at 160,559 tons, an increase of 2308 tons during the year. Additional ground has been acquired during the year to the north and west of the old boundaries. The superintendent, C. H. Richards, gives interesting information as to recent discoveries, all pointing to the continuance of the present satisfactory condition of things. The workings are now down 2450 ft. vertical, or 3050 ft. on the lode. This is one of the most interesting as well of the most valuable Indian gold mines, and its prosperity is pleasing.

An unexpected slump in Anglo-Continental shares, from £8 to £5, on March 15, caused a collapse in the Nigerian tin department in London. The general tone, however, of the London share market has improved lately.

General Mining News

ALASKA

JUNEAU

The February report of the Alaska Treadwell G. M. Co. shows a production of free gold and concentrate with a 'realizable value' of $130,051. Operating expenses for the month amounted to $88,392 and construction expenses to $15,064, leaving a net profit, estimated, of $26,595. The yield per ton was $2.11. The stock of broken ore was increased 4562 tons. During the month 1020 ft. of development work was done. The mill crushed 62,020 tons of ore.

COPPER RIVER

The Bonanza copper mine, the Guggenheim property which disbursed $10,000,000 in dividends, shipped 16,000 tons of ore, valued at $3,500,000, in the period for which the dividend was declared, the first nine months of operation, which was commenced last April. The dividend was made possible by the completion of the Copper River & Northwestern railroad.

ARIZONA

PINAL COUNTY

The Ray Con. Copper Co. in February produced 2,140,000 lb. copper, according to its regular monthly report, just issued. The profit for the month was about $95,000. The January production amounted to 2,476,944 lb. copper. During February the company treated 93,794 tons of ore assaying 1.66 to 1.85% copper. The company has sold all of its March copper, it is reported, a large part of the April, and a fair amount of the May output. More than half of the outstanding Ray Central shares have been deposited for exchange for Ray Consolidated, on a basis of eight for one.

CALIFORNIA

INYO COUNTY

The Skidoo Mines Co. in February produced $11,602 in bullion. Development and operation costs amounted to $8724, leaving a net profit for the month of $3078. The mill treated 1350 tons of ore.

A 10-stamp mill has been ordered for the Wilshire Bishop Creek mine from the Traylor Engineering Co. The mill will have 1250-lb. stamps. Gaylord Wilshire is president of the company owning the property. Algernon Del Mar will have charge of the construction of the mill.

NEVADA COUNTY

(Special Correspondence.)—George Scarfe, manager for the South Yuba Water Co., has notified local mining companies not to depend on water for power purposes after June 10. This is due to the exceedingly light rainfall, which is less than half of normal. The Empire Mines Co. will install an electric-power plant.

Grass Valley, March 25.

Jacob and Joseph Weissbein have brought suit in the Superior Court of Yuba county to recover from the Tarr M. Co. *et al* possession of the old Blue Point property, sometimes known as the Paddy Campbell. The defendants include, in addition to the Tarr company, the New Blue Point M. Co. and E. W. Tarr, former president and general manager for the company. The Weissbein brothers years ago secured possession of the Campbell properties on a mortgage, and it is alleged that they were in possession when Paddy Campbell sold the property in question to the New Blue Point company in 1890. The Weissbein brothers are residents of San Francisco.

PLACER COUNTY

Henry Jones, M. Langstaff, and associates have acquired the dredging rights for four miles of river bed along the north fork of the American river, according to advices from Auburn. F. A. Moss and R. H. Young have their shaft at Succor Flat down about 30 ft. They expect to find pay-gravel with a further depth of 60 feet.

SAN BERNARDINO COUNTY

B. J. Bledsoe, judge of the Superior Court, has decided that the F. G. Cottrell device for the electrical precipitation of suspended particles at the California Portland Cement Co.'s plant has met the requirements of his injunction issued a year ago when complaint was made by orange growers in the vicinity that the plant was damaging their orchards. An examination of the groves was made recently by R. E. Swain, of the faculty of Stanford University, and it is stated that his report probably was the basis of the court's decision.

KILNS OF RIVERSIDE PORTLAND CEMENT CO., SHOWING EXPERIMENTAL COTTRELL UNIT AT LEFT AND ERECTION OF PERMANENT EQUIPMENT AT RIGHT.

SHASTA COUNTY

(Special Correspondence.)—The Blue Ledge copper properties, in the extreme northern part of this county, have passed into the hands of La Compania Metalurgica Mexicana, according to records filed with the County Recorder. The new company is organized under the laws of New Jersey. The purchase price is not given, but is said to be large. The Blue Ledge company has expended a large sum in development work. The property has large orebodies of high-grade copper, containing also gold and silver. Much placer and hydraulic mining is going on in the Salmon river and other districts. The recent rains and snow aided the miners to some extent, but the lack of sufficient water will install an electric-power plant.

Yreka, March 24.

Complaint was made to the Mammoth Copper Co. by a committee of the Shasta County Farmers' Protective Association, on March 26, that fumes from the smelter damage crops as far south as Redding and Anderson, particularly after a rain and north wind. When the Balaklala smelter was shut down about a year ago it was thought that the bag-house at the Mammoth smelter would prevent injury to crops from that source, but the ranchers now assert that sufficient protection is not afforded by the bag-house.

The Afterthought Copper Co. is planning the resumption of work at its property, 20 miles east from Redding. The company owns 19 claims, of which 18 are patented. The present corporation succeeded the Great Western Gold Co., which itself was a reorganization of the Afterthought M. Co. T. H. Adams, of Indianapolis, president of the company, with L. A. Townsend, a director, and S. E. Bretherton, manager for the company, recently inspected the hold-

ings. Mr. Adams said that probable construction of the long-planned branch railroad to connect the property and Bella Vista station would be started during the coming summer. The company is planning to add a zinc-ore treating plant to the smelter.

The Noble Electric Steel Co. has resumed operation of its large furnace at Heroult after a shut-down of a month due to relining the furnace. Several additional furnaces will be put in commission this spring. The Bully Hill Copper M. & S. Co. is planning to resume operation at Delamar by treating zinc ore, and a plant for zinc ore treatment may be built soon. The smelter has been closed for 21 months.

TUOLUMNE COUNTY

(Special Correspondence.)—A boring machine has been installed at the Basin mine to prospect the claims owned by the Columbia Basin & Development Co. The Republican mill is completed and several hundred tons of rich ore now awaiting crushing will be placed at once under the stamps. The adit at the McPherson-McCormick claim, near Jacksonville, will be run to the 1500-ft. mark and active work will be started. At the Melones mine, in the Tuttletown district, a great find was made last week on the 1350-ft. level on a vein averaging 20 in. The value of the discovery is estimated at $200,000. The Melones has generally been regarded as a low-grade proposition, though it is situated in a rich pocket district. Work has started in earnest at the Columbus near Tuolumne. Good ore has just been found at the 400-ft. level in the Dreisam mine at Arastraville.

Tuolumne, March 25.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—Warren & Co. have taken a lease on the west Donaldson vein, operation being through the Rockford adit. Shaffer & Co. have taken a lease in the Centurian shaft, work being done between the Rockford and Centurian adits. F. Fransen, manager of the Moon Anchor property, has resumed operation, and shipments will be started soon. The company plans erecting a 25-ton mill during the coming summer. The McKelvey mill is running steadily, with an average of 20 tons of ore per day. A number of improvements are now being made about the plant.

Idaho Springs, March 21.

GILPIN COUNTY

The Ingalls mine, Nevada district, is to be reopened by L. H. Teagarden, according to Central City advices. The property has a 600-ft. shaft. Mr. Teagarden also will reopen the Skelley mine on Quartz hill, near the Illinois and Edinburgh properties. Machinery for both the Ingalls and Skelley mines has been ordered from Denver.

LAKE COUNTY (LEADVILLE)

A new schedule has been offered to zinc shippers, applying particularly to the lower grades of zinc carbonates, with 22% zinc as its basis. It is reported that two zinc-buying companies have bid for the ore. One offers $3 and the other $3.50 per ton for the grade mentioned, with 50c. variation per unit.

The machinery for the Mt. Champion M. Co.'s new mill has been delivered at the property, at the head of Half Moon gulch, after considerable difficulty in transportation owing to the recent snowslides. The equipment includes a set of No. 4 Samson crushers, rolls, tube-mill, and two Deister tables. The capacity will be 75 tons per day, but it is reported that if the mill is successful the capacity will be doubled this summer. Work has been continued through the winter and there is a large amount of ore ready. The new mill on the Helena property will be ready in the near future. The collar of the shaft and the headframe are to be raised 12 ft., and a trestle will be built to the new 50-ton ore-bin at the mill. The Iron-Silver company recently found a new orebody south of the hitherto proved ground. The company in 1911 shipped 46,811 tons of zinc, lead, and iron sulphides, zinc carbonate, and lead carbonate. The Great Eastern is to have an electric hoist. Shortage of cars has resulted in the storing of 1200 tons of ore in the bins of the Ibex mine.

SAN MIGUEL COUNTY

The Colorado Carnotite Co., of Telluride, owning properties in the Paradox Valley district, is making preliminary plans for the erection of a concentrating plant, according to recent reports. The plant will treat carnotite and other uranium and vanadium ore, of which there is said to be large deposits along the Dolores river, in San Miguel and Montrose counties. Interesting photographs taken by exposure to light from carnotite ore only recently were made at Telluride.

TELLER COUNTY (CRIPPLE CREEK)

William Millar and associates of Victor have obtained a three-year lease on the Jennie Sample G. M. Co. property. L. Campbell and associates, lessees on the Mollie Kathleen property, Tenderfoot hill, recently discovered rich ore in a winze sunk from the 100-ft. level. The Stratton estate is erecting an electric hoist at one of the Longfellow shafts, Bull hill.

T. R. Countryman, engineer of the Roosevelt deep-drainage adit, in a report issued March 18, asserts that the work already has paid for itself. On March 9 a heavy flow was developed in the breast of the adit, and the ground continually caved. The flow increased until from this source 5240 gal. of water per minute poured on March 11. On the same day the flow from the portal amounted to 17,500 gal. per minute. The flow since has decreased 1000 to 1500 gal. The total subsidence in the Gold Coin shaft, measured March 17, was 118 ft., showing a fall of eight feet between March 1 and March 18, or a rate of 15 ft. per month. On a basis of $5000 per vertical foot as the cost of lowering the general water-level by pumping, Mr. Countryman estimates that the adit has paid for itself, although its benefit has only just commenced to be evident. His report in detail is as follows:

	Feet.
Total distance from shaft to breast, March 11, 1912..	8,876
Total distance from shaft to breast, March 1, 1912...	8,817
Progress March 1 to 11, 1912.....	59
Total progress since resuming work in Sept. 1911...	1,113
Total length of adit, portal to breast.....	16,857

IDAHO

ADA COUNTY

Dredging operations in the Boise basin are producing $40,000 per month, acording to a report in the *Tribune* of Salt Lake City. The area was first worked by American placer miners in the early days, and later re-worked by the Chinese. The Boston & Idaho Dredging Co. has a large Risdon dredge with a capacity of 2500 cu. yd. per day, on Elk creek, and a 15-ft. Bucyrus dredge. The yield is reported to be 17c. to 50c. per cubic yard.

IDAHO COUNTY

A report from Elk City states that at least five companies are preparing to operate this season in the Dixie placer district. The Central Idaho P. & M. Co., for which J. Hudson Wise is manager, cleaned its ditches last fall and is taking in hydraulic pipe and giants. Its property is in Fourth of July gulch. The Idaho Realty & Power Co. has equipment on the ground for an active season. The company enlarged its ditch last fall. S. R. Gayton is manager for the company. The Salmon River Mines Co. will soon start work on the bars owned by the company. Operation will be by the drag-scraper system, and a complete electric plant has been built to supply power. J. R. Painter is general manager of the property, which is about fifteen miles south of Dixie. Construction of flumes and sluices is now going on at the Lemhi bar, owned by the Adams brothers of Chicago. Walter Cook is manager of the property. Several other bars along the Salmon river are being considered by capitalists, it is reported.

MONTANA

Lincoln County

(Special Correspondence.) The Libby Placer Co.'s hydraulic plant on Libby creek, which was built last year, is to be started early in April and will be operated throughout the season, according to John P. Wall, attorney for the company here. It was completed only a short time before winter set in, but was operated during the few weeks that the weather permitted. Then work was suspended until this spring. The company is the largest corporation engaged in placer mining in the Libby district, and owns about 1000 acres of gold-bearing ground on Libby creek. The corporation is composed largely of Butte men, headed by P. J. Brophy.

Libby, March 23.

Madison County

The placer mining season will soon open in Alder gulch, if the weather of the past few weeks continues. There is an abundance of water. The Shafter mill at Virginia City is about to be started on ore from the Nelson mine. S. H. Ribbel is manager of the mine for lessees.

NEVADA

Clark County

The Searchlight-Spokane mill has been placed in operation and is treating ore from the Princess property. Milton McKee is superintendent of the mill, which is operated by electricity.

Humboldt County

Charles Ray has found a good vein of gold ore on his claim near Lovelocks.

Lincoln County

The Home Run Copper Co. has been incorporated with a capitalization of $100,000 in 1,000,000 shares. The new company owns eight claims adjoining the Day-Bristol Con. M. Co.'s property in the Jackrabbit district. M. C. Godbe is president of the company, E. S. Woodward vice-president, and H. F. Earle secretary and treasurer.

Nye County

The Tonopah Extension M. Co. has started sinking a new shaft on its O. K. claim, 1600 ft. west of the present working shaft, and will carry it to a depth of 1000 ft., according to present plans. The present two-compartment shaft is inadequate for the mill, it is said.

The production of the Tonopah district for the week ended March 23 is summarized as follows by the *Tonopah Miner*: "The Tonopah Mining Co. sent 3350 tons, the Belmont company 2250 tons, the Montana-Tonopah 1029 tons, the Tonopah Extension 1085 tons, the West End 638 tons, and shipped 75 tons to the smelter, the MacNamara 440 tons, making the total production for the week 8867 tons, the estimated value being $221,675."

The Big Four is about to build a mill, according to an announcement by L. K. Koontz, president of the corporation. The first unit is to have ten stamps, and a capacity of 50 tons of ore per day. Friction within the War Eagle M. & M. Co. has culminated in the levying of two attachments, one for about $25,000 and the other for $3600, on the mill and other property of the company. The first is on an alleged promissory note, held by W. C. Lamb, and the second is on claims of the Wittenberg Warehouse & Transfer Company.

Storey County (Comstock Lode)

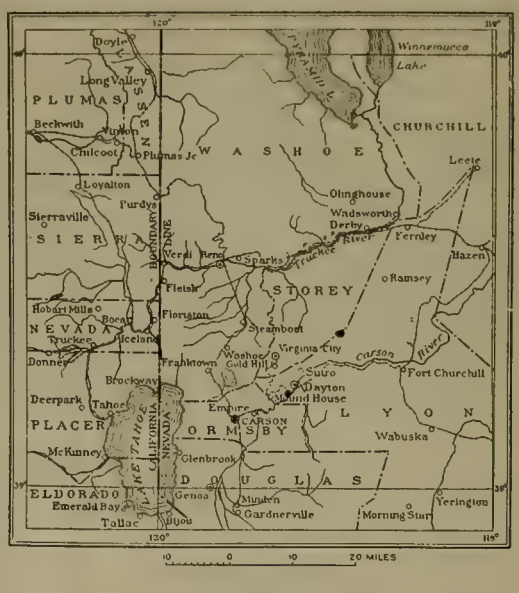
The report of C. H. Fish, superintendent for the Con. Virginia M. Co. for the year ended February 29, shows that during that period 3077 tons of ore was produced. The previous report stated that 552 tons was in process of reduction, and with this the total amount of ore treated during the year in the Sutro mill was 3629 tons. There is on hand in the bins 12 tons of ore assaying about $94 per ton, and 189 tons assaying about $24 per ton. On March 1 the designation of levels in the mine was changed to conform to the system used in the Mexican, Ophir, Union Con., and Sierra Nevada mines.

Operation is to be resumed soon on the Clermont Con. G. & S. Co. property, in the Flowery district, east of the Comstock. L. J. Murphy was elected president of the company at the annual meeting recently held. J. D. Moore is superintendent of the property. The main shaft is down 110 feet.

For the week ended March 23, work in the Ophir was confined principally to the 2100-ft. level. The total production for the week was 192 tons averaging $27.80. Along with the usual repair work, the Con. Virginia mine produced 43 tons of ore averaging $23.97. The usual repair work was done in the Union. The Mexican mill ran 67% of the time and treated 404 tons of ore, of which the gross assay value was $9817. The Crown Point produced 252 cars of ore, averaging $6.17 per ton. The Comstock Pumping Association report for the week shows that the water on Saturday stood about 295 ft. below the 2300-ft. level.

Washoe County

Press reports state that James Secoy, owner of the Nar-



PART OF NEVADA AND CALIFORNIA.

ragansett group of claims, has discovered the source of rich float found on that property, which is a few miles to the north of Reno. The discovery was made in a shaft now being sunk by Secoy, at a depth of 56 ft. One assay of the ore is reported to have shown 300 oz. silver and 1 oz. gold per ton.

White Pine County

The Giroux Con. Mines Co. is now hoisting ore from the Bunker Hill shaft, and in a few weeks should begin steady shipment to the Steptoe concentrator at McGill. Retimbering is being done in the lower workings of the Bunker Hill. Pumping for one hour per day is sufficient to remove the water in the sump. At the Morris the four boilers have been bricked in, and pipe connections are being made. The two large hoists for the skips are in place, but have not been connected. A smaller hoist will operate the cage in the third compartment of the shaft. Much heavy work remains to be done in building the ore-bins.

The Veteran is shipping about 1100 tons of ore per day. The ore is taken from the 400-ft. level, where the caving system is being used. The company has about 325 on the payroll.

NEW MEXICO

Grant County

George Utter is reported to be planning additions to his zinc concentrating plant near Silver City. He recently shipped a carload of concentrate to Oklahoma. The Chloride Flat M. Co. is making regular shipments of silver ore to the El Paso smelter.

UTAH

Beaver County

Work has been resumed at the Moscow property. Development is being concentrated on the new ground recently acquired. The [illegible] M. Co., of [illegible], has been organized to develop two claims adjoining the [illegible] M. Co.'s property. J. L. [illegible] is president of the new company.

Juab County (Tintic District)

The [illegible] M. & M. Co. is about to sink a new shaft on its property at Mammoth. It is intended to sink the shaft about 300 ft. before opening a station. The new shaft is to be situated on the [illegible] from the [illegible] adit, about 2700 ft. from the portal. James Fitzgerald is in charge of the work.

The Eagle & Blue Bell shaft has almost reached the 1400-ft. level, and by the close of next month William Owens, superintendent of the property, believes the 1400-ft. level will be reached. About a carload of ore per day is being shipped, while shaft-sinking is in progress.

Salt Lake County

The Utah-Apex earned during the six months ended February 29 a net profit of $[illegible].

An adit for drainage, development, and transportation is to be driven on the Maxfield property, Big Cottonwood district. The water from drainage is to be used to generate power. It is reported that the [illegible], Maxfield, and Big Cottonwood [illegible] properties are under option to the people planning the new adit.

The Bingham-New Haven Copper & Gold M. Co. has paid its customary dividend of [illegible] per share. The company is shipping about 200 tons of ore per day to the A. S. & R. Co.'s plant at Garfield. The ore assays [illegible] copper and about $[illegible] per ton gold, according to a Salt Lake report. Stock issued amounts to [illegible] shares.

Tooele County

The second lead furnace of the International S. & R. Co. has been blown in, according to a recent report from Salt Lake City. About 800 tons of ore per day is being treated in the company's three copper reverberatories.

WASHINGTON

Okanogan County

Operation has been resumed at the [illegible] mill at [illegible], after a shut-down of several months. The [illegible], in the same district, will resume in a short time. F. J. [illegible], of [illegible], Massachusetts, representing the bondholders of the corporation, acquired the assets of the [illegible] Mountain Tunnel Co., at Loomis, at a receiver's sale in Spokane, for $[illegible], and will continue the development work, according to recent reports.

Spokane County

Frank B. [illegible], chairman of the mining committee of the Spokane Chamber of Commerce, has announced that the [illegible] question will be the keynote of the annual meeting of the American Mining Congress at Spokane in November. Delegates of Washington, Oregon, California, Nevada, Arizona, New Mexico, Texas, [illegible], Utah, Colorado, Wyoming, Montana, the Dakotas, Minnesota and other states will be invited to participate in the discussions. J. F. Callbreath, secretary of the Mining Congress, will visit Spokane in [illegible].

J. F. Callbreath, secretary of the American Mining Congress, sent a telegram from Washington to the Spokane Chamber of Commerce:

"Your invitation to hold at Spokane the [illegible] session of the American Mining Congress has been accepted by the [illegible] of the directors of the congress. The congress will convene at Spokane during the week of November 18, unless you prefer some other date."

The Northwest [illegible] of Mines, recently organized at Spokane with William A. [illegible] as president, and the Spokane Mining Men's Club, headed by L. K. Armstrong, will cooperate with the Chamber of Commerce.

CANADA

British Columbia

The Hedley G. M. Co. has declared a quarterly dividend of 3%, and an extra dividend of 2%, payable March 30 to stockholders of record March 20. The company is about to commence treatment of the contents of its slime pond, in which lies the accumulation of about six years.

It is reported that $[illegible] will be expended by the Northern Anthracite Syndicate, recently organized by Andrew Laidlaw, of Spokane, Washington, in developing 12,800 acres of coal lands in the Groundhog Mountain district, 150 miles north of Hazelton. The work, which will occupy three years, will include building a railroad from the forks of the Skeena and Stikine rivers to the mouth of the Nass river and [illegible], and bunkers on the Pacific coast. Surveys will be made this spring.

Ontario

Special Correspondence.—In the Porcupine district properties in the prospect stage are proceeding with development, while the unproved properties are marking time or waiting idly until success or failure of the large properties is definitely decided. The Rea, under the management of O. H. Bergstrom, is being developed as rapidly as possible, the main shaft having been continued to the 300-ft. level. Cross-cutting has been started to reach the orebody at that depth. At the Hollinger the usual development is being carried on. Mill construction is being rushed. The McEnaney management is sinking the shaft on the No. 2 vein to the 300-ft. level to prospect the orebody at that depth. The No. 2 vein has shown free gold in numerous places. Four diamond-drill holes have been put in from the 100-ft. level, cutting the vein at 150 and 180 ft., proving an orebody 2½ to 4 ft. wide. The cores show ore assaying $10 to $30 per ton, the average assay being $20.

The Porcupine Gold Vipond management is pushing development and has the excavating for the mill foundation almost completed. The stamps at the Dome will begin dropping on March 22 and the new mill is doing excellent work. The opening of the mill will be celebrated by a large banquet, for which many invitations were sent out, and a large attendance is expected.

Porcupine, March 23.

Yukon

Prospectors in the Sixtymile district are preparing to work, according to T. D. [illegible], Government inspector, who has returned to Dawson from a trip to the district. He stated that considerable prospecting had been done on [illegible], Christmas, [illegible], [illegible], [illegible], [illegible], [illegible], Nettie, and Pine creeks as well as along Sixtymile. In the last district he stated that, excepting [illegible] and No. 1 Below, the total gold recovery would not exceed 15 cents, although [illegible] shafts had been sunk to bedrock, which was of soft schist.

The Yukon Gold Co. in 1911, by its dredge and hydraulic operations, produced $[illegible], as against $[illegible] in 1910, an increase of $[illegible]. The gross hydraulic production amounted to $[illegible], as against $[illegible] in the preceding year. The decrease is attributed to the fact that [illegible]. The production by dredging totaled $[illegible] gross gold, an increase of $[illegible] over the production in 1910. Two dredges were [illegible] during the year, making an equipment of [illegible]. The total yardage was increased by [illegible] cu. yd., as the company acquired a number of claims by purchase and working agreements. Dredge operation was started three weeks earlier than in the preceding year, and during the season [illegible] cu. yd. of gravel, averaging [illegible], was handled. In 1910 only [illegible] cu. yd. was handled, which averaged [illegible] per cubic yard. Costs increased from [illegible] to [illegible], the net yield being [illegible], as compared with [illegible] in 1910. Hydraulic operations handled [illegible] cu. yd. of gravel, a [illegible] increase for the season. Despite unusually low water during the latter part of the season, a cost record of [illegible] was made for the

year, the lowest in the company's history. The company reports an increase of $4253 in the surplus, bringing it to $486,654. For depreciation $451,108 was written off, an increase over the preceding year of $145,409.

MEXICO

While the revolution has interfered with much foreign commercial activity and with many mining ventures, according to late press advices, not all the properties are affected by the internal political troubles of the country. The A. S. & R. Co. smelter at Aguascalientes is in operation, although interruptions in the train service have stopped ore shipments from the north. If the San Luis division of the National Railways is put out of commission, however, the smelter will be able to run only a week or so. The La Dura M. & M. Co. property, in Sonora, is still in operation, and the usual production is being maintained, according to late reports. According to good authority, the Compagnie du Boleo, in Baja California, is operating as usual. The West Mexican Mines, Ltd., of Guadalupe y Calvo, mill has been shut down, but those in charge are not alarmed at the outlook. Most of the Parral district properties are being operated.

WESTERN AUSTRALIA

(Special Correspondence.)—On February 10 a cyclone did a great deal of damage in this town and around the mines. The Power company's mains are down, and the Boulder, Kalgurli, South Kalgurli, Perseverance, Lake View & Star, and Oroya Links mines are temporarily almost at a standstill. January was excessively warm. The temperature rose to over 109° on the 29th, and on eight days in the month 100° or over was registered. On February 1 the mercury rose to over 111 degrees.

Kalgoorlie, February 10.

Among the Copper Mines

The Elmore vacuum plant at the SULITJELMA company's mines, Norway, during February produced 876 tons of copper concentrate.

UTAH CON. in February produced 16,000 tons of ore, which exceeds the 1911 average monthly production by 2000 tons, according to a report from Salt Lake City.

The MIAMI COPPER CO. produced 983,500 lb. copper in the ten days ended March 20, as against 594,140 lb. in the first ten days of the month. It is believed that when the machinery gets into good working order the concentrator can turn out more than 3,000,000 lb. of copper per month. The sixth unit was put in operation at the end of February.

THEODORE PHILLIPS has discovered a large deposit of ore resembling in appearance that of the Ray property on land situated at Christmas, Gila county, Arizona, according to recent press despatches. The A. S. & R. Co. is reported to have secured options on every promising claim between Hayden and Troy. The options cover all claims around Christmas excepting the Christmas mine and the claims held by Phillips.

The A. S. & R. Co., according to a New York report in the *Boston News Bureau*, in the year ended December 31, earned, before deductions, more than $6,000,000. This includes the Smelters' equity in the earnings of the American Smelters Securities on its common stock, now all owned by the A. S. & R. Co. The Smelters' earnings on its common stock, after deductions, will show about $4,500,000, including the equity in the Smelters Securities common stock.

The RAY CON. COPPER CO.'S annual report shows the following assets on December 31: Property, $7,903,383; expenditures, additions, construction, equipment, and development, $6,716,119; deferred charges to future income, $22,742; cash in banks, $59,813; equity in copper in transit, $778,256; supplies, $450,950; accounts receivable, $81,643; treasury stock, $500; outside investments, $1,025,000; total, $17,038,409. Liabilities: capital stock, $11,991,750; first mortgage bonds, $3,000,000; accounts payable, $950,000; freight and treatment, $294,918; deferred liabilities, $75,200; surplus from sale of securities, $259,137; undivided profits, $208,640; total, $17,038,409.

ALTOGETHER 44,736,617 lb. of copper, valued at $10,275,767, was exported from Japan to various foreign countries during 1911, the figures showing a decrease of 1,612,802 lb. and $412,329, as against 46,349,266 lb. and $10,558,097 for the previous year. The decrease is attributed to the accumulation of stocks in the European and American markets, consequent upon the economic inactivity abroad. Of the total export, copper ingots and bullion were exported to the extent of 44,079,564 lb., valued at $10,006,290; copper sheets to the extent of 352,864 lb., valued at $96,628, and copper wire to the extent of 304,188 lb., valued at $78,849.—*Japan Times.*

Goldfield Consolidated Report

The total production of the Goldfield Consolidated Mines Co. during February 1912 was 27,641 tons of ore, containing $740,793, or an average of $26.80 per ton. The whole was milled with an average extraction of $25.08 per ton, or 93.57%. The total net realization was $487,262, or $17.64 per ton. During the month, 2869 ft. of development work was performed. The total cost of mining, development, milling, office and general expense was $7.47 per ton, distributed as follows:

Mining:		
Development	$0.96	
Stoping	2.62	
		$3.58
Transportation		0.09
Milling		2.19
Marketing		0.33
General expenses		0.48
Bullion Tax		0.26
Construction		0.54
Total cost of operation		$7.47
Miscellaneous earnings		0.03
Net cost per ton		$7.44

The sill of the 428 stope in the Clermont, being cut from the 466-intermediate between the 650 and 750-ft. levels, was considerably extended, and produced 561 tons of ore averaging $48.57. The 604-raise from the 1000-ft. level rising up toward the 534 on the south end of the 900-ft. level produced 472 tons of ore averaging $93. The 3-E sill on the 150-ft. level in the Mohawk near the old Sheets-Ish workings, was again extended and produced 59 tons of ore averaging $17.57. The 3-D sill on the same level is being extended along the south end of the old Sheets-Ish workings, and produced 70 tons of ore averaging $70.27. The No. 29 drift, being cut around the 3-E stope in the foot-wall, has found the extension of the 3-E ore, and produced 30 tons of ore averaging $15.30. The 111-M sill was considerably extended, and produced 854 tons of ore averaging $14.67. The 415-X cross-cut from the 491-intermediate, between the 450 and 600-ft. levels, produced 198 tons of ore averaging $41.13. The 491-sill, being cut from the 415-X, has produced 111 tons of ore averaging $23.35. The 353-intermediate of the Red Top, between the second and third levels, just north of the shaft, has been extended, and produced 90 tons of ore averaging $41.34. Work through the Red Top shaft has been discontinued, the Laguna surface plant and shaft now serving both mines. The 292-O sill, being cut from the 295-X cross-cut on the fourth level, south and west of the Hampton stope, in the Combination, produced 138 tons of ore averaging $20.87.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

C. W. MERRILL is at Porcupine.

L. A. GREENE has gone to Chicago.

HOWARD D. SMITH is in New York.

O. MCCRANEY is at Tonopah, Nevada.

FRED L. LOWELL has gone to Amador City.

JEROME B. LANDFIELD is in San Francisco.

H. W. HARDINGE is examining mines in Arizona.

GELASIO CAETANI has gone to Telluride, Colorado.

FRED SIEBERT was in San Francisco during the week.

MALCOLM MACLAREN has left San Francisco for London.

CHARLES JANIN sails today from New York for London.

T. A. RICKARD will leave for Denver on Tuesday morning.

A. K. SCHELLINGER has gone to Dawson, Yukon Territory.

GEORGE H. GARREY has returned to New York from Mexico.

JOHN B. FARISH was in San Francisco and has gone to Denver.

C. T. HUTCHINSON and T. A. RICKARD visited Coalinga this week.

K. P. SWENSEN has accepted a position with F. W. HORNE at Yokohama.

S. P. MACKNIGHT has moved from Kingman, Arizona, to Randsburg, California.

GEORGE T. COFFEY and C. A. THOMAS are leaving for Dawson, Yukon Territory.

FRANCIS DRAKE has gone to Rhodesia as consulting engineer for Lewis & Marks.

F. M. SIMPSON has returned to Berkeley from San Jose de Gracia, Sinaloa, Mexico.

ENRIQUE VALLÉ is in charge at the Santa Catarina mines at Taviche, Oaxaca, Mexico.

PAUL MESSER and MRS. MESSER are expected in San Francisco from Yokohama in May.

G. A. SWANQUIST has left Salvador, Central America, and is now at Cripple Creek, Colorado.

A. C. FRENCH is in charge of the development for the Lost Josephine Mining Co., near Provo, Utah.

A. M. HARRIS has succeeded A. B. STROCK as superintendent for the Marysville Gold Dredge Co., at Marigold, California.

C. H. HOLLOWELL has resigned as superintendent of the Millerette mill at Gowganda, Ontario, to take charge of the Powerful mine, at the same place.

HENRY B. KARDING is on his way to New York from Bluefields, Nicaragua, and should be addressed in care of the American Institute of Mining Engineers.

NORMAN C. STINES returned to Nikolaievsk late in February from a 600-mile journey down the Amur, and expects to leave just before the breaking up of ice travel.

J. M. CALLOW, consulting mill engineer for the Inspiration Copper Co., has returned to Salt Lake City after four months absence on professional work in connection with the new mill.

N. P. TURNER has resigned his position as chief engineer of the Cuba railroad. In association with L. D. MOORE, of New York, he will take up mining and general engineering and exploration in the West Indies, Central and South America, with headquarters for the present at Hotel Camagüey, Camagüey, Cuba.

'SMELTOR' has sent us an interesting letter which we will be glad to publish if he will furnish us with his name and address. Anonymous contributions will not be published under any circumstances.

Market Reports

LOCAL METAL PRICES

San Francisco March 28.

Antimony	11—11½c	Quicksilver (flask)	45.50
Electrolytic Copper	16—16½c	Tin	47—48½c
Pig Lead	4.45—5.40c	Spelter	7¼—7½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

Average daily prices in cents per pound, based on wholesale transactions, standard brands.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Mar. 21	14.75	4.20	6.35	58¼
" 22	14.85	4.20	6.35	58¼
" 23	14.98	4.20	6.35	58¼
" 24	Sunday.	No market.		
" 25	15.15	4.20	6.35	58¼
" 26	15.28	4.20	6.35	58¼
" 27	15.34	4.20	6.35	58¼

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, Mar. 28.		Closing Prices Mar. 28.
Adventure	5½	Mohawk	$ 6 ¼
Allouez	46	North Butte	33½
Calumet & Arizona	72	Old Dominion	53½
Calumet & Hecla	465	Osceola	116
Centennial	20½	Quincy	83
Copper Range	62½	Shannon	14½
Daly West	7	Superior & Boston	3½
Franklin	14½	Tamarack	29
Granby	40½	Trinity	6
Greene Cananea, ctf.	9½	Utah Con	19½
Isle-Royale	27½	Victoria	[illegible]
La Salle	5½	Winona	6½
Mass Copper	7½	Wolverine	112

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, March 28.

Atlanta	$ .28	Mayflower	$ .0[illegible]
Belcher	.75	Mexican	3.40
Belmont	10.10	Midway	.41
B. & B.	.22	Montana-Tonopah	3.00
Booth	.11	Nevada Hills	2.45
Challenge	.16	Ophir	1.45
Combination Fraction	.21	Pittsburg Silver Peak	1.32
Con. Virginia	.77	Round Mountain	[illegible]
Florence	.85	Savage	.36
Goldfield Con.	4.75	Tonopah Extension	1.97
Gould & Curry	.06	Tonopah of Nevada	7.95
Jim Butler	.67	Union	1.05
Jumbo Extension	.45	Vernal	.17
MacNamara	.25	West End	2.70

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, March 28.

Associated Oil	$45.25	Peerless	$ 4.50
Brookshire	.60	Pinal	4.25
Caribou New Stock	1.25	Premier	.58
Claremont	[illegible]	P. S. Petroleum	[illegible]
Coalinga National	.15	Republic	.35
Con. Midway	.02	Silver Tip	.90
Empire	1.07	Sterling	1.47
Enos	.03	S. W. & B.	.20
Maricopa 36	.51	Turner	.80
Midway Premier	.30	Union	98.00
Monte Cristo	1.32	United Oil	.32
Palmer	.64	W. K. Oil	2.10

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. Mar. 28.		Closing Prices. Mar. 28.
Amalgamated Copper	$ 79½	Miami Copper	$ 26
A. S. & R. Co.	85	Mines Co. of America	3½
Braden Copper	5½	Nevada Con	20½
B. C. Copper Co	5½	Nipissing	8½
Camp Bird Ltd	7½	Ohio Copper	1½
Chino	28½	Orville Dredging	11/16
El Oro	4½	Ray Con	19
Esperanza	8½	Santa Gertrudis	7½
First National	2½	Tenn. Copper	40
Giroux	7½	Tomboy	4½
Goldfield Con.	4½	Tonopah Belmont	10
Greene-Cananea	9½	Tonopah Ex.	1½
Hollinger	11½	Tonopah Mining	8½
Inspiration	20	Trinity	6
Kerr Lake	2½	Tuolumne Copper	4
La Rose	8	Utah Copper	60½
Mason Valley	12½	West End	2½
McKinley-Darragh	1½	Yukon Gold	3½

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TABLE OF CONTENTS

EDITORIAL

COPPER continues to advance in price in spite of industrial and political disturbances, both at home and abroad, and many of the larger companies are increasing their dividend rate.

LETTERS to the editor are always a source of interest, but are sometimes cause for astonishment. One such, recently received, contains a request for "the names of the mineral mines in operation in the United States, Mexico, and South America; also the addresses of their superintendents."

ATTEMPTS to minimize the effects of the gases and fume emitted by smelting plants are of great importance on the Pacific coast, and we are glad to present this week an account of the results so far obtained with the Thiogen process at the smelter of the Penn Mining Company at Campo Seco.

THE second annual meeting of the Pacific Association of Scientific Societies was held at Stanford University this week, and members of twelve learned societies have been in attendance. The Cordilleran section of the Geological Society of America held its meeting on Friday and a notable list of papers was presented.

VEINS and their structure offers many puzzling geological problems, and some unusual features of the remarkable crenulated veins of the Nova Scotia gold deposits are interestingly discussed by Mr. T. A. Rickard, in a contribution to the Canadian Mining Institute, of which a portion appears in this issue.

A MEDAL of honor was presented Mr. Robert E. Peary by the Peary Arctic Club on Friday, in commemoration of the third anniversary of the reaching of the north pole. It is interesting that though the north pole baffled the attempts of explorers for a long period the south pole was attained after but a brief period of effort.

PREPARATIONS are well under way for the eighth International Congress of Applied Chemistry, which is to be held in Washington, D. C., during September next, and the titles of a hundred papers to be presented have been announced. No effort is being spared to make this a notable event in the world of chemical engineering.

COAL in British Columbia is a source of interest just now. Spokane investors are reported to be about to expend $12,000,000 in the Groundhog Mountain district, while Montreal and Toronto capitalists are similarly interested in coal lands on Vancouver island. The Pacific coast, which until the advent of fuel oil was but inadequately supplied with fuel, now seems likely to have an abundance.

APPOINTMENT of Mr. Talcott Williams, associate editor of the Philadelphia *Press*, to the head of the newly constituted school of journalism at Columbia University meets with general approval. An untilled field lies before his plow, and an opportunity to exert a widespread

influence that will surely not be allowed to escape. When daily journalism shall have been made worthy of respect we shall hope to see technical journalism rendered worthy of honor.

VENTILATION problems are not peculiar to mines, and the modern development of subways has brought them to the fore in acute form. Both in New York and London it has been found difficult to secure a proper circulation of fresh air, and the necessities of construction to facilitate speed of operation often militate against proper circulation of air currents, which are also disturbed by the erratic movements of the trains through the 'tube.' Attempts have been made to supplement ordinary ventilation by fans, and 80,000,000 cubic feet of air is driven daily into the London underground system. But with 'workings' of so great extent and with so numerous connections with the surface it is hard to control the air currents, while the 'dead' odor which is noticeable but not objectionable in mines is a cause of much protest on the part of the underground traveler.

BEWILDERMENT is the usual outcome when the average man attempts to grasp the intricacies of foreign exchange, and the American drawing on a letter of credit abroad often has little first-hand knowledge as to whether he has been justly dealt with or not. When a concrete problem is so puzzling, it is not remarkable that an apparently interminable discussion wages over the question as to whether the increase in the production of gold is the direct cause of increase of commodity prices or not. The argument that commodities are cheaper in New York than along the Yukon is not so convincing upon close examination as on first view. The stock of gold in the world is so small in comparison with the amount of business done, and the latter varies so greatly and independently of changes in the former, that it is evident that the relation between them is not a simple one. Mr. Irving Fisher has worked out a mathematical formula showing that prices depend on the volume of trade, the amount of money in circulation, its circulating velocity, and the amount of bank deposits and their activity; but this is only true in general, and disquieting variations occur. Where the shoe pinches is in faulty adjustment to conditions, as conditions change in the evolution of industry.

LOOSENESS of specifications is often responsible for much dissatisfaction in construction work. In a letter to the editor of *The Cement Age*, Mr. Leslie H. Allen cites the case of a firm which furnished an estimate upon a $200,000 reinforced concrete building in competition with five other firms, after having devoted the entire time of one man for two weeks, and a second one for one week, to making estimates, and having secured bids from eighty subcontractors. The cost of this must fall upon the ultimate consumer, the firm which lets the contract, and in the final analysis it must pay five firms to do work a large part of which should have been done by the one asking bids. When the specifications are loose the bidder must either employ the time of his own staff to fill the gaps or must make ample allowance for contingencies, with the result that the bid is larger than it otherwise would have been. The members of the English Master Builders Association refuse to bid on work costing over £1000, unless quantities are supplied to bid upon. Even this is not entirely satisfactory, for the methods and results of estimating quantities vary greatly, according to the personal equation of the engineer. Nevertheless, this is an enormous advance over the practice of some mining companies in calling for bids; the story is told of the successful business man, who, in his newly assumed rôle of manager of a mining enterprise, told his friend and club-mate, "Joe, I want you to build me a good mill." Needless to say, the ensuing transactions were satisfactory to neither side. The prevention of unnecessary waste is now the order of the day, and may well exhibit itself in the prevention of unnecessary and useless effort.

MUCH interest has been aroused by the reports which have appeared in the daily press concerning High Grade, as the Hogue mining district in Modoc county, California, has been rechristened. The mining centre is about eight miles from New Pine Creek, a station on the Northern California & Oregon railroad, but some of the prospects are in Lake county, Oregon, as the district adjoins both that state and Nevada. There is good reason to believe that the excitement is the artificial product of speculators and promotors who wish to dispose of their holdings, as, on the authority of an engineer who is thoroughly familiar with the district, we are informed that there are only three properties which so far merit attention: the Sunshine, Consolidated, and Big Four. Small and erratic rich streaks of ore occur in brecciated andesite, and the low-grade ores are not developed sufficiently to allow any accurate judgment of their possibilities. As the district lies at an elevation of 8000 feet and snow covers the ground from November to June, the early prospector is likely to reap only disappointment.

Primitive Metallurgical Methods

Primitive methods are always interesting, since they give direct evidence of the development of art and industry, and are no less useful, since they often afford hints as to possible makeshifts when the regular conduct of work on a more elaborate scale is interrupted by unfavorable conditions. For this reason the discussion of the early history of cupellation, presented in this issue, will interest many of our readers. The importance of early vague references to a topic is apt to be exaggerated, however, since the translator reads the words of the ancients in the light of present knowledge; so that, like the poetry of Browning, the content of the text is measured by the concepts of the reader. This is especially true of the references to mining topics in the poetical Book of Job, which, as Dr. R. W. Raymond pointed out in the *Mining and Scientific Press* of April 7, 1906, though ostensibly describing a state of knowledge pertaining to a much earlier period, cannot with authority be taken as portraying a period any earlier than 750 B. C. The generally accepted belief that cupellation was first practised at the mines of Greece and the Mediterranean provinces is probably not an incorrect one, at least so far as Mediterranean civilization is concerned. That in early times silver was much more difficult to obtain than gold, as it occurs less commonly in the metallic form, is shown in its less general employment for objects of use and adornment. King Menes, who is supposed to have ruled Egypt in the 38th century B. C., fixed the ratio of exchange at two and one-half of gold to one of silver, and silver remained more valuable than gold until 2000 B. C. Early in the development of Indian and Chinese civilizations silver was adopted as the medium of exchange, and the extensive silver-lead mines of the Shan states are known to have been worked in very early times. How early will doubtless never be known, as the writing materials of the Chinese are not well adapted to the preservation of ancient records, and the use of inscriptions upon stone as a method of preserving records seems never to have occurred to these ingenious people until after the destruction of the books of the period by Imperial command in 210 B.C. It would not be re-

markable, however, if the invention of cupellation were due to early workers of the deposits of the Shan states, since cupellation is there necessary to obtain the silver. The Far East is still the place in which to observe the operation of primitive methods, and numerous writers in recent years have described the methods employed by the natives of western China for the manufacture of cast and wrought iron, and in southwestern China in producing copper, tin, zinc, quicksilver, and antimony from their ores. Primitive methods may be seen in the Philippines, but are doubtless ascribable to early Spanish influence, while the intensely interesting methods formerly followed in Japan, especially for the production of copper, were perhaps not entirely free from Dutch influence. The early metallurgist was not a prominent member of society and failed to get his name into the 'Who's Who' of the day, so that historical research on metallurgical topics is commonly hampered by lack of records and results are indefinite and inconclusive.

Mexico and Intervention

Conditions in Mexico continue to be so disturbed as to make impossible any accurate forecast of the outcome. The 'Liberal' army, under leadership of Pascual Orozco, dominates the situation in Chihuahua and has gained recent advantages over the federal troops sent against them by the Madero government. In the south Emiliano Zapato has not only maintained himself but has extended his authority over several states. Recently one of his officers demanded the surrender of Puebla. Both Zapata and Orozco are supposed to be acting in behalf of Vasquez Gomez, who, from a secure position at San Antonio, Texas, issues, from time to time, addresses and pronunciamientos. It is by no means certain that there is a real bond between the leaders of the various factions of discontent, and it is widely believed that success of this re-revolution would but lead to disagreements and further revolts. In the meantime, over much of Mexico local authorities are left to their own devices. The results are good when strong able men are in office, and bad where weak or cowardly men have happened to be in power; which indicates that human nature in Mexico is much like it is in other parts of the world. A recent traveler through Jalisco states that conditions there border on anarchy in that there is no recognized authority. It is not surprising that robbery and open brigandage are rife. It is rather notable instead that there have been few murders and that in many parts of the country, and especially in the cities, life goes on much as usual. Most of the larger mines and many of the other industries continue operations, though train service is irregular on many lines and labor shortage is felt at many points. Work on the Conchos river dam at Boquilla has gone forward steadily with plenty of labor and has only been hindered by irregular receipt of supplies. The Aguas Calientes smelter is running, though some regular sources of ore-supply have been closed. Friends in Sonora state that aside from occasional visits from "horseback hoboes" they have suffered no interference.

The outlook for settled conditions is undeniably gloomy, and the interference with business, native and foreign, is serious. Persistent efforts are being made to embroil the United States with Mexico, and intervention has been called for by many. No self-respecting government can or will permit its citizens in foreign countries to be subjected to needless indignity, loss, or danger, and with the large number of Americans in Mexico and our extensive interests in that country, there is inevitably much danger of rupture of friendly relations if conditions long remain so disturbed. The people and the governments of the two countries have been conspicuously friendly through many years. In the time of Maximilian the good offices of the United States were freely exerted in behalf of the Mexican people and the pressure exerted on Napoleon III by the Washington Government was an important factor in the re-establishment of the Mexican Republic. Speaking generally, there is but one wish north of the international boundary line, and that is to see a strong, stable, republican government in Mexico. Intervention in any form would be as unpopular in the United States as in Mexico. There is no danger of it occurring except through a rush of popular feeling following some great disaster, accidental or designed. It is widely believed in the United States that the *Maine* was blown up to inflame public opinion and force intervention in Cuba, and it has recently been made a matter of court record that a faction in the United States does not hesitate to dynamite buildings and kill innocent people in the conduct of a labor war. There is in many parts of Mexico a slumbering hatred of Americans, a feeling not unnatural when all circumstances are taken into account, and this is an element of danger. It is also true that, along with the many high-minded and honorable Americans in Mexico, there are those of whom the country is not proud, and here is a second element of danger. Unpopular as is all thought of intervention, a riot, such as has frequently occurred in many of our own states, coming at this time, might easily inflame popular opinion to a point beyond control, since no one supposes the United States would tamely submit to any number of its citizens being killed or jeopardized. Americans in Mexico are in the same position as Italians in the United States. They are entitled to the full measure of protection that the local government can give. Neither is entitled to more, and until the *de facto* government of Mexico fails to protect foreigners as well as it protects its own citizens, no foreign government has just cause for complaint. Hardships, loss, and danger come to all, native and foreigners, who reside in a country in time of civil war. It was true in the United States in 1861 to 1865, and is true now in Mexico. We regret it keenly. Many of our personal friends are, in this instance threatened, but Mexico belongs to the Mexicans and they are entitled to settle their affairs in their own way. If the world was patient with us for four years during which our civil war caused the greatest distress in England and much loss in France, we hardly can complain of the Mexicans in the present instance.

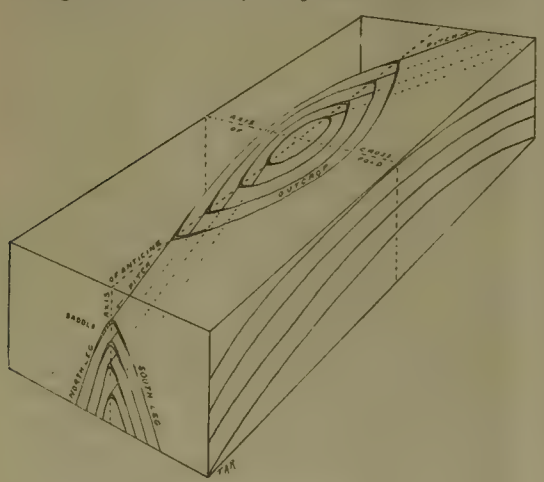
Francisco I. Madero is president of Mexico by the same sort of title as was held for so many years by Porfirio Diaz. If the Mexican people desire to make a change that is their right, and it is not our duty even to see that they abide by rules they have themselves laid down. The great majority of the Mexican people wish for peace and stable government as ardently as we can wish it for them. It is one of the unfortunate results of the, in many particulars, excellent regimen established by Diaz that the people as a whole have not come to think of themselves as responsible units in government. They wish for good government—but to fight for it is different. We may misjudge the forces now in the field for the so-called Liberal party, but in our opinion they are fighting mainly for spoils. The cry for division of estates carries but little conviction so long as the movement is backed and financed mainly by large land-owners. Leaders of the old *Cientifico* party are entirely too prominent in the movement to engender much belief in sincere reform. The Madero government has by no means lost the fight and at any time may re-establish its authority in the disaffected states. In the meantime both federal and revolutionary forces have been conspicuously regardful of the rights of aliens, and we trust no American will do anything to precipitate trouble between the United States and Mexico. Only a premeditated crime or a criminal blunder can excuse intervention.

The Domes of Nova Scotia

By T. A. Rickard

*The gold is associated with quartz, which in the main follows the bedding of the country rock; hence it forms sheeted bodies of ore that are sandwiched between the strata, especially along the thin seams of slate. Since the quartz follows the structural lines of the country rock, it forms 'saddles' where the slate and quartzite have been bent into anticlinal folds; but the most pronounced development of ore—for sometimes the quartz contains enough gold to constitute ore—is on the 'domes' formed where folds cross each other.

This domical structure leads to interesting results. Owing to erosion, the crests of the domes have been degraded to the level of the present surface, on the plane of which the bedding now assumes elliptical form. Any vein of quartz deposited along a bedding-plane will reproduce this structure. If on a flank of the dome, north or south, it will have a nearly straight strike, but in the approach to the ends, east and west, of the dome, it will curve in accord with the fundamental structure. At the 'nose,' or extreme ends of the longer axis of a dome, the quartz will be curved to a



IDEAL DIAGRAM.

bow. All this is on the plane of the surface. If followed underground such a quartz vein will form a saddle, by being curved with the bedding of the anticlinal fold whose axis is east and west. Again, owing to the synclinal fold, whose axis runs north and south, the saddle will pitch or slope if exposed at the east or west end of the dome, where the strata plunge in accord with the synclinal curvature of the cross-fold. This description will be made clearer by reference to the accompanying diagram, which, in effect, exhibits the appearance of a model made of glass. The top of the block represents the geological surface; the elliptical outcrops are evident; at the west end of the curving strata are shown the quartz veins. These in cross-section, as exposed at the left side of the block, constitute 'saddles,' the pitch of which is indicated.

Only a small portion of the total gold contributed by Nova Scotia has been extracted from quartz at the apex of these domes. Most of it has been broken from interbedded veins associated with the legs or stumps of arched structures whose crests have vanished. It will be understood that the present surface, from which all mining starts, represents a nearly horizontal section that has been cut, by erosion, through the folds at a varying distance from their crests. The bedding-planes, and the quartz veins conforming to them, that are least curved, are simply farthest from the anticlinal crests, since all the beds of slate and quartzite are members of the folded series. The greater the distance from the anticlinal axis the less the curvature, so that many veins following the nearly straight strike and nearly vertical dip of the country appear to be unrelated to quartz deposits on the domes, although structurally they are allied. Such veins follow the lower portion of an arch, the crest of which, at a higher horizon, since denuded, overlapped the dome that survives in the centre of the fold. A distinction must be

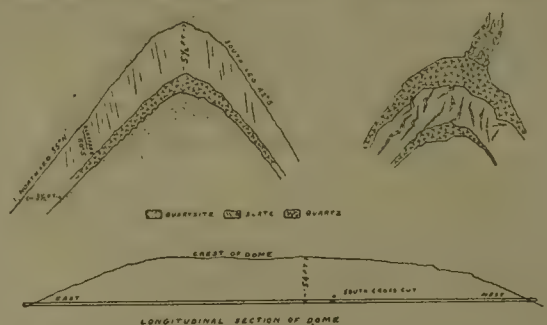


Fig. 2. Saddles and dome structure in Dufferin mine. Sketches of vein No. 1A, on the 300-ft. level.

made, however; it is not necessary to assume, as some writers have done, that every quartz vein at one time extended over an arch of rock that has since been removed. That is another question. Whether the quartz was conterminous with the entire fold of the country rock before it was reduced by erosion to the level of the present surface is a point on which I shall speak later. At present I am dealing with facts only, not theory. It is advisable to follow the scientific method of proceeding from the known to the unknown. It is not necessary to assume, and I do not believe, that the quartz vein distant from a dome, or an anticlinal arch, is a

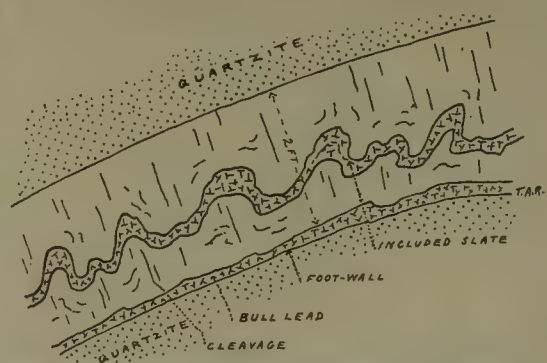


Fig. 3. Crenulated quartz vein in middle of slate band and crossing cleavage.

part of a much more extensive body that covered the crest of a dome eroded long ago, nor that the interbedded quartz now found several thousand feet from any anticlinal axis was contemporaneous in its origin with, however dependent in structure upon, the lines of weakness created in the rock formation during the process of folding.

At the Dufferin mine, in the Salmon River district, I saw a dome whose outcrop is barely 2000 ft. long, east and west. In other districts, such as Caribou, Mount Uniacke, and Oldham, it is obvious, from the geological surveys of E. R. Faribault, that domes exist having a length of 2500, 2000, and 3000 ft., respectively. Quartz, in the shape of saddle-veins, has been concentrated at the cross-folds, where the nose of the dome plunges underground, but in no case, as

*Portion of a paper read before the Canadian Mining Institute, March 8, 1912.

far as I know, has it been exploited profitably at both ends of a dome. In the Dufferin the domical structure is exposed on the 300 ft. level, which follows a quartz vein known as the No. 1A. Here, as shown in Fig. 2, the east and west legs of the dome are 1,300 ft. apart, while the north and south legs have a spread of only 200 ft. at the same level. Since Mr Fairbault's map was published, it has been ascertained by him that the anticlinal fold is not a single flexure, but divided into two saddles at its crest. Of these, the southern is accompanied by a succession of quartz veins, which have been exploited to a vertical depth of 300 ft. and then abandoned as unprofitable.

The 'saddles' of Nova Scotia are also remarkable for peculiar corrugations or crumplings of quartz, to which the name of 'barrel formation' has been accorded, because, when such a corrugated deposit is uncovered, it looks to the miner like the back or top of barrels lying in rows. The old woodcuts, appearing in a report by Silliman, indicate the appearance of such a lode as exposed in a large open-cut on the crest of a hill at Waverley. I went thither in August 1905, and saw enough to confirm the general accuracy of

plain. The first idea, adopted by some of the early observers, is that the quartz constitutes an integral member of the sedimentary series, that is, the silica that became quartz was deposited contemporaneously with the silt and sand that became slate and quartzite. According to this theory, the quartz underwent folding and corrugation with the encasing rock, and was particularly plicated at the places where anticlinal movements crossed. This simple explanation is killed by the single fact that the crenulated veins cut across the bedding-planes between the slate and quartzite.

The next theory that may be proffered is that the quartz has replaced another mineral, segregated from the original sediment and distributed along bedding planes or other lines affording passage to underground solutions. Calcite is prevalent throughout the region, and in association with the quartz; therefore it may have occupied the fractures in which the quartz is now found. Such calcite would have been crushed by the earth-movements, and thus it would be all the more easily soluble in silicious acid waters. This theory also lacks the support of evidence. It is true that although we cannot conceive a layer of quartz undergoing

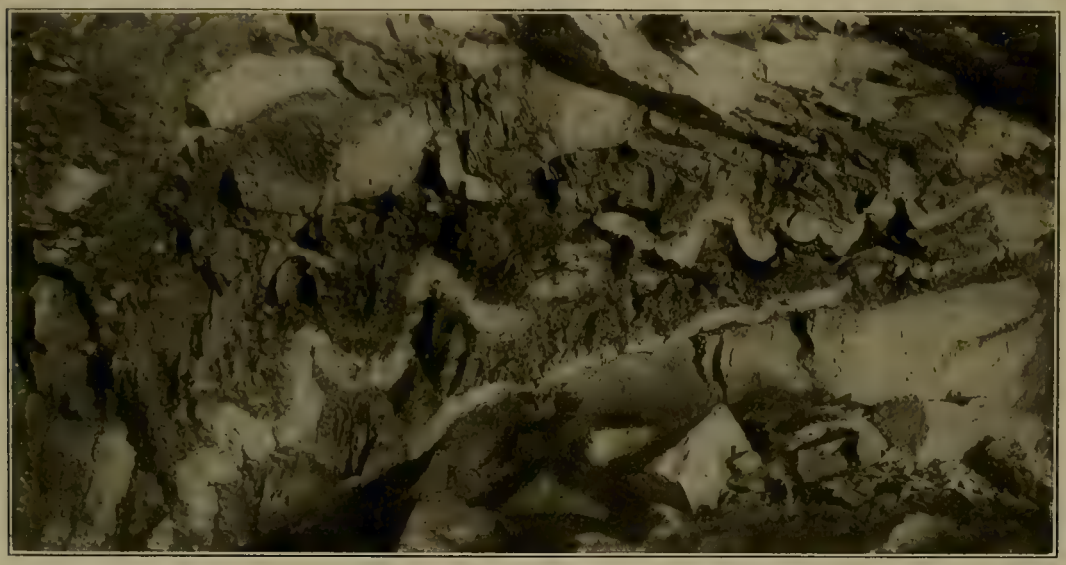


FIG. 4. THE BORDEN VEIN IN THE WEST LAKE MINE AT MOUNT UNIACKE.

his sketches. The corrugation, crinkling, or crumpling, as it has been variously termed, was most remarkable. As a technical term descriptive of this structure, I suggest 'crenation,' from *crena*, a furrow or notch, or the larger barrel structure, and 'crenulation,'[1] from *crenula*, the diminutive of *crena*, for the smaller apparently serpentine threads of quartz.

While adopting the Latin derivative for the barrel structure, I deem it best to use the English word, 'furrow,' for the individual markings that constitute the appearance termed 'crenulation.' For the larger manifestation of the same structure it might, from an academic point of view, be desirable to use 'crenation,' but this is not necessary to a clear description, and may therefore be set aside for the present. 'Furrow' and 'crenulation' apply to the markings in the wall-rock, and not to the quartz filling them. The quartz is found in veins of varying continuity, and in shape reproducing the structure of the encasing rock. Hence it appears crinkled, corrugated, crumpled, or serpentine, according to the degree to which the angles are curved. When enlarged, the bends make the so-called 'barrels'; when infrequent or individual, and especially when persistent, the 'barrel' becomes known as a 'roll.'

The origin of this beautiful structure is difficult to explain. violent bending without becoming crushed, a condition in which quartz is not uncommonly found in lodes,[2] we can imagine more readily that calcite could better withstand the strain, and even if crushed it might, at a later period, be replaced by quartz. In this connection we may remind ourselves, on the testimony of natural sections, that rock deformation ensues in the deeper portion of the earth's crust. C. R. Van Hise has estimated that at 12,000 metres "the weight of the superincumbent mass is greater than the ultimate strength of the rocks,[3] which then undergo 'flowage' or deformation without fracture." These considerations might well apply to the case in point, for, as we have seen, the rocks encasing the gold-bearing quartz now being mined in Nova Scotia were at one time covered by eight miles, or 42,000 ft., of superincumbent strata. Moreover, the practical researches of Frank D. Adams, in the laboratory of McGill University, prove that many rocks and minerals are capable of deformation without rupture when under great pressure.[4] Thus we have evidence on this point; but it is not applicable to our problem. If it be supposed that the quartz replaced another mineral which was deposited along the bedding-planes, either by original sedimentation or by subsequent segregation, we are again faced by the fact,

[1]This term has been previously used by J. Edmund Woodman, in his paper on the 'Geology of Moose River Gold District'; Nova Scotian Institute of Science, 1903, Vol. XI, Part I, pp. 18-88.

[2]Such as the Comstock.

[3]*Trans.* Amer. Inst. Min. Eng., Vol. XXX, p. 32.

[4]*The Journal of Geology*, Vol. XVIII, No. 6. 'An Experimental Investigation into the action of differential pressure on certain minerals and rocks,' by Frank D. Adams.

that the crenulated veins traverse the bedding. Hence they could not so originate. If we recognize that the quartz does not lie wholly along the planes of bedding, then the problem of explaining the crenulated structure is not facilitated by imagining quartz to have replaced calcite, for any explanation that would suffice for one would be adequate for the other. Therefore this second theory does not carry us any farther forward. We dismiss it with regret.

The next theory is not so easily stated, but it is based on the observation that quartz veins exhibit a step-like or zigzag course in traversing beds of diverse texture and in crossing the cleavage, joints, or other structural inequalities of a homogeneous rock. Thus, at Bendigo, I noticed that the 'spurs' or cross-veins, which are mined profitably on a large scale, have a marked characteristic: they cross the sandstone almost at right angles to the bedding, but they tend to follow the cleavage of the slate. On turning to the description of the Bendigo goldfield, written in 1892, I find that I referred to this characteristic in the following words: "A quartz seam upon leaving a bed of sandstone and entering one of slate, invariably turns its dip in sympathy with the cleavage of the slate." To put it in another way: a fracture crossing a series of slate and sandstone (or quartzite) beds will cut right across the sandstone because it is of fairly uniform texture, so that it is as easily broken one way as another. The same fracture, when encountering a fissile rock, like slate, will find the path of least resistance along the cleavage rather than across it. Hence the fracture, in crossing an alternation of such rocks, will take a step-like or zigzag course.

If, next, we suppose the alternation to be repeated with greater frequency—if, in other words, we take a shaley sandstone marked by well developed cleavage—we obtain conditions favorable to a crinkly line of fracture.

This affords a clue, which appears to be confirmed by the significant fact that the crenulation, as seen in the Nova Scotian mines, has a pitch conforming to the line of intersection between the bedding and the cleavage. It appears to be dependent on a relation to the cleavage.

Crenulation is not unknown at Bendigo, although there it is not a dominant characteristic. On turning to my first paper on the Bendigo goldfield (*Trans.* A. I. M. E., Vol. XX) I find two sketches illustrating this structure. One of these shows that the deposition of quartz has followed not only the lines sympathetic to the bedding but also a nearly vertical fracture along the anticlinal axis, as well as another that shows some kinship to cleavage. We must remember that the shape of the quartz is determined by the nature of the receptacle that it occupies; even if we suppose it to have found space by replacement of portions of the country rock, we have to ascertain the nature and shape of the fractures along which it found a way when in solution. Veins of quartz vary in dimension and direction in accordance with the diverse texture and hardness of the rocks traversed by fractures precedent to ore deposition.

These fractures are various. The lines of weakness along the bedding-planes, especially such as separate a relatively soft from a relatively hard rock, a slate from a quartzite, for example, furnish obvious facility for rupture. Along these is deposited the quartz of the ordinary saddle-vein. Other things being equal, the crest of an anticline furnishes an opening or a tendency to open; the syncline does this also, but, while the principle of the arch tends to keep the anticlinal fracture open, the dead weight of a trough-like depression or syncline tends to close it. Between the two bends, on the flanks of the anticline—which are also the reversed flanks of the syncline—the strata are compressed, the bedding planes are tight, and the least possible facility is afforded for the circulation of underground waters. Connection between the crests of the anticlines is obtained by fractures that follow the anticlinal axis, as in Nova Scotia, or by dikes that have been injected in the wake of regional dislocation, as at Bendigo.

In a region marked by folding the greatest intensity of fracturing is exhibited at the place of maximum plication. At Bendigo this is found at the apex of an anticline. In Nova Scotia it is found where the folds intersect, that is, where an anticline plunges in obedience to a transverse syncline: at the nose of a dome. It is there that the crenulation is most marked. Folding is accompanied by cleavage in fissile rocks and by jointing in those of granular texture. The main anticlinal axes are characterized by a dominant cleavage, usually at a high and persistent angle. At the approach to the apex of the fold, and more especially at the place where the rock is twisted by cross-folds, the regional cleavage is dominated by a local radial fissility.

At the place of maximum flexure, where the cleavage dominates the bedding, any fracture due to regional movement will find a devious way. In part it follows the bedding or, at least, it confines its divagation to one soft bed—of slate; in part it responds to the invitation of the cleavage lines; in default of such assistance it traverses both bedding and cleavage, but not for long. A vein-fracture in one mine plays many parts. That was the lesson at Bendigo; that is the teaching of Nova Scotia.

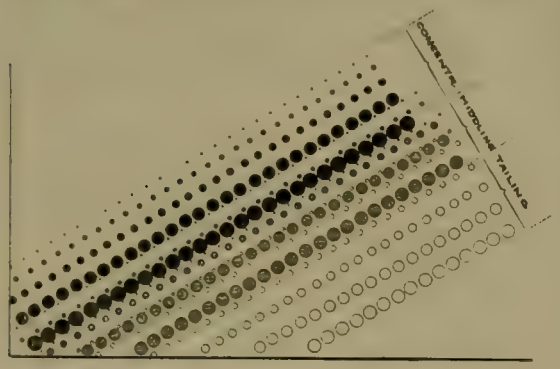
When the solutions containing both quartz and gold began to course along the fractures thus prepared, they were deposited wherever conditions were favorable, and after deposition they tended to reproduce the character of their abiding place. Thus I argue that they were precipitated along the bedding-planes, to form the simply tabular deposits that delight the writers of text-books; they likewise were laid down along the arches that gave us the symmetrical saddle-lode; they rested in cross-fractures that became the 'spurs' of Bendigo and the 'angulars' of Nova Scotia; and, finally, they found a way into the intricate and rythmically crinkled passages prepared for them, where cleavage and bedding disputed for structural mastery.

Thus the crenulation may finally be regarded as the beautiful product of complex fracture due to cross-folds in rocks of uneven texture. The fissility induced by extreme plication has afforded a sinuous line of passage to rupture and to the quartz that subsequently healed the rupture. As originally formed, the veins were crooked, that is, they zigzagged in a sharply angular line. In the course of mineral impregnation they became rounded. Nature hates an angle as she abhors a vacuum. Time softens hard lines, is a poetic way of saying that chemical corrosion is most rapid where the largest surface is exposed to solvent action. The angles of the zigzag vein-fracture were filled with quartz, which, in the course of accretion from further passing solutions, replaced the crushed slate adjacent to it and slowly gained a rounded outline. On the 700-ft. level in the Gagnon mine, at Butte, I have seen boulders 5 or 6 feet in diameter, formed by the solvent action of water that has seeped along joint-planes in the granite. These were similar in origin to the boulders formed by erosion at surface, and were due to the sculpturing hand of chemical waters. Once rounded, the hard quartz bent the neighboring soft slate to its unyielding shape. Neither movement nor solution ceases underground at a given moment. Since the veins were formed, the continual shifting of loads of sediment, by transfer from mountain to river, from land to sea, has caused the disturbance of equilibrium that incites geologic unrest. This has been the cause of new fractures along which later solutions have found a patient way. We who see a vein in a mine today are apt to regard it as a finished product, brought to our attention at the close of a completed cycle of chemical and physical operations. We regard ourselves as full-stops in time. On the contrary, the whole of the period during which man has tenanted the earth barely punctuates the geologic record; ours is a brief phase synchronizing with a minute portion of the vast stretch of time during which the vein of ore has undergone successive change. Had we left it in the ground it would have undergone, in later eons, a further alteration. When we remove it with the pick and hammer we break the normal sequence of its development; we are for a brief moment the masters of forces that have operated since the dawn of creation.

Re-treatment of Table Middlings

By Gelasio Caetani

The arrangement and distribution of the grains of sulphides and gangue on the deck of a reciprocating table has repeatedly been described by R. H. Richards[1], and is illustrated in the accompanying figure. The characteristic feature of this arrangement is that the grains of equal specific gravity will arrange themselves in order of size; the fine grains tend to advance toward the concentrate side of the table, while the coarser grains, on which the wash water has a stronger action, roll more rapidly over the inclined deck of the table, distributing themselves closer to the tailing side. Therefore all grains of equal specific gravity will arrange themselves strictly in accordance with their diameter. On the other hand, the heavy particles of sulphides will roll less easily over the deck than the lighter grains of gangue, and this, coupled with the progression



ARRANGEMENT OF MINERAL PARTICLES ON A TABLE.

imparted by the motion of the table, causes the minerals of different specific gravity to dispose themselves in bands. These bands overlap each other to a certain extent and, on account of this overlapping, some fine grains of the light minerals are intermingled with the coarse ones of the heavy minerals.

In a theoretically perfectly classified feed, this intermingling of fine gangue and coarse sulphide grains could not exist. This intermingling is the result and an index of imperfect classification of the feed, and it can be said that the band of middling on a table represents the zone where all the errors of classification have accumulated. In practice a perfect classification is not obtainable, therefore the middling from any table of the Wilfley type will contain, in addition to the grains of gangue carrying included sulphide, a variable amount of coarse and practically clean sulphide grains and some fine low-grade sand. Advantage ought to be taken of this characteristic nature of the middling while attempting to recover the free and included sulphides it contains.

Any material having the characteristics described above, I have designated as a 'counter classified' product,[2] for the reason that this product is exactly the contrary to that obtained by hydraulic classification, in which the small particles are found to be of higher specific gravity, and the coarse particles of lower specific gravity. Other machines, besides reciprocating tables, produce 'counter classified' products; an instance being the hutch discharge of Harz jigs operating an unsized feed.

It is evident that a 'counter classified' product is an ideal material for classification, and that a classifier will easily separate it into a discharge containing practically all the high-grade sulphides, and an overflow containing most of the fine gangue and a small amount of very fine free sulphide.

[1] *Trans.* Amer. Inst. Min. Eng., 38, p. 577; 'Ore Dressing,' p. 1475, etc.

[2] 'Milling of Lead-Silver Ores,' *The Mining Magazine*, June 1910.

This is illustrated by the following analyses of the products separated by hydraulic classification from the middlings of reciprocating tables.

Middlings of Coarse Wilfley Table Classified by Caetani Pipe Classifier

(Tomboy G. M. Co.'s mill. Galena-pyrite-blende-quartz ore.)

	Weight, %.	Iron, %.	Lead, %.	Insoluble, %.
Coarse Wilfley Middling.				
Classifier discharge	34.10	11.90	1.15	7.6
Classifier overflow	19.50	7.20	0.80	32.8
Fine Wilfley Middling.				
Classifier discharge	20.70	22.50	....	6.6
Classifier overflow	13.25	6.25	....	48.2

Second series of tests:

	Weight, %.	Zinc, %.	Iron, %.	Insoluble, %.
Coarse Wilfley Middling.				
Feed to classifier	100.0	23.70	8.10	34.70
Classifier discharge	91.0	25.70	8.60	32.60
Classifier overflow	9.0	3.85	3.50	77.80
Sand Wilfley Middling.				
Feed to classifier	100.0	27.50	11.20	22.70
Classifier discharge	78.6	33.60	12.50	12.20
Classifier overflow	21.4	12.90	6.00	55.20
Fine Wilfley Middling.				
Feed to classifier	100.0	25.90	12.50	21.90
Classifier discharge	78.0	28.40	13.80	17.30
Classifier overflow	22.0	18.10	8.30	40.90

Middlings of Coarse Card Tables Classified by Pipe Classifier

(Bunker Hill & Sullivan mill. Galena-siderite-quartzite ore.)

Product.	Lead, %.	Iron, %.	Insoluble, %.
Coarse Card Middlings.			
On 60-mesh	26.00	26.25	3.20
On 80-mesh	17.15	30.70	3.40
On 100-mesh	13.30	32.25	3.90
On 150-mesh	8.85	32.95	5.30
On 200-mesh	5.80	32.70	7.80
Through 200-mesh	7.05	31.00	10.00
Direct assay	13.25	31.00	6.20
Classifier discharge	21.60	30.15	2.90
Classifier overflow	12.45	32.10	5.00

In certain instances this concentration of sulphides in the coarse spigot discharge of the middling classifier is so marked that this product becomes a concentrate of shipping grade. This is being done at the Tomboy mill.

This method of concentration by classification depends on whether a considerable portion of free, coarse sulphide grains is allowed to go into the table middling. This is the case when endeavoring to make a very clean concentrate. If, however, some of the higher-grade silicious middling is thrown in with the concentrate and the grade of the concentrate is allowed to drop, the table middling will contain a lower percentage of coarse sulphide grains and no shipping product can be expected from the classifier. In all cases, however, classification will produce a concentration of all the large grains of higher specific gravity in the coarse spigot discharge. By re-treating this product on tables it will be possible to separate a clean concentrate, and the table tailing will be found to contain practically all the material that requires re-grinding to liberate the included sulphides. The finer spigot discharges of the classifier and its overflow will yield, when fed to a table, some clean concentrate, and the table tailing will generally be found to be sufficiently low grade to be rejected.

In most mills the practice of classifying the middling is not followed, and this hybrid product is either directly returned to the table which has produced it (as when middling elevators are used on a Wilfley table), or it is sent to a second set of tables, on which it is concentrated a second time without previous classification. The middling represents a product that imperfect classification has rendered unsuited for good separation on a table, and to concentrate this material a second time without removing the source of difficulty is merely attempting the impossible.

In many mills the tonnage of middling produced is not sufficient to warrant the installation of a classifier and Wilfley tables, solely for the purpose of re-treating the middling. In such case it is advisable to return the mid-

dling to the original classifier where this product will be again distributed to the tables according to size. The drawback of this method lies in the fact that the coarse middling often contains only a small amount of free sulphide particles, the rest being coarse grains containing included minerals which require to be re-ground before further concentration can be effective. The result of it is that these coarse grains of middling, by circulating over and over again from the classifier to the tables, will gradually accumulate until they take up a large part of the table capacity, and eventually are thrown off either in the concentrate or in the tailing, to neither of which do they belong.

A system followed in several mills is to send the middling directly to the re-grinding machinery, and, though this method often simplifies the general arrangement of the mill, it causes the sliming of a portion of the free sulphides and crowds the grinding machinery and the retreatment tables with fine gangue which does not require further treatment. In mills with sufficient table capacity and sufficient fall for handling the table middling, it will always be advisable to subject this to close classification and secondary concentration, and in many instances it will be found that this system will produce a considerable amount of clean concentrate and low-grade tailing, and thereby increase the efficiency and capacity of the mill.

Workmen's Compensation in Great Britain

The British Compensation Act of 1906 is summarized as follows by the *Journal of Industrial Safety:*

Injuries Compensated.—Personal injuries by accident arising out of and in course of the employment which cause death or disable a workman for at least one week from earning full wages at the work at which he is employed. Compensation is not paid when injury is due to *serious and willful misconduct,* unless it results in death or serious and permanent disablement. Industries covered: "Any Employment."

Persons Compensated.—Any person regularly employed for the purposes of the employer's trade or business whose *earnings* are less than £250 ($1216.63) per annum; but persons engaged in *manual labor* only are not subject to this limitation, or those whose employment is of a casual nature.

Government Employees.—The act applies to civilian persons employed under the Crown to whom it would apply if the employer were a private person.

Burden of Payment.—The entire cost of compensation rests upon the employer.

Compensation for Death

(a) A sum equal to three years' earnings, but not less than £150 ($729.98) nor more than £300 ($1459.95) to those entirely dependent on earnings of deceased.

(b) A sum less than above amount if deceased leaves persons partially dependent on his earnings, the amount to be agreed upon by the parties or fixed by arbitration.

(c) Reasonable expenses of medical attendance and burial, but not to to exceed £10 ($48.67) if deceased leaves no dependents.

Compensation for Disability

(a) A weekly payment during incapacity of not more than 50% of employee's average weekly earnings during previous twelve months, but not exceeding £1 ($4.87) per week; if incapacity lasts less than two weeks no payment is required for the first week.

(b) A weekly payment during partial disability, not exceeding the difference between employee's average weekly earnings before injury and average amount which he is earning or is able to earn after injury.

(c) Minor persons may be allowed full earnings during incapacity, but weekly payments may not exceed 10 shillings ($2.43).

(d) A sum sufficient to purchase a life annuity through the Postoffice Savings Bank of 75% of annual value of weekly payments may be substituted, on application of the employer, for weekly payments after six months; but other arrangements for redemption of weekly payments may be made by agreement between employer and employee.

Revision of Benefits.—Weekly payments may be revised at request of either party, under regulations issued by the Secretary of State.

Insurance.—Employers may make contracts with employees for substitution of a scheme of compensation, benefit, or insurance in place of the provisions of the act, if the Registrar of Friendly Societies certifies that the scheme is not less favorable to the workmen and their dependents than the provisions of the act, and that a majority of the workmen are favorable to the substitution. The employer is then liable only in accordance with the provisions of the scheme.

Security of Payments.—In case of employer's bankruptcy, the amount of compensation due under the act, up to £100 ($486.65) in any individual case, is classed as a preferred claim; or where an employer has entered into a contract with insurers in respect of any liability under the act to any workman, such right of the employer, in case he becomes bankrupt, are transferred to and vested in the workman.

Settlement of Disputes.—Questions arising under the law are settled either by a committee representative of the employer and his workman, by an arbitrator selected by the two parties, or, if the parties cannot agree, by the judge of the county court, who may appoint an arbitrator to act in his place.

Three of the most important features of the act are:

(1) "Serious and willful misconduct" on the part of the injured person bars recovery of compensation only when the injury "does not result in serious and permanent disability or death." Thus the workmen's right to recovery is in inverse proportion to his care for himself and others. If an intoxicated fireman or engineer should cause a boiler to explode, demolishing the plant, causing death to the employer and serious injury or death to the engineer, besides the ruin of the plant, the employee or his dependents would be preferred creditors against the estate of the employer.

(2) By "a person whose employment is of a casual nature" is meant that a workman who may be doing a chance job for a man could not receive compensation, if he should be injured while performing his duty, while if he should be working for the man regularly, he could claim compensation. To illustrate this difference, suppose that a house-owner had his roof damaged during a storm, and he employed a carpenter to mend the roof, the carpenter job would be one of a casual nature, and, therefore, recovery of compensation would be barred by the act, in case he should be injured. Again, suppose the same house-owner employed a woman to come in and do the washing once a week, such a woman would come under the act, since her employment is not of a casual nature.

(3) "Arising out of and in the course of employment" is the wording of the act, which signifies that it makes no difference as to the locality of the accident, as long as the injured man was pursuing his employment. To illustrate, suppose that the house-owner had his house burned accidentally, and the servant lost her life while in the house, her dependents could claim compensation, since her death was one "arising out of and in the course of her employment," but if that same servant injured her eye, due to a fright caused by a bug flying in through the window, it would be held that, while it occurred "in course of employment," it did not "arise out of it."

According to Section VII of the act, masters, seamen, and ship apprentices of vessels registered in the United Kingdom, or the owners or managing owners, who reside in the United Kingdom, can claim compensation for injuries arising under the act. Also workmen employed by or under the Crown (except persons in the naval or military service) are included in the act.

Experiments With the Thiogen Process

By Frank L. Wilson

At a lecture recently delivered before the Mining Association of the University of California, S. W. Young, professor of physical chemistry at Leland Stanford Jr. University, gave a very interesting and detailed account of his Thiogen process and the results so far obtained. His remarks, in slightly condensed form, follow.

The gases and waste products issuing from the flues of roasters, blast-furnaces, reverberatory furnaces, and converters, are made up for the most part of flue-dust, SO, SO_2, CO_2, and nitrogen in varying proportions. The main sources of these products are the roasters and blast-furnaces. The flue-dust is largely caught before leaving the stack, while the gases pass out into the atmosphere. The most troublesome of these gases are the SO_2 and SO_3. The SO_3, being but a small part of the gas, has not proved of importance, but the SO_2 issues from the stacks in large quantities and travels great distances. One method of present-

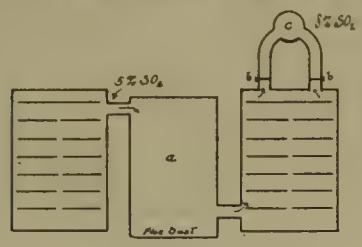


Fig. 1.

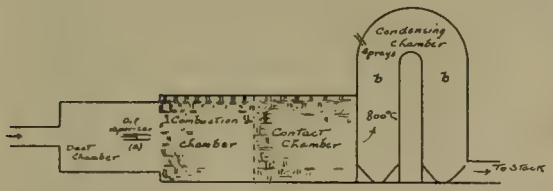


Fig. 2.

day practice is to dilute the gases by mixing with sufficient air to meet the requirements of the law before discharging into the atmosphere, and heretofore no attempt has been made to recover the sulphur as such.

The present sulphur supply is obtained from the sulphur wells of Louisiana, and the natural deposits of Japan, Sicily, and Mexico. At the present time sulphur is being discharged into the atmosphere from the stacks of different metallurgical plants (1000 tons of pyrite ore discharging approximately 800 tons of SO_2). To recover this sulphur it is necessary to have some reducing agent to combine with the oxygen of the SO_2. Carbon has been tried, the SO_2 gas being passed over red-hot coke. This process was found to be expensive and only partly successful. In the Thiogen process an oil spray is used to furnish the necessary carbon, and the reaction is shown by the following equation:

$$SO_2 + CH_2 = S + CO + H_2O$$

Ordinarily the CO would reduce more SO_2, as is shown by

$$4CO + 2SO_2 = 2S + 4CO_2$$

but this reaction takes place very slowly. In the presence of a catalyzer, however, the reaction is accelerated. It has been shown by the Mannheim process that in the manufacture of sulphuric acid the reactions are accelerated by means of a catalyzer in the form of Fe_2O_3. The SO_2 gases are passed over hot Fe_2O_3.

$$3Fe_2O_3 + SO_2 = 2Fe_3O_4 + SO_3$$

and the Fe_3O_4 again reacts with the free oxygen in the gas

$$2Fe_3O_4 + O = 3Fe_2O_3$$

A suitable accelerating reagent was found in calcium sulphide. Potassium and other alkaline sulphides might be used, but calcium is the cheapest and the most infusible of them all, standing quite high temperatures. As a catalyzer the calcium sulphide acts as follows:

$$2CaS + 3SO_2 = 2CaSO_3 + 3S$$

and in the presence of a reducing agent, as vaporized oil, the $CaSO_3$ is reduced to CaS

$$CaSO_3 + CH_2 = CO_2 + H_2O + CaS$$

In laboratory experiments these reactions are rapid, especially so when iron salts are present in the catalyzer. No CO was formed, and all of the carbon combined with the oxygen to form CO_2 direct. The mixture of CH_2 and SO_2 may be passed over almost any calcium compound, as $CaCO_3$ or $CaSO_4$, and the resultant compound is CaS. In case the gases contain free oxygen, this must be taken care of before the CH_2 will replace the oxygen in the SO_2, and this difficulty presents the worst drawback to the process from an engineering standpoint. A suitable tempera-

THIOGEN PROCESS PLANT, CAMPO SECO.

ture must be maintained for the gas passing over the catalytic agent.

It is preferable to clean the gas as thoroughly as possible and concentrate it before allowing it to pass to the combustion chamber. An 8% SO_2 content has been obtained by passing the resulting gas products from one roaster through a large drum (*a* Fig. 1) to another similar roaster, the draft being controlled by means of dampers (*b*). The gas finally passes through the connecting flue (*c*) to the apparatus.

The roasters at Campo Seco, where this process is being tried experimentally, are of an old type, not constructed to control the amount of oxygen passing in so that all the admitted air may be utilized, and 8 or 9% gases are the best that can be obtained from them.

The vaporization of the oil is accomplished by the use of steam injected burners, as shown at *a*, Fig. 2. This spray of oil is directed into the combustion chamber, which consists of a checkerwork of brick, and a temperature of about 800°C. is obtained. Beyond this is a reaction chamber, similarly filled with a checkerwork of brick. This chamber is 4½ ft. square and 30 ft. long, and is more than able to handle the gases from the two roasters. The spaces in this checkerwork of brick are nearly filled with a mixture of equal volumes of plaster of paris and sawdust wetted with water, to which a small amount of iron salts is added. This mixture has the advantage that it decreases the amount of plaster of paris used and gives a porous mass. The sawdust burns out and the $CaSO_4$ reduces to CaS quickly, the mass shrinking so as to fill

about half of the space between the bricks. Condensing chambers are necessary to collect the sulphur liberated. Cast-iron condensers were found to be too leaky, and at present an inverted V-shaped pipe is used (see *b*, Fig. 2), each condenser having a sloping floor with a trap-door. Difficulties were encountered in this chamber. Any selenium, arsenic, or antimony compounds that the ore contains distill over and condense with the sulphur. To overcome this a low, broad, slightly inclined, condensing chamber can be used, in which water-sprays cool the gas below the boiling point of selenium and arsenic (about 750°C.), or about 500°C., the selenium, arsenic, and antimony being deposited on projecting tiles placed in the walls of the chamber for that purpose, and finally drawn off through traps in the lower corners. The sulphur, having a lower boiling point, passes on and is caught in the regular condensing chamber described above.

Tight construction is required throughout, and the brick walls so far used have been too porous to withstand the inward pressure of the air due to the vacuum caused by the draft up the stack. Leakage of air has been guarded against by means of sand sealing. Trouble also occurred through ends of the chambers being forced out, due to expansion of the brick, and it is hoped this will be overcome in a great measure by building the separate chambers independently and allowing for telescoping, using sand sealing to guard against air leakage inward.

Three trials have been run so far at Campo Seco. The first was largely to show the supervisors that the process was feasible. The apparatus used consisted of a 4-in. pipe connecting with the flue and discharging into an 8-in. pipe, 5 to 6 ft. long, in which the contact material was placed. A gasoline burner was placed at the junction of these two pipes and the necessary CH_4 and heat obtained. Leading from the 8-in. pipe, a 2-in. pipe discharged into a large iron drum. At a point in the drum above the 2-in. pipe a spray of water was allowed to play on the gases, the resultant liquid being tapped from the bottom of the drum. This resultant liquid showed free sulphur and was milky white in appearance. Connected with the drum by means of another pipe was a blower that drew the gases through the apparatus with considerable velocity and discharged the soot and the gas on a piece of corrugated iron. Analysis of this soot showed free sulphur. The escaping gas was nearly free from SO_2.

The second trial was made about a month ago, and on a larger scale. There was considerable leakage of air and consequently considerable oxygen came in contact with the free sulphur and combined with it. Heat was generated by this combustion, and the temperature at the condenser was raised to slightly over 950°C. Analysis of the gas showed 5.6% SO_2 at the inlet and 0.2% at the condensing chamber, a decrease of 5.4%, or above 97% of the sulphur dioxide present.

On March 11 the present condensing chamber was ready and the apparatus tried (see Fig. 2). Trouble was encountered shortly after the burner was started. The temperature ran up beyond 1100°, and on shutting down it was found that someone had shut off the spray-water, and as a result the sprays were burned out and rendered useless. A tremendous draft was developed, due to the excessive heat. The present sprayers are an improvemnt over the former ones, in that they cause the spray to be thrown in all directions, thus cooling the gases more uniformly.

The cost of repairs cannot be estimated at the present time. Gases from the roasters have been passed for some time through the apparatus without settling out the flue-dust, but if the dust is settled out, the apparatus can run indefinitely without becoming clogged. Gypsum is not very expensive and the old contact material is not wasted, as it can be used in the smelting operations. Indicators are now being devised to register the percentage of SO_2 in the gas automatically, the supply of gas in turn being regulated by dampers placed at convenient points. Any excess oil burned will be taken care of by the $CaSO_3$, and any excess SO_2 by the CaS.

Working Costs on the Rand

JOHANNESBURG CORRESPONDENCE

The problem of how to effectually reduce the working costs on the Rand is becoming every month of increasing importance. Two years ago the average working cost of ore per ton milled was 17s. 1d., when both the profits and dividends paid to stockholders attained their highest level. Since that date, not only has the average cost of working increased to the extent of over a shilling per ton, but the grade of ore milled has declined to the same amount, with the result that, despite the steady increase in the production of gold during the past two years, both profits and dividends have perceptibly declined. There are not wanting signs to indicate that those who control the mining industry are fully alive to the necessity of increasing the profits in order to maintain the confidence of stockholders, but there seems to be some difference of opinion as to the best methods to pursue in order to attain that object. One school advocates an artificial improvement in the grade of ore sent to the mill by selecting ore in the stopes to add to the profits, but, in addition to its other drawbacks, this always adds to the working costs. This method does not meet with general favor on the Rand, although there have been several notable converts made in its favor during the past six months, largely because the efforts at economy and improvement in methods of mining have not brought the anticipated relief to mining costs. That there is room for economy in Rand working costs, from the native laborer to the top of the administration, seems to be the prevailing opinion here, and it is possible that the growing cost of unskilled labor has more to do with the higher working costs than anything else. The blame for this must be fully borne by those who control the industry, who of late have not only been the means of one group of mines competing with another to obtain a full labor supply, but have displayed a wanton recklessness in giving labor agents contracts on such conditions as to render higher working costs inevitable. Then again, during the past two years there has been an attempt to introduce a cheaper grade of white labor into the mines, but its efficiency has been so low that in the long run it has been more expensive than trained, experienced, and more highly paid labor. A similar result has attended the introduction of a cheaper form of administration in that particular branch where experience and long training are so essential. The introduction of a lower-salaried and more numerous administration has resulted in a much increased salary bill, and drastict attempts have been made to bring down the wages by wholesale reductions of office expenses by dismissals. It is evident that the grade of rock sent to the mills on the Rand must on the average continue to decline, as no artificial efforts can be made on a sufficiently large scale to prevent it, but the decline will be so gradual that no difficulty should be experienced in making a compensating reduction in the working costs. Despite the continued development of the country and the growing demand for native labor, a revision of wages and conditions is absolutely necessary if mining costs are to be reduced. Little benefit seems likely to accrue from encouraging the employment of a cheaper and less efficient supervising staff, from the miner to the administrator. Some benefit must result from the costly and unnecessary aim at uniform monthly results being abandoned, adoption of closer sorting, and the placing of underground mining operations on similar lines to those which in other mining fields are found essential to reduce working costs to a minimum.

COPPER MINES at Ferrobamba, in Peru, 40 miles west of Cuzco, are owned by Ferrobamba, Ltd. Tests made by Claude Vautin show that both the oxidized and sulphide ore can be concentrated, with a saving of 74%, to a product assaying 30% copper. The company owns several mines and the total amount of ore available is stated at 7,500,000 tons.

Matanuska Valley Coalfields, Alaska

By G. C. Martin and F. J. Katz

*The coal of the Matanuska valley is of three kinds; an thracite, high grade bituminous, and low grade bituminous. Of these, only the last two have been found within the area mapped in detail in the investigations here described. The anthracite occurs farther east and has been described in earlier reports. The high-grade bituminous coal occurs on the south side of the Matanuska, east of and in the vicinity of Coal creek, and on the north side of the river in the valleys of Chickaloon and Kings rivers. The low-grade bituminous coal is known in the valleys of Young, Eska, and Moose creeks.

The high-grade bituminous coal is fragile and soft, like most coal of this kind, and the beds show the effects of having been severely crushed and at many places are without any well defined bedding planes or planes of fracture. The friability of the coal is such that it will probably not stand shipment without being badly broken. This is not so great a detriment as might at first seem, because many of the beds contain so many impurities that the coal from them ought to be crushed and washed. It is, therefore, highly probable that much of this coal will be used in the manufacture of coke, a purpose for which lump coal is not desirable. Coal which possesses coking properties, as much or all of this coal does, can be burned as slack about as well as in lumps, for the slack coal when thrown into the furnace will fuse and cake, thus preventing loss of coal through the grates.

The low-grade bituminous coal on Moose, Eska, and Young creeks is on the border line between bituminous coal and black lignite. It is harder than the higher-grade coal farther east. Many of these beds have not been crushed, and a larger proportion of lump coal can probably be obtained from them in mining than from the coal beds described above. This coal possesses no coking properties and will probably be used under stationary or locomotive boilers. It is not so good for this purpose as the coal from the east end of the field; but, because the latter is well suited for the manufacture of coke and for use as smithing and naval coal, it will command a higher price and thus probably leave a lower-price market for the poorer coal farther west. The low-grade coal can probably be mined and shipped more cheaply than the high-grade coal. The two kinds of coal will, to a certain extent, be non-competitive, each having its own special market.

Chemical Analyses and Tests.—The following table includes characteristic analyses of coal from various parts of the area. Sample 1 1910 was taken during the investigations here described. The other analyses have been published in Bulletins 289 and 327, and represent samples collected in 1905. All the samples except No. 1 and 2 were obtained from surface prospects or from outcrops, and were consequently somewhat weathered. Samples 1 and 2 came from an adit at a distance of 43 to 58 ft. from the mouth and probably under about 25 or 30 ft. of cover.

Coking Qualities.—A rough test of the coking qualities of the coal from adit No. 2 on Chickaloon creek was made during the summer of 1905 by coking a large pile of coal under a covering of stones and dirt. The resulting coke was hard and firm and had a good ring and a good texture. The test indicated that by proper treatment a coke of satisfactory grade can be produced. No further tests have been made by members of the Geological Survey. The analyses indicate, however, that the high-grade bituminous coal of Chickaloon and Kings rivers and on Coal creek is probably, at least in part, coking coal, and that the coal in the west end of the district, on Moose, Eska, and Young creeks, is low-grade bituminous and is probably all non-coking coal.

Mining Conditions

Mine sites should be selected only after a careful study of local conditions accompanied by drilling. The selection of a site should be governed by the accessibility to the railroad and by the structure of the rocks. The latter should be determined in detail for each property by careful drilling or otherwise in order that the mine may be opened at such a point that the underground haulage of the coal and the disposal of the mine-waters may be accomplished at a minimum of expense.

Although many of the coal beds outcrop at the surface, the outcrops dip for the most part at steep angles. Few if any localities have been found at which it would be possible to open an extensive mine on the outcrop of the coal bed. The amount of coal above the general drainage level is not great, and it will be necessary from the beginning of mining to sink shafts or slopes to considerable depths. When any large mines are opened, it will probably be found desirable to sink shafts to the coal beds at considerable distances from their outcrops.

Local Supplies.—The local region will furnish none of the supplies needed in coal-mining except timber. Everything else will have to be shipped from outside of Alaska. The development of this field on a large scale will consequently probably involve the building up of other industries, such as establishments for the manufacture of mine cars and other machinery and mine supplies.

Underground Water and Gas.—In any large mines which

Analyses* and Tests of Matanuska Coals

Sample No.	Thickness of coal in feet	Proximate Analysis: Loss on air-drying	Proximate Analysis: Total moisture	Proximate Analysis: Volatile combustible	Proximate Analysis: Fixed carbon	Proximate Analysis: Ash	Ultimate Analysis: Sulphur	Ultimate Analysis: Hydrogen	Ultimate Analysis: Carbon	Ultimate Analysis: Nitrogen	Ultimate Analysis: Oxygen	Calorific Val.: Calories	Calorific Val.: B.t.u.
1	12.3	1.60	2.55	16.66	69.72	11.07	0.57	4.19	76.58	1.37	6.22	7,545	13,581
2	5.2	...	0.99	19.03	75.19	4.79	0.60	4.71	83.90	1.48	4.52	8,205	14,769
8	5.0	0.80	1.97	18.58	75.19	4.26	0.50	4.80	82.77	1.79	5.88	8,146	14,663
12	9.9	1.80	2.68	20.69	64.72	11.91	0.59	4.68	74.38	0.87	7.57	7,422	13,360
1-1910	12.2	6.10	10.57	33.80	50.57	5.06	0.23	5.41	65.16	1.13	23.01	6,236	11,225
17	2.6	...	4.74	34.79	54.06	6.41	0.42	5.54	71.06	1.60	14.97	6,985	12,573
18	3.3	...	5.00	33.90	50.65	10.45	0.41	4.77	63.59	1.38	19.40	6,338	11,408
19	6.0	...	4.75	32.64	50.63	11.98	0.38	4.76	64.09	1.09	17.70	6,428	11,570
20	11.7	4.60	9.49	33.63	51.71	5.17	0.25	5.52	65.85	1.20	22.01	6,445	11,601

*These analyses were made by F. M. Stanton on the same samples as those with corresponding numbers in the preceding table. The differences in proximate analyses are due to the fact that the samples dried somewhat in the months which elapsed between analyses, and that somewhat different methods of analysis were used. (See Bull. U. S. Geol. Survey No. 290, 1906, pp. 29-30.)

*Abstract from Bulletin 500, United States Geological Survey.

are opened in this region it will be necessary from almost the beginning of mining to pump or hoist mine water. It is not believed that it will be possible to open any large mines having natural drainage. The amount of underground water which will be encountered will probably not be great, unless the mines are opened on the outcrop. Precipitation in this region is so slight that large amounts of water can get into the mines only from the streams. If ordinary precautions are taken to prevent streams from breaking into the mine openings the mines ought to be fairly dry. The heavy cover of gravel which exists at the lower altitudes throughout most of the Matanuska valley will cause certain dangers in mining. Unless the depth of the gravel at different points and the shape of the underlying rock floor are determined by drilling there will be danger of the mine workings breaking through the surface of the rock into the gravels. The gravels probably carry large amounts of water in some places and serious accidents might thus result. Gas will probably be a serious problem in local mining from the very start. The experience of the few small adits which have been driven indicates that these coal beds will yield large amounts of dangerous gases. Some provision ought to be made in advance of mining for the enforcement of suitable regulations for protection of the miners and the mines against gas explosions.

Effect of Intrusive Rocks.—Intrusive rocks are known to be present in abundance and in large masses throughout the greater part of the area of coal-bearing rocks, except in the valleys of Moose and Eska creeks, where they are so small and are much less numerous than farther east. In conclusion, it must be stated that the presence of intrusive rocks in the coalfield introduces factors that make an undetermined percentage of the coal areas of very doubtful value. The size and distribution of these intrusive masses beneath the surface, as well as at the surface in the area of scanty outcrops, cannot be determined without underground exploration. The effect of the smaller intrusive masses on the coal depends on the extent to which these masses have been intruded into or along the surfaces of coal beds. Where the intrusive mass is in contact with the coal, the coal is worthless, but where it is a few feet away the quality of the coal is probably unimpaired, or may even be improved.

Effect of Folding and Faulting.—The steep dips and complex structure of much of the coal areas introduce serious problems in coal mining and call for careful investigation of the structural conditions of each individual tract before the development of mines is attempted. It is believed that areas will be found in which the difficulties of mining, due to structure, will not be serious. Both Castle mountain and Wishbone hill are of fairly simple structure, so that, if the coal beds persist beneath the conglomerate and if the coal-bearing rocks were not folded before the conglomerate was laid down, mining should not be difficult, at least so far as structural conditions are concerned. It may perhaps be assumed to be probable that the structures of the entire valley are of the same general type as those known in the areas of the conglomerate. If this is the case, there are probably large areas in which the structure will permit the mining of the coal. This condition is not, however, positively known, and the character of the structure must be regarded as a problem to be solved by underground exploration before the feasibility of mining at a profit of the coal of any particular tract can be demonstrated.

A RECENT consular report states that Butusoff, a Russian government mining engineer, is making a detailed examination along the banks of the Iman river, a tributary of the Ussuri. Results show that this territory is likely to become a field for large gold-mining undertakings. At present this district is the chief point where colonization is being concentrated. In connection with reports of discoveries of various mineral deposits along the Amur railroad, the Council of Ministers has decided to apply to the Duma for appropriations to organize surveying and geological stations along the entire railroad. Geological researches of this region by parties of the Amur Expedition cover the whole line of this road from the northwest Trans-baikal to Khabarofsk. The 'expedition' came to the conclusion that this region is of great importance, owing to its richness in minerals. There are reasons to believe that gold mining will develop in many places along the Yablonoi mountains, in the valleys of the Urka, Omutnaia, Urshi, and Olden rivers, and more especially in the valleys of the Kerak and Urkan. In the central and eastern parts of the railroad region large deposits of lignite were discovered, and they are thought to be valuable as they are near the line. Valuable iron deposits have been discovered near the Amur river.

Retention of Gold in a New Mill

By H. A. WHITE

*It may be interesting to briefly enumerate some of the sources of short returns in the first month's output of a new modern plant. Beginning at the mortar-box, where some little concentration takes place; the launder to the elevating plant picks up a little gold in any small crevices that exist; the tailing wheel or pumps, especially the former, have been known to gather quite a rich coating; the tube-mills have been known to yield as much as 500 oz. of gold upon removal of the lining when worn out, and even silex liners can easily accumulate 200 or 300 oz. of amalgam. Besides the tube-mill plates, already discussed, the succeeding launders and traps will not yield their full share to the first clean-up. If in addition to these sources it is considered that all the rock crushed cannot be completely treated in the time, that a fair amount of gold is in the working solutions, that a large amount of partly coated zinc must be left in the extractor-boxes, that new furnaces and pots absorb some gold, and that some valuable by-products formed are not immediately treated, it is clear that the usual statement to shareholders is considerably more than mere soothing-syrup. Indeed, considerable capital is necessarily locked up in this way, though this is seldom provided for in the estimates framed. I agree that liquid amalgam may be the means of conveying gold into minute cracks in the retorts; but where suitable trays are used no overflow can take place, and in such cases the retort will not be found to contain much gold, though the assay figures certainly warn us to cut out a piece for assay and not to rely upon appearance only. I would add, however, that at the Co-operative Smelting Works rich bonanzas are not found, and though gold content of the retorts bought is not taken into account, no unmanageable surplus of gold is found in the outputs. In fact, the manager, after a good deal of experience in breaking up old retorts, deprecates any enthusiasm about further supplies.

The fact that heat enormously increases the fluidity of most liquids has a considerable bearing upon this subject, and it is very instructive to examine a brick from the bottom of the ordinary furnace used in the lead smelting of zinc-gold slime. The minute cracks, visible only under the microscope, are yet filled with metallic lead; for though the pressure was small the lead was red-hot, with a corresponding decrease of surface tension and viscosity. A similar pressure of cold mercury would not so penetrate the brick if applied for years on end. It is a well known fact that a filter-paper moistened with such a liquid as paraffine is impervious to water, and if someone could apply this principle and discover a liquid with which the bottom of a pan-furnace might be soaked, thus avoiding the infiltration of gold-bearing lead and so evading a tiresome source of absorption of that precious metal, he would be performing a valuable service.

A CONCESSION to develop placer gold ground along the Santa and Chuquicana rivers of Peru has been obtained by John Bryson and Frank Klepetko, and an examination of the deposits is in progress.

*Excerpt from *Journal* of the Chem. Met. and Min. Soc. of S. A.

The Early History of Cupellation

By R. C. Benner and M. L. Hartmann

The process of cupellation, or the separation of the precious metals from lead and other impurities by fire, was known to the ancients. Early chemistry treated chiefly of the properties of the metals and their behavior when subjected to high temperatures. Metallurgy then ranked as one of the most learned sciences. In proof of the antiquity of man's knowledge of the purification of metals by fire, the following quotations from the Bible have been cited by James Napier, in 'The Ancient Workers and Artificers in Metal,' London, 1856:

"For thou, O Lord, hast proved us: thou hast tried us as silver is tried." Ps. lxvi, 10.

"Take away the dross from the silver and there will come forth a vessel for the finer." Prov. xx, 4.

"Behold I have refined thee, but not as silver: I have chosen thee in a furnace of affliction." Isaiah xlvii, 10.

"And I will bring the third part through the fire and will refine them as silver is refined, and will try them as gold is tried." Zech. xiii, 9.

"Surely there is a vein for the silver and a place for the gold where they fine it." Job xxviii, 1.

But perhaps the earliest known reference to the actual cupellation process is made in a poetical passage in the Scriptures in which David implied the common existence of this process:

"The words of the Lord are pure words, even as silver tried in a furnace of earth, purified many times." Ps. xii, 6.

Napier says of this reference: "Here, we observe, David is not satisfied with saying that the word of the Lord is as pure as silver, tried and purified several times. He wishes to represent the most perfect state of purity. Consequently he descends to a particular method and says, 'Tried in a furnace of earth.'"

This distinct reference to an earthen furnace leads naturally to the conclusion that different methods were known and practised, and that the earthen furnace was considered best. Whether, as now, burned bones were used in making this earthen cupel, is not indicated, although bone-ash is not essential to the operation. Other earths have been used, but it would not be inconsistent with the common practice of those times to have used bone-ash, since we find that this substance was frequently used in the arts at that time. This is indicated by the passage, "I will not turn away the punishment thereof because he burned the bones of the king of Edom into lime." Amos ii, 1.

Other Scripture references cited by Napier (reference cited) and by W. H. Pulsifer ('Notes for a History of Lead,' New York, 1888, p. 136), in which the application of the cupellation is readily seen, are given below:

"Son of Man, the house of Israel is to me become as dross: all they are brass, and tin, and iron, and lead, in the midst of the furnace; they are even the dross of the silver. Therefore thus saith the Lord God; because you are all become dross, behold, I will gather you in the midst of Jerusalem. As they gather silver and brass and iron and lead and tin into the midst of the furnace to blow the fire upon it, to melt it, so will I gather you in mine anger and my fury and I will leave you there and melt you. Yea, I will gather you and blow upon you in the fire of my wrath and ye shall be melted in the midst thereof." Ezek. xxii, 18-22.

"Thy silver is become dross • • • I will turn again my hand upon thee and purely purge away thy dross and take away all thy tin." Isa. i, 22-25.

"They are all brass and iron: they are corrupters. The bellows are burned, the lead is consumed of the fire, the founder melteth in vain: for the wicked are not plucked away. Reprobate silver shall men call them." Jer. vi, 28-30.

Pliny is the earliest writer who attempts to give any detailed description of the process. However, his descriptions are vague and inaccurate, and are of little value. Pulsifer, in his 'History of Lead', gives a detailed discussion of the works of Pliny, as well as of some more recent writers, relating to cupellation, some of which are as follows: According to Leger,[1] this metallurgical process was commonly known in the East and practised before the time of Cyrus (600 B.C.). Cupellation was not practised in the West until much later. Agatharcides[2] describes the process of purifying gold by melting it in an earthen pot, together with lead and tin, to which barley, bran, and salt had been added. The fire, he says, was kept up during five successive days. Strabo[3] refers to cupellation when he says that the silver ore from the mine was washed five times, the dregs were then selected, and the lead being poured off, the silver was obtained pure. He describes the silver furnace as being constructed so that the pestilential vapors of the lead were raised and carried off. The use of lead in refining gold is mentioned by Theognis,[4] who lived in the sixth century, B.C.

Evidences of the practice of this method of refining argentiferous lead are abundant in the ancient mining districts of the Old World. Near Cartagena, Spain, pigs of lead of undoubted Roman smelting have been found, with cakes of silver lying near them. In the province of Barcelona great heaps of litharge have been discovered near the site of an ancient furnace. In the many ancient camps of France, evidences are abundant of this method of separating silver from argentiferous lead.

Remains of the ancient cupellation furnaces have been discovered near Almeria,[5] Spain. Quantities of litharge have been found mixed with scoriæ near old furnaces in Greece. Geber[6] understood the process of cupellation, and Theophilus, who wrote in the eleventh century, describes minutely the method of preparing the crucible or cupel for the purification of the silver, and with careful detail gives directions for conducting the process. Agricola[7] describes a smelting-house with the necessary apparatus for the separation of silver from lead by cupellation, and illustrates his description with wood-cuts, in which the smallest details are treated in the most painstaking manner. The cupellation furnace was much like those in use in Germany today. The blast was furnished by bellows operated by a water-wheel, the iron cover or hood was removed or put into position by a crane provided with a system of gears, the power being supplied by men working a crank-shaft.

The native Peruvians[8] seem to have independently discovered this metallurgical process. They made 'souls' of clay called *guayras*, in the shape of flower pots, with many holes in them. These were filled with a mixture of ore and charcoal, carried to the mountains, where advantage of the wind currents could be taken, and there fired. The product of this fusion was further refined at their homes, the blast being secured by small hand bellows. Gracilaso de la Vega[9] describes the Peruvian method of recovering the silver from its ores as follows: "The silver for the most part is extracted from the 'Hatum Potassi', in the melting of which they first found great difficulty; for, not being able to run, it burned away or evaporated in smoke, of which the Indians could not penetrate the cause or discover a remedy. But as necessity and covetousness make men ingenious and contriving, so, particularly, the Indians were infinitely industrious to find some way to melt their gold and silver. At length, after many experiments, they happened to try melting a baser sort of metal, which the 'lesser potassi' produced, consisting for the most part of lead mixed with silver, the which being more easily melted and run, and when put in the melting pots, together

[1] Leger, 'Les Travaux Publics,' p. 716.
[2] Agatharcides, 'De Rubro Mari.'
[3] Strabo's 'Geography,' book III, chap. II.
[4] Moore, 'Ancient Mineralogy,' p. 44.
[5] Dubreé, 'L'Exploitation des Mines'; also Leger, 'Les Travaux Publics,' pp. 698-715.
[6] Theophilus, 'Diversarum Artum Schedula,' translated by Hendria, London, 1847, p. 227.
[7] Agricola, 'De Re Metallica,' pp. 324-382.
[8] 'Travels of Pedro de Cieza de Leon,' translated by C. R. Markham, London, 1864, p. 389.
[9] De La Vega, 'Royal Commentaries of Peru,' p. 364.

with the fine gold and silver, would immediately cause them to melt and dissolve; for which reason the Indians gave it the name *curuchee*, which signifies anything that dissolves." This was the first melting, and was conducted in the mountains; the product was taken to their houses, where it was subjected to a second melting, when, by the use of the blowpipe, the lead was completely oxidized and the silver recovered.

The natives of India were acquainted[10] with the process of cupellation three hundred years ago. Digging a hole in the ground, they worked up a composition of moist ashes with which they plastered the cavity, making a sort of a combined cupel and furnace in which they fired the mixture of lead and ore. The operation was repeated until finally the silver was recovered. Little progress was made during the time of the alchemists in the methods of refining precious metals, but Geber gives a complete description of the process of cupellation, which he states was hastened by the addition of saltpeter, by which impurities such as copper and tin were removed. After the alchemistic period had passed, much attention was given to the working of gold and silver ores, and the processes were greatly improved. At this time quantitative determinations of gold and silver by the cupellation process were coming into use. The use of the balance was made obligatory by law in all cupellation and cementation processes in order to prevent fraudulent practices. In the phlogistic period, quantitative determinations were developed, although few changes were made in the metallurgical operations connected with gold and silver. Since then the process has been steadily developed until it has reached its present state, although the essentials of the operation are the same as the ancients used.

Patent Laws of the United States

At a meeting of the Inventors' Guild, held November 24, 1911, the following resolution was adopted:

Whereas, The Constitution of the United States provides: "The Congress shall have power to promote the progress of science and useful arts, by securing for limited times, to inventors, the exclusive right to their respective discoveries"; and

Whereas, This constitutional provision was intended to obtain for the benefit of the Nation the publication of every new and useful invention in such full, clear, concise, and exact terms as to enable any person skilled in the art or science to which it pertains to make, construct, compound or use the invention, after the limited time for which the exclusive right is secured to the inventor by patent; and thereby to secure for the Nation the great benefit which, all experience shows, results to a Nation from publishing inventions, in contradistinction to following a policy which would tend to encourage trade secrets, monopoly, and trade combinations, which minimize the value of inventions to the Nation; and,

Whereas, A patent is in effect a contract between the Government and the inventor by which the Government, in consideration of the right to publish the invention for the benefit of the Nation, agrees that in return for his satisfactory disclosures of his new and useful invention under reasonable conditions, to be determined by the Government, it will secure the inventor for a limited time in the exclusive right to his new and useful invention; and,

Whereas, An inventor, after having performed his part of the contract by having made proper disclosure of a new and useful invention to the United States Government officials, is frequently subjected to unreasonable delay, expense, and injustice before obtaining his patent, and after having obtained his patent is not equitably secured in his exclusive right as the Constitution intended that he should be secured in return for his disclosure in good faith of his new and useful invention; and as a consequence of this unfair treatment of inventor patentees, the United States is not obtaining, in the degree that it should, the National benefit of the best inventive work of its many able inventors; and,

Whereas, The United States patent system has been evolved to its present condition without proper consideration of the rights of the Nation, and of the inventors, who are the two real parties at interest, but on the contrary has been developed to its present condition almost entirely as the result of suggestions from persons who do not occupy the position of one of the parties to the contract which every patent represents; and who do not suffer damage from the delays, complications, injustice, and expense characteristic of the United States patent system and the United States Courts which hear patent causes; said damage being borne principally but indirectly by the Nation and to a lesser degree, but directly, by the inventor-patentees; and,

Whereas, It is a well known fact that modern trade combinations tend strongly toward constancy of processes and products, and by their very nature are opposed to new processes and new products originated by independent inventors, and hence tend to restrain competition in the development and sale of patents and patent rights; and consequently tend to discourage independent inventive thought, to the great detriment of the Nation, and with injustice to inventors whom the Constitution especially intended to encourage and protect in their rights; and,

Whereas, Under existing methods of trying patent cases, an inventor-patentee of average means could not, at his own expense, carry to a conclusion an average patent litigation against a wealthy opponent, and therefore a few wealthy concerns usually acquire nearly all important patents in their field, to the great damage of the Nation because of the restraint of competition and because of the resultant tendency of such inventors to seek protection for their invention by trade secrets or else to cease inventive work; and,

Whereas, Efficient protection by patent of new and useful inventions would offer to the average American manufacturer one of the best methods of meeting foreign competition, and would, in addition, improve quality, reduce first cost, and stimulate fair competition, with resulting benefit to the entire Nation;

Resolved, The Inventors Guild, composed exclusively of independent and experienced inventor-patentees, does hereby respectfully ask the attention of the President of the United States to the urgent need of reforms in the Patent Office and also in the Courts which hear and decide patent causes; and hereby requests the President to recommend to Congress the advisability of appointing a committee to confer with experienced and representative inventors with the object of promptly accomplishing such reforms as will result in more effectively carrying out the intention of the Constitution; and to supplement such recommendations by such executive action as in his judgment seems likely to assist in accomplishing the needed reforms.

ORSK GOLDFIELDS, LTD., has now made arrangements to work its Kolchan property in its own name, being the only foreign corporation to receive permission to work in the prohibited zone. The chief features of the work accomplished during 1911 have been the transport and construction of the 7½-cu. ft. dredge and power plant, the trial run of the dredge, and the operation of the stacker-scow plant. The dredge, which operated intermittently for 433 hours between October 25 and December 5, extracted gold to the value of £2750 from 47,089 cu. yd. treated. The operating costs were approximately 6d. per cubic yard. The Pokrovsky plant, which operated from May 14 to October 18, extracted gold to the value of £24,155 from 88,654 cu. yd. treated, or 5s. 5¼d. per cubic yard. The operating costs having amounted to 9½d. per cubic yard, C. H. Munro has recommended, and the board have agreed, that this stacker-scow plant shall be converted at the end of the coming season into a 3½-cu. ft. dredge, at an estimated capital outlay of about £9000. Mr. Munro estimates that this conversion will reduce operating costs to 5d. per cubic yard. He also estimates the amount of ground at present available for dredging at 10,000,000 cubic yards.

[10]Percy, 'The Metallurgy of Lead,' p. 211.

Sintering and Briquetting of Flue-Dust

By Felix A. Vogel

*Flue-dust, to most blast furnace operators, means a troublesome by product, the formation of which should be curtailed, if not eliminated entirely. However, with the increasing use of fine ores, larger furnaces, and high pressure blast, the production of flue-dust is constantly increasing, and amounts annually in the United States to from 3,000,000 to 3,500,000 tons, an exceedingly high tonnage, of which, in the iron industry, a large part has been discarded as valueless. The first efforts were to re-charge the flue-dust into the furnace, either by moistening it down with an excess of water, or mixing it with clay to form balls or pulp, or treating it with lime-water. These methods have been practically discarded, as they failed to produce the desired result. To recover, in the blast-furnace, all the metallic content of the flue-dust, the following conditions should be complied with:

1. The dust should be agglomerated into lumps about the size of furnace-coke, so that it will help to carry the burden and facilitate the flow of the gases.

2. The agglomerated material should be strong enough to carry the burden without disintegrating; it should be heavy so as to decrease its volume, and it should be sufficiently porous to permit the furnace-gases to penetrate fully. Under no condition should the surface be glazed.

3. It should contain all of the valuable constituents of the dust, such as coke, iron ore, lime, etc.

4. It must stand handling, without undue breakage, and should not produce more than 5% of dust.

5. It must stand the weather.

6. It must not disintegrate in the blast-furnace before being greatly or totally reduced.

7. It must submit to easy reduction without requiring additional fuel.

8. It must not contain substances detrimental to blast-furnace operations.

9. Its cost of production must be low.

Iron blast-furnace operations, by the use of such agglomerated material, will profit by:

1. Regular steady operation.

2. Increased burden, increase in the yield and metal produced.

3. Decrease in the consumption of coke.

4. Decrease in the production of flue-dust.

5. Decrease in the cost of producing pig iron.

In order to obtain these results, American and European metallurgists have followed two different lines. In the United States it has sufficed to save the iron content only (though not in the best possible form), while abroad the endeavor has been to make a high-class product which would meet all the conditions above enumerated.

A number of processes have been evolved in the United States, generally known as agglomerating and sintering processes. They are based on fritting together the particles of ore by heat, the binding action being due to the formation of silicates, mostly of iron. When the coke has not been eliminated mechanically from the dust, it is burned out, leaving ashes in the agglomerated material, which increases the formation of silicates of iron or glazing material. In some cases, however, more fuel is added to the flue-dust, which, naturally, further increases this drawback. The nodulizing process, the oldest process in the United States, has been in successful operation for a number of years. Flue-dust is treated either directly, or it is previously submitted to a magnetic separation to eliminate coke and lime. This is done to facilitate the subsequent nodulizing operation, which is carried on in a slowly rotating cement-kiln from 80 to 120 ft. long. From 200 to 300 lb. of finely powdered coal is used per ton of finished material, the coal being blown into the kiln. Gas and oil have also been tried with more or less success. The heat produced is considerable, and difficult to control, the semi-soft material formed consisting of iron ore particles and slag, which, by the revolving action of the kiln, is balled together in nodules of various sizes from a pinhead to that of a cannon ball which are usually quite dense, often fused, and glazed. They contain from 60 to 67% of iron, which makes them quite attractive from the furnace-man's point of view. To make nodules, an elaborate and expensive plant is required, the operation of which is more or less difficult and costly.

The Huntington-Heberlein pot process, which has been used with good results in the roasting of pyrite cinders, has been recommended for the fritting of flue-dust. The resulting fritted material is of more or less cellular structure. However, this would not be an advantage, as the surface would be largely glazed, rendering it impermeable to gases, and would have to be removed in the blast-furnace at about smelting heat. The process is somewhat simple, requiring stationary iron pots fitted with a perforated false-bottom through which the air is blown into the charge. The equipment is cheap; the operation, however, is not continuous, which makes it expensive.

The Gröndal briquetting process has also been applied to flue-dust. The flue-dust, either moistened, or after the elimination of the coke and stone, is pressed into bricks which are subsequently fritted at high temperatures. To facilitate the operation it was found necessary to eliminate the coke; this, however, increases the cost. The separated coke is of little value, since it contains many impurities. The presses used are ordinary brick-presses. The bricks are carefully placed in layers on cars, which are run into long kilns about 170 ft. long, where they are submitted to high heat, gas being used for the purpose. The platforms of the cars are built of firebrick and form the bottom of the kiln. The highest temperature, about 1300° or 1400°C., is reached in the centre of the kiln, the highly-burned briquettes working gradually toward the cooler end of the kiln, where they are finally unloaded. The operation lasts about 7 hr. The resultant briquettes contain 65 to 70% of iron with practically no impurities, these having been eliminated. No ashes are left by the fuel. The briquettes are only slightly fritted, are very porous and friable, and make a high-class material for use in an open-hearth furnace. The manufacturing of Gröndal briquettes is expensive, necessitating a costly plant, which has a limited output. A ton of flue-dust will produce about two-thirds of its weight in briquettes.

Quite recently the Dwight-Lloyd process has been applied to the sintering of flue-dust. The material is submitted to internal combustion in layers of from 5 to 7 in. thick. It is fed on an endless conveyor formed of iron pallets or grates. After the fuel therein contained has been ignited by means of a gasoline torch, or some other device, the air is drawn through by suction. The operation lasts about 20 minutes. A good deal has been published of late in regard to this process. It is claimed that the required plant is not costly, while the operating expenses are considerably lower than in the previous process. The resultant sintered material is not homogeneous and, while a large portion of it is of cellular structure, it is glazed on the surface, which makes it quite difficult to reduce in the blast-furnace.

The Greenawalt process uses much the same apparatus as the Heberlein pot, but air is drawn through the charge similarly to the Dwight-Lloyd process. The sintered material from these various processes is expensive on account of the loss of carbon and, with the exception of the Gröndal briquette, is not of good physical structure and is usually glazed on the surface. The briquetting of flue-dust has been more practised abroad than has the sintering.

In the lime process the flue-dust is mixed with from 5 to 10% of hydrate of lime, and, after briquetting, the material is exposed to the air for a certain length of time, so that a carbonate is formed which is the binding medium.

*Preliminary edition of a paper presented before the American Institute of Mining Engineers, New York meeting.

This binder will eventually act as flux and replace a certain amount of limestone. The process, while having decided advantages, is quite cumbersome and costly, as the briquettes must dry from two to four weeks under cover. The Pioneer process uses sulphide pitch (obtained from the sulphide pulp mills) as a binder. It is an organic substance, rich in carbon and hydrocarbons, which will burn readily and thus increase the calorific value of the material. The flue-dust is pressed into briquettes with from 4 to 8% sulphide pitch; they are quite hard and give fair results, but the process is expensive. The Ronay process does not use a binder. The flue-dust is submitted to a very high pressure in a specially constructed type of hydraulic press; the resulting briquettes can be handled immediately, and have proved very satisfactory. The process requires an expensive plant, however, increasing the operating cost.

The Schumacher process does not use what may properly be called a binder, but is based on the latent cementing actions existing in fresh flue-dust and which are made active by the presence of a small amount of a catalytic substance. Thus 0.25% of magnesium chloride mixed with fresh flue-dust and from 6 to 10% of water, pressed into briquettes, will create a strong reaction, noticeable by the considerable heat developed; the briquettes will be perfectly set and hard within a few hours. The process is very simple, an ordinary pug-mill being used in which to mix the material, which is subsequently pressed into briquettes in a toggle-press and then loaded on cars to allow them to set. Some flue-dust will react so strongly that a large amount of ore or coke breeze may be added to the briquettes; in these cases the flue-dust acts as a binder. The Schumacher process requires an inexpensive plant, and the cost of manufacturing is low. It is extensively used abroad and has replaced some of the other methods. The briquettes of all-agglomerated materials have given most satisfactory results abroad and highest returns and values to the blast-furnace operators.

Australian Gold Output

The decline in the gold output of Australia proceeds apace. It began in 1903-4, and has continued ever since. In 1903 the output amounted to 3,836,095 fine oz.; in 1904, to 3,742,549 oz.; in 1905, to 3,660,095 oz.; in 1906, to 3,444,606 oz.; in 1907, to 3,181,728 oz.; in 1908, to 3,074,315 oz.; in 1909, to 2,967,352 oz.; in 1910, to 2,717,715 oz.; and in 1911, to some 2,481,000 oz. The figures for 1911 are as yet only approximate, for the reason that the output for the last quarter in Tasmania has had to be estimated, and nothing but probabilities can be considered in regard to the returns from South Australia and the Northern Territory. If the estimate for 1911 be correct, and it assuredly is not far wrong, the decline amounts to 237,000 oz. in twelve months, 486,000 oz. in two years, 964,000 oz. in five years, and 1,355,000 oz. in eight years; in other words, the drop, when put on a percentage basis, amounts to very nearly 9% on the previous year's output, and to over 35% on the output for 1903. For the production to have declined more than one-third in the short space of eight years is very serious indeed, and perhaps not the least serious feature of it is that the decline is not confined to particular localities, but is general throughout the Commonwealth. Thus, turning to the figures for the various states, though Western Australia is once again enormously ahead of all its rivals, the decline even in this state has been steady, amounting to over 17% in three years. Victoria, whose total of 503,541 oz. compares very unfavorably with the 1,370,867 oz. of Western Australia, has suffered in the period a still more serious drop, equal to about 25%, and the condition of the industry in this state is beginning to give serious cause for anxiety. In Queensland, which holds the third place, with a return of 381,845 oz., the decline is practically in the same proportion as that of Western Australia. In New South Wales, whose output of 181,821 oz. entitles it to fourth place, the drop is one of nearly 20%. Tasmania has suffered more than any of the others, a falling off amounting to 42%. The South Australian and Northern Territory totals are not available, but in all probability they also show declines. But, serious as is the drop shown in this three-year period, it is much heavier when the comparison is made, not with the figures of 1908, but with those for each state's best year of the past decade. Considering it in that light, Western Australia's decline amounts to nearly 34% in eight years, Victoria's to nearly 35% in five years, Queensland's to nearly 43% in eight years, New South Wales to about 34% in six years, and Tasmania's to more than 55% in six years. As for South Australia and the Northern Territory, the former's output dropped from 7111 oz. in 1909 to 6592 oz. in 1910, and the latter's from 5685 oz. in 1909 to 5111 oz. in 1910. The figures for 1911 will be available in the dim and distant future. It will not be far wrong, probably, to estimate about 11,000 oz. for the two. But it is not only absolutely that the Commonwealth figures of gold production have of recent years been so unsatisfactory. The unsatisfactoriness is even more marked by comparing the output to that of the world at large. In 1901, the proportion of the world's gold that came from the Commonwealth was no less than 26.26%. Since then, it has steadily declined till in 1910 (it need hardly be said that the world's returns for 1911 are not yet available), it stood at only 12.26% of the total. That is because, while the Commonwealth's output has declined from 3,297,228 oz. in 1901 to 2,717,715 oz. in 1910, the production of the rest of the world has increased during the same period from 9,260,000 oz. to 19,457,225 oz.; so that, while Australia has gone back materially, the output of the rest of the world has more than doubled. It would be agreeable to say that a better year is anticipated in 1912 than in 1911, but in point of fact everything seems to indicate a continuance of the decline. If there be any state that promises to do better this year than it did in the past year, it is Queensland. Except that state, it is doubtful if any will be able to show better figures for 1912. But there is no need for despondency. The country always turns away from mining in its days of general industrial, pastoral, and agricultural prosperity, such as it has been blessed with during the past few years; but when the present spell of prosperity has run its course, as it must inevitably do sooner or later, mining may be trusted to come to its own again, new enterprise bringing about new discoveries that will send the returns up with a run once more.—*Australian Mining Standard.*

The Wandiligong Gold Dredging Co., at Bright, Victoria, during the half-year ended January 31, treated 263,253 cu. yd. of gravel, of which No. 2 plant treated 134,188 cu. yd. The gold won amounted to 1200 oz., valued at £4909, No. 1 contributing 652 oz. and No. 2 548 oz. To date the company has dredged 132 acres, of which 111½ was treated during the half-year under review, while the total yield to date amounts to 13,628½ oz., valued at £55,512. The total dividends paid amount to £15,210, or £2 10s. 8d. per share, of which 4s. per share was paid during the last half-year.

Of Western Australian gold received at the Perth branch of the Royal Mint during January, more than half (67,257 gross ounces) was supplied by Kalgoorlie, the next most productive field being the Mt. Margaret, which, however, furnished only 14,325 gross ounces, the average of the gold through the state being £3 9s. 1d. per ounce, as against £4 4s. 11.45d., which is the standard value of fine gold. The total production was 95,672.57 fine ounces.

Increasing use of large shafts on the Rand has led to readjustment of underground transportation methods. The tendency now is to concentrate tramming on main haulage levels, handle the ore at main hoisting stations, and do the hoisting through large central shafts. Mules and ponies have never been used to any extent on the Rand for underground haulage, but are now being employed as a stopgap until mechanical haulage can be installed.

Saving the Gold in Beach Sand

By A. H. Harris

Along the beaches of Oregon, sand containing gold and platinum is found. Many efforts have been made to save the fine gold, but failure has usually been the result. Recently, near Newport, a new style of concentrator has been constructed and is doing remarkable work. The machine handles 10 to 12 tons of sand per hour and is operated at a minimum expense. The whole scheme is simple and cheap. On the beach is a 'dead man' which is connected with the engine-house on the hill by two heavy steel cables. Attached to the cables is a bucket like that of a drag line scraper. This is dragged along the beach and picks up about a ton of sand. It then runs up an incline of logs and dumps its load into a 'mill.' The sand falls on an incline, across which runs a stream of water. All the rocks, sticks, and clay are carried off this incline and dumped. The sand being lighter, is carried into troughs. The sand-laden stream then runs into the 'concentrator,' but before reaching it the stream is utilized to turn the 'platinum carpet.'

SCRAPER AT THE BEACH.

CONCENTRATOR.

The concentrator, which is 6 ft. wide at its widest point, is floored first with heavy duck, on top of which are two layers of burlap, on which a quantity of quicksilver is sprinkled. This catches most of the gold; when the burlap becomes black, which is every two hours, it is taken off and washed in a tank containing chemical solution. After leaving the concentrator the stream falls on the platinum carpet. This is a strip of heavy carpet which is revolved slowly in the opposite direction to the flow of the water, and which picks up most of the platinum. It is washed in the same manner as the burlap from the concentrator. The stream then runs over an ordinary tailing screen and a little sand containing both gold and platinum is caught there. The tailing and the sand from the washing tank are re-concentrated by being run through a second and much smaller concentrator. Each 50 lb. of the last reduction represents a ton of the raw material. From this an amalgam is obtained and the gold and platinum retorted in the usual manner.

Electric Smelting of Copper Ores

Smelting experiments lately carried out in Germany with strongly arsenical sulphide copper ores in the electric furnace, fully described in *Metallurgie*, are of considerable interest to copper producers. The ore used contained 20.3% SiO_2, 10.1% Cu, 27.10% Fe, 9.45% Al_2O_3, 9.25% As, 0.48% Mn, 15% S. After being roasted from eight to nine hours, the ore had the following composition: 22.5% SiO_2, 10.5% Cu, 34.6% Fe, 11.5% Al_2O_3, traces of As, 0.5% Mn, 1.5% S. The carrying out of reaction smelting between ore and roasted material in an electric shaft furnace showed that the matte produced was impure and that the slag carried too much copper. Further experiments demonstrated the easy feasibility of smelting the slag in conjunction with the recovery of the arsenic content. The matte obtained was free from arsenic and contained 21% Cu, while the slag held only 0.15% Cu, and the As recovery amounted to 65 per cent.

January Gold Output, Australasia

The following returns of gold yields from Australasian mines for January are given by the *Australian Mining Standard*:

Western Australia.—The output was 106,370 fine oz., valued at £451,830, as compared with 119,498 fine oz., valued at £507,595, for January 1911, the decline being 13,128 fine oz., valued at £55,765.

New South Wales.—The usual return furnished by the Under-Secretary for Mines shows that the yield recorded for January was 15,085 crude oz., equal to 12,906 fine oz., valued at £54,821, as compared with 16,516 crude oz., or 13,397 fine oz., valued at £56,906, for the same month in 1911, showing a decrease of 491 fine oz., or £2085 in value.

Victoria.—The production of gold for January was 36,178 gross oz., or 33,787 fine oz., valued at $143,519. Compared with the yield for January of last year, this was an increase of 2262 fine oz., valued at £9608.

New Zealand.—The January production of gold amounted to 35,875 gross oz., or 33,916.25 fine oz., valued at £144,067, as compared with 49,566 gross oz., or 46,086.5 fine oz., valued at £195,783 for the corresponding month last year, the decrease being 13,691 gross oz., or 12,175 fine oz., valued at £51,716. The silver produced in the Dominion during January 1912 amounted to 9464 oz., valued at £946, as against 114,845 oz., valued at £11,530 for January 1911, or a decrease of 105,381 oz. of a total value of £10,584.

The gold ore treated at Arltunga, Northern Territory, and at the Winnecke mill during November was as follows: Arltunga mill: 66 tons 15 cwt., which yielded 80 oz. 60 dwt. 5 gr., valued at £303 14s., the average extraction per ton being 1 oz. 4 dwt. 1 gr., or in money value equivalent to £4 10s. 11d. Winnecke mill: 28 tons 3 cwt., which yielded 33 oz. 8 dwt. 11gr., valued at £132 10s. 4d., the average extraction per ton being 1 oz. 3 dwt. 17 gr., or in money value equivalent to £4 14s. 1d.

February production of the Nipissing Mining Co. amounted to 385,666 oz. of silver valued at $226,419, which compares with 406,826 oz. in January and 407,114 oz. in December. During the month there was shipped ore valued at $545,559. This figure was exceptionally large, owing to the low shipments of $113,647 worth of ore in January.

Gold has been found at Carrizal, about five miles from Putu, according to a report from Talca.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Transportation of Tailing Through Pipes

The Editor:

Sir—I have been much interested in several articles which have appeared in your journal concerning the transportation of battery pulp through iron pipes for great distances, and as data on this subject are rather scarce, probably the enclosed item, which was very kindly sent to me by T. J. Grier, superintendent of the Homestake Mining Co., at Lead, South Dakota, will prove of general interest to your readers.

HOMESTAKE MINING CO. DATA OF FLOW OF TAILING IN PIPE.

	Lead Sand Line.	Central City Tailing Line.	Lead Slime Line.
Diameter of pipe	12 in.	8 in.	12 in.
Thickness of pipe	9 16 in.	9/16 in.	9/16 in.
Average grade	Part at 5%	1¾%	1½%
	Part at 2½%		
Bends in line	The pipes generally follow the contours of the hills; the sharpest curve is 22½°, a standard elbow for flanged C.I. pipe being used.		
Fineness of tailing	30% on 100-mesh	25% on 100-mesh	100% through 200-mesh
	25% on 200-mesh	20% on 200-mesh	
	45% through 200-mesh	55% through 200-mesh	
Water in pulp	70 to 75%	85 to 90%	65 to 70%
Solids per 24 hours	1950 tons	450 tons	1100 tons
Pipe runs	About ⅓ full	Full	
Wear of line	(It is customary to turn pipe through about 120° when bottom is worn thin; thus the pipe will be used until three lines of wear have been developed.)		
	On 5% grade, worn out in 2 years.	In use 8 yr. without turning.	In use 5 yr. without turning.
	On 2½% grade, worn from 9 to 10 yr.; most of line still in use after 11 yr., but badly worn.		
Remarks	Grade has been reduced to 2½% throughout, and new pipe 1 in. thick recently installed, for use in another month.		

The data are particularly interesting on account of the fact that the experience covers a period of eleven years.

S. B. CHRISTY.

Berkeley, California, March 20.

Cyanide Regeneration

The Editor:

Sir—In the article on 'Cyanide Regeneration' by George Nicholl in the *Mining and Scientific Press*, March 16, 1912, there are some statements, apparently quoted by Mr. Nicholl, which I believe are open to discussion.

Descriptive of the process patented by Isaac Anderson and Michael Scanlan, it is stated that, "This process is based upon the fact that when sulphuric acid is added to a cyanide solution of the precious metals *in which sulphides and chlorides are present*, the sulphuric acid so added will combine with the potassium of the potassium cyanide to decompose the double cyanides formed by the action of the potassium cyanide on the precious metals, and *the metals freed from combination with the potassium cyanide will then combine the sulphur and chlorine present to form insoluble sulphides and chlorides, which will be precipitated*, leaving the cyanogen in the liquid in the form of hydrocyanic acid, *or in combination with the radicals with which the sulphur and chlorine have been combined. The precious metals having been precipitated as chlorides or sulphides*, the superabundant liquor can be decanted off, and the potassium cyanide may be regenerated by decomposing the potassium sulphate formed by the action of the sulphuric acid from the solution. The decomposition of the potassium sulphate and the removal of the sulphuric acid may be readily accomplished by introducing lime into the solution and *decanting off the precipitated gold and silver*, the lime so added causing the decomposition of the potassium sulphate with the formation of insoluble calcium sulphate and simultaneous regeneration of potassium cyanide. In the operation of this process, it was claimed *a regeneration of 90% of cyanide could be effected.*" The italics are mine.

Two or three years ago I made some experiments upon cyanide regeneration with the use of sulphuric acid, and, as Mr. Nicholls states, practically rediscovered the essential features of the process accredited to Messrs. Anderson and Scanlan, as, at that time, I was unaware that any previous experiments had been made along the same lines. Consequently I am quite interested in any articles upon the subject, and usually regard them rather critically. I realize, however, that the practical value of the process in comparison with processes of wider adaptability and greater proved utility, may not justify such a lengthy contribution.

Certain conclusions which I based upon the experiments mentioned are somewhat at variance with statements made in the paragraph quoted. For instance, I do not believe that the presence of sulphides and chlorides is necessary to effect the precipitation of the heavy metals from a cyanide solution when sulphuric acid is added. If the sulphides and chlorides of the heavy metals are to be inferred, they would hardly remain as such in the cyanide solution, but would enter into chemical reaction therewith, possibly as follows:

$$2CuCl + 2KCN = Cu_2(CN)_2 + 2KCl$$
$$\text{or, } 2CuCl + 4KCN = K_2Cu_2(CN)_4 + 2KCl$$

In the presence of chlorides or sulphides of the alkali metals, the ultimate result, at least, of the reaction occurring upon the addition of sulphuric acid, I believe, would be the same as though they were not present, presumably

$$K_2Cu_2(CN)_4 + H_2SO_4 = K_2SO_4 + Cu_2(CN)_2 + 2HCN$$

This brings us to the statement regarding the precipitated

metals and their chemical form. The results of my experiments, the equation just cited, and other data led to the conclusion that they are cyanides; in the case of copper, probably $Cu_2(CN)_2$. In support of this conclusion, I made a number of tests upon the precipitate by the process, treating a known quantity with acid in a stoppered flask. A tube leading from this flask conveyed the gases arising upon digesting the precipitate in acid, through a beaker of NaOH solution. Upon the conclusion of this treatment, titrations of the NaOH solution with silver nitrate showed sufficient cyanogen present, after making allowances for experimental error, to indicate that the reaction is as cited.

It further appeared that practically all of the cyanogen released remained in the solution in the form of hydrocyanic acid, rather than in any more stable form, as the odor of this acid was noted and, upon agitation or long standing, the available cyanogen content decreased, until, in time, it was practically nil, the decrease being in direct ratio to the amount of agitation or length of time the acidified solution stood exposed. Nor would the subsequent addition of acid to break up any cyanogen compounds which may have formed serve to restore any of the original strength of solution in available cyanogen. It therefore seemed fair to surmise that practically all of the released cyanogen remained in the solution in a volatile form.

In my experiments it was noted that an almost complete removal of the gold and silver from the solution was effected with the precipitation of the baser metals, and assays of the precipitate showed the precious metals present therein in the quantities and proportions one would expect in that case. No attempt was made to isolate them in the form thrown down from the balance of the precipitate or to determine in what chemical form they are precipitated. As they are soluble in cyanide solution in a manner similar to the baser metals, it is not unreasonable to infer that the reactions which cause their precipitation and the resultant precipitate are analogous to those of the baser metals. In regard to the statement that the precious metals are precipitated as chlorides or sulphides, one would suspect a misquotation.

From the paragraph quoted, I gather that lime is added before the precipitate produced by the acid is removed. In that case, as my experiments indicated, the lime would neutralize the acid present and restore the hydrocyanic acid to a stable and available form, either as calcium cyanide, or, more probably, as potassium cyanide, by breaking up the potassium sulphate as described. This potassium cyanide, in turn, would re-dissolve the precipitate wholly or in part, dependent upon the length of time of contact. One would merely have moved in a circle, with the net result of the loss of some available cyanide, due to the escape of hydrocyanic acid during the process, and the loss of the acid and lime used. I found it wise to effect the removal of the precipitate as completely as possible before the treatment with lime. It is further stated that a "regeneration of 90% of cyanide could be effected." If the general equation of the reaction cited is correct, the possible theoretical saving, based upon the cyanogen in the solution, not that originally used, is not over 50%, unless the precipitate, which contains the remainder, is treated.

In conclusion, permit me to state that the deductions here given are based primarily upon my individual experiments, aided by a limited bibliography dealing in an unsatsfactory manner with the reactions occurring in cyanide solutions, and, furthermore, commercial practicability rather the requirements of chemical research dictated the methods employed, consequently I may have overlooked some salient points which might be obvious to others better informed upon the subject. I am sending this contribution in the hope that, if such is the case, criticisms will be forthcoming. I might add that I was granted a patent upon the process as I worked it out, application for the same having been made before I learned of the experiments performed by Messrs. Anderson and Scanlan, consequently there may be some essential undetected differences in our methods.

R. P. WHEELOCK.

Kingman, Arizona, March 22.

The Mine-Owners' Liability for Accidents

The Editor:

SIR: I find in your issue of March 9 a thought inspiring article from the pen of F. J. Martin, of Angels Camp, in relation to 'Employers Liability and Accident Insurance,' and, if you can spare the space in your columns, I should like to discuss some aspects of the Roseberry Liability and Compensation Law as they relate to the hazardous occupation of mining. This industry stands by itself, and its importance to the state is, as Mr. Martin points out, very great, and deserving of careful consideration. But it will be impossible to treat a subject of such surpassing importance within the limits of a single article, and so, with your consent, I shall be glad of an opportunity so far to trespass upon the hospitality of your columns as to furnish a series of short letters upon the Roseberry law, with especial reference to the mining interests of California. It will be a necessary prerequisite for understanding what is to follow, to lay a foundation of succinct statement as to what the Roseberry law is and what it undertakes to do, as well as to set forth the fundamental reasons why it undertakes to do the things that it does.

By the way, mining divides with seafaring the honor of furnishing the impulse which sent the world toward the compensation system of caring for industrial accidents. It was early noted on the continent of Europe, and in Great Britain, that these two industries contributed very largely to the pauperism of crippled men and their dependent women and children, and, more than a century ago, parliaments and imperial councils began to say to employers engaged in these occupations: "See here, you are hurting a great many men and throwing very heavy burdens upon the poor rates. You must take care of your own killed and wounded and those dependent upon them, and not leave them for others to care for," and they did it, at least partly. If they did nothing else, ship-owners and mining companies established hospitals and relief funds, mainly paid for at first by deductions from the wages of their workers, but added to more and more by the owners as the years went by until public and official sentiment settled down to the conviction that each industry should be made to care for its own killed and wounded and those dependent upon them; the corner-stone of the compensation theory of dealing with industrial accidents.

First enunciated with relation to these two, perhaps the most hazardous of all industries except that of wrecking old buildings, the principle was applied to the railroads when they came into being, to mill and factory workers when the high-pressure engine had revolutionized industry, and so on, extending from industry to industry in the order of their respective degrees of hazard, until, in all Europe and Christendom generally, outside the United States, practically all industries and occupations came under the 'compensation' theory of caring for industrial accidents. So it may be perceived, on investigation, that this Roseberry law, which at first seemed so new a thing to be hurled unannounced upon the industries of the state, really is not a new thing at all, but only new to those of us who did not happen to know about it. It was long, very long on the way, and very much more tardy in America than is creditable to us Americans.

Now the Roseberry Liability and Compensation Act is a two-part act. Part I consists of the first two sections and has to do with liability in damages for injuries inflicted as a result of negligence. Part II has to do with compensation for accidents without regard to negligence and requires twenty-nine sections to set the matter out *in extenso*. Every employer in California is doing business under one or other of these two laws, for they are in fact two separate and distinct laws, although grouped together in one legislative act. Each such employer must determine for himself which of these two masters he will serve. He cannot well serve both, and he cannot choose to serve neither and do business in California. It is 'up to him' to say which. If any employer does nothing about it, he is under the law of liability in damages for injuries inflicted be-

cause of somebody's carelessness, or, as it is generally termed, negligence, and will so remain until he does do something about it. If, after investigation, an employer concludes that it will be better, on the whole, to pass from under the law of 'negligence' to the law of 'compensation', all that he has to do is to notify the Industrial Accident Board, Pine and Sansome streets, San Francisco, to that effect, and that Board will place him under compensation in five minutes, and there he will have to remain for one year.

A great deal of misapprehension has existed in the public mind on this point, more especially among farmers, perhaps, but too prevalently among other employers and employees generally throughout the state. They have supposed that the Roseberry law consisted wholly of its 'compensation' provisions, and that the amendment to the state constitution, adopted October 10, 1911, giving the legislature power to make such a law compulsory, did in fact, by virtue of its adoption, make the compensation provisions of that law compulsory upon all. Such is not the case. That amendment only gave the legislature power to compel, but it has not yet exercised that power and ought not to exercise it until the people of the state have become thoroughly familiar with the law and its purposes, and also not until the statute has been perfected in numerous incidental but important details and in the light of actual experience in its practical application to human affairs. The compensation provisions of the Roseberry law are still elective, and whoever has not elected to do business under them is not under them, and they are, to him, as though they did not exist. This is not quite true of the 'Liability in Damages' provisions. They are compulsory upon all who do not elect the compensation provisions, and they were very greatly changed by the Roseberry act; but of that more in a later installment of this series.

There is a sense of humiliation in the thought that great, progressive, free America should be thirty years behind Europe in grappling with this, perhaps the greatest reform movement in economic history since feudalism gave place to free industry, and yet the reason why is not far to seek. With something like a million persons a year pouring into our land from over seas we have, so to speak, had 'men to burn,' whereas Europe, feeling the drain of its labor to America, has had to conserve its working population. It was the great Bismarck who laid down and made effective the profound truth that every able worker is a national asset and as necessary to be taken care of, if the Fatherland would grow rich, as that horses and mules, cattle and hogs, be taken care of; and so he established a universal and compulsory insurance system that virtually provides care for every German toiler from the cradle to the grave. But if in America a workman was killed there was always another to step in and take his place, and so why bother to take care of men any more than of our (supposedly) inexhaustible acres of soil and timber, coal and iron? Rounded up by Roosevelt and his conservation cry, we have discovered that nothing is inexhaustible, neither acres, nor soil, nor timber, nor coal, nor men, and conservation becomes the watchword all along the line, from broad acres to toiling men and women. This, then, is the reason why the compensation issue is upon us, and why and how it came to be a 'burning issue' of our time.

A. J. Pillsbury.

San Francisco, March 25.

Slime Filters in New South Wales

The Editor:

Sir—In Alfred James' able 'Review of the Cyanide Progress for 1911', he states that the Ridgway slime filter has ousted a "grouped frame filter of well known type in New South Wales." He is certainly misinformed. There are only two vacuum slime-filter plants at work in New South Wales at the present time. One is at the Occidental mine, Cobar, being the first Moore filter plant erected in Australia, and still working most successfully; and one No. 2 type Ridgway is working on some residues at the Mitchell's Creek mine, Wellington. The only other vacuum filter plant that was erected in this state was a Wilfley drum, at the Myall's and Peak Hill mine, but was found unsuitable. The largest gold mine in this state, the Mount Boppy, is now erecting a new slime plant and adopting the Moore filter.

A. J. Chapple.

Parramatta, New South Wales, February 15.

Treatment of Matte From Mill Clean-Up

The Editor.

Sir—I have read with considerable interest the article by M. W. von Bernewitz in the *Mining and Scientific Press* of March 2. I also tried the process of treating matte by reducing it with potassium cyanide soon after reading A. E. Drucker's article, but I did not like the process, as it yielded a thick pasty slag, rich in gold and silver. I am operating a cyanide plant and treating about 80 tons per day of mill tailing and canvas sweeps. I dip my zinc-shavings in a solution of lead acetate when charging them into the precipitating-boxes, hence my melt contains quite a quantity of lead in addition to the usual matte. My process of treatment is as follows: I clean up twice a month and the acid-treated precipitate is melted in two furnaces, using No. 25 plumbago crucibles. The result is about 15 lb. of lead, and matte, in addition to the precious metals. This I oxidize and refine in about three hours time, by using a modification of what Mr. von Bernewitz terms bessemerizing; but which I think might more properly be called crucible cupellation.

I have a ⅜-in. air-line from the air-compressor, ending with a valve to which is attached about 6 ft. of ½-in. rubber hose, and 4 ft. of ¼-in. pipe for a nozzle. The pipe-line runs along the roof of the melting-room, so that the hose and nozzle come down from above, and are made adjustable by means of a rope that is fastened to the air hose and to one of the rafters. The melting pot is covered with a plumbago cover, having a small slot in one side to admit the end of the pipe, which is adjusted so as to enter the melting pot at an angle and is kept about 4 in. above the surface of the melt. I use a large quantity of air under about 10 lb. pressure, and add borax and silica to absorb part of the metallic oxides and protect the pot. The melt gives off dense fumes of zinc, lead, and sulphur, so that it is impossible to remain in the room even with the windows open in addition to top ventilation of the building. I shut the air off and skim off the slag when it gets thick enough to interfere with the cupellation of the base metals. When the matte and lead are oxidized the dense fumes cease and the melt is poured. This gives a bar about 550 fine in gold and 250 in silver, the remaining base being chiefly copper. This can also be removed by long-continued blowing and fluxing, but is unprofitable.

I once made a lot of clay pipes about 3 ft. long and tried refining by Rose's method of blowing air into the metal, but it bubbles violently and spatters metal all over the room if a strong blast is used, while if only a small quantity of air is admitted it works much slower than when using a strong blast on the surface of the melt. When refining I keep the furnace covered, with the exception of a small opening to admit the ¼-in. pipe into the furnace, and through the hole in the crucible cover, and maintain a high temperature, as the matte will not burn at a low one.

Wilter E. Darrow.

Amador City, California, March 8.

Copper production in the Transvaal for January consisted of concentrate of the value of £4453. In the same month 234 tons of tin concentrate was shipped, valued at £26,682.

The Great Cobar G. M. Co. (New South Wales) metal output from January 3 to 31 was: Copper produced at Cobar, 42 tons, containing by estimation 2250 oz. gold and 10,751 oz. silver.

Special Correspondence

RHODESIA

DEPRESSION IN SHARES. CAM & MOTOR CO. IN GOOD CONDITION. DIVIDEND NOTES. GEOLOGICAL SURVEY TO PUBLISH REPORTS.

Rhodesian stocks in common with South African shares generally have been much depressed. The Amalgamated Properties of Rhodesia affair has exerted a depressing influence on the market, and it is an open secret that at several of the leading mines of Southern Rhodesia the position at present is far from satisfactory. At the Eldorado, for instance, development of late has been discouraging and it is freely rumored that the pay-shoot is contracting as work proceeds in depth. Report has it too that in the lowest levels of the Globe & Phoenix conditions are unsatisfactory. Add to this the fact that the Giant Reef has not yet been re-discovered. These are the most profitable three mining projects in Rhodesia, and that Rhodesian shares generally should be depressed because of unsatisfactory developments in their lowest workings is not to be wondered at. Then again, the Surprise mine, near Selukwe, for which such good things were anticipated is virtually on its last legs and will probably be operated on a tributing basis by a small syndicate of working owners. Numerous properties in the Salisbury area have also been closed

MILL AT GIANT MINE.

down, and in a few instances have been forced into liquidation.

The brightest spot in the mining industry of Southern Rhodesia today is undoubtedly Gatooma, where the Cam & Motor Co. is opening up a huge body of ore of more than average value. Development in depth is satisfactory, and in the opinion of many competent judges the Cam & Motor is destined to become the second mine of the country and will rank next to the Shamva mine at Abercorn in point of size, production, and profit. At the end of September the ore reserve in the Cam & Motor was estimated to amount to 700,000 tons, of an average assay value of 47s. 2d. per ton, the total gross value thus amounting to £1,653,000. During the past few months this tonnage has been largely increased and today there is probably over a million tons of a gold content averaging close to 11 dwt. per ton exposed in the mines. As to the Shamva, the last statement regarding development placed the reserve at 1,555,000 tons of 4.77 dwt., 'reduced value.' Under C. W. Terry's management development work is being rushed. H. A. Piper, consulting engineer for the company, recently arrived in Bulawayo from England, and his return to Rhodesia is expected to indicate increased activity. An encouraging feature in connection with the Rhodesian mining industry is the increase in dividends. Not only was the 1911 gold output a record production, but, what is of greater importance from the point of view of investors, the profits distributed last year were greater than in any previous year. The Globe & Phoenix mine paid out 160% or £320,000, as compared with 125%, or £250,000 in 1910. The Giant Mines distributed 10%, as compared with 15% in the previous year. The Lonely Reef company paid its first dividend of 10%, on a capital of £271,000 and the Selukwe Columbia 10%, on £110,000. The Eldorado Banket mine maintained a distribution of 30%, or £90,000, and the Rhodesian Exploration & Development Co. declared 10%, or £150,749, the same as the 1910 distribution. The total for all companies has been given at £933,422, which compares with £883,829 in 1910, £421,950 in 1909, and £197,837 in 1908. Mention may also be made of the fact that the Consolidated Gold Fields, which has large Rhodesian interests, paid out £600,000, equal to a dividend of 30%, for last year.

Much satisfaction is expressed at the announcement by H. B. Maufe, director of the Geological Survey of Southern Rhodesia, that, in the future, reports will be regularly published and that special monographs relating to vital economic problems will be issued. It is now 15 months or more since Mr. Maufe arrived in Rhodesia to take over his important duties, yet up to the present the Government has not seen fit to issue any official statement. Mr. Maufe has a vast field for his labors in Rhodesia, and he is understood to have already obtained much valuable data. It has thus been very naturally felt that the Chartered company was guilty of a distinct error in keeping the results of the director's work a secret.

ELY, NEVADA

STEPTOE PLANT SECURES PERMANENT WATER-SUPPLY.—GIROUX ACTIVITIES.—BOSTON ELY TO SEEK SECONDARY ENRICHMENT.—ELY CENTRAL MAY RESUME.

Weather conditions for the entire winter have been quite favorable for mining and milling in the Ely district. During the earlier months of the winter there was a scarcity of water for milling at the Steptoe plant, but that has now been overcome by a series of settling-tanks and the pumping back of the water which had passed over the tables. About 4500 gal. of water per minute is now being pumped back and used again, giving a guarantee of an ample water-supply for the present capacity of the plant. The plant is now running at about its full capacity, treating 10,000 tons of sulphide ore per day. The ore comes from the Copper pit, the new Liberty pit, and the Veteran mines of the Nevada Consolidated. The ores from the pits average about 2%, while that from the Veteran mine averages about 3½% copper. All of the ores average about 20c. gold per ton.

The Giroux company, which has been so long in the preparatory stage, will enter the shipping list about May 1, under a contract with the Steptoe Valley M. & M. Co. for treating 1000 tons of ore per day. The Giroux ore averages a little higher in copper content than that of the Nevada Consolidated, and contains about 60c. gold per ton. It is stated that the Giroux company secured a favorable contract for treating its ore, and at the present price of copper will be able to net about $600,000 per year from ore shipment. The Morris shaft on the sulphide zone has been well equipped for handling the output, and all the old workings in that part of the property are being cleaned out and the mines put in shape for heavy production. Development in the Alpha mine of the company's property has been practically abandoned for the present. The Giroux shaft, in which a fire occurred August last, has been retimbered and put in shape to the 1200-ft. level, and the pumps are in operation raising the water from below that level. The water is being lowered at the rate of three inches per day, and at this rate it will be nearly two years before the 1400-ft. level will be reached, barring accidents, after which work will be resumed on that level and the Giroux shaft sunk to a depth of 1800 ft. The tremendous inflow of water is favorably regarded by the management as a guarantee of sufficient water for milling purposes when the company is ready for the erection of its plant and smelter. The Boston Ely company soon will have diamond core-drills in operation on the 1245-ft. level of its

property, to seek the secondary enrichment believed to exist on account of the leaching shown in the big vein above the 1245-ft. level. The management has proved a large amount of low-grade ore, but so far little of it is of a commercial grade. The Ely Consolidated company has decided to continue its Zack shaft on down from the 600-ft. level for a distance of at least 200 ft. It has developed a large amount of good ore above the 600-ft. level, but as the veins still show much leaching, it is considered advisable to go to greater depth with the shaft. A 600-gal. pump will be placed on the 600-ft. level. The shaft will be followed down by Cameron sinkers as it attains depth. R. T. Pierce, consulting engineer for the reorganization committee of the Ely Central company, has been spending a few days in the district, looking over the company's property. It is expected that the company will soon resume operation.

LONDON

CARN BREA & TINCROFT HAS ENCOURAGING REPORT.—MYSORE STILL LEADING KOLAR DISTRICT PROPERTIES.—COPPER COMPANY NOTES.

Carn Brea & Tincroft is certainly one of the most cheerful spots in Cornwall at present. The report for the six months ended December 31 shows clearly that at last a 'live' man is in control of operations, and that the whole affair is being regarded and conducted as a business proposition. E. S. King's speech to the shareholders was a distinct change from the type of remarks one usually gets from a Cornish mine manager, for he not only exhaustively dealt with matters which closely concerned the shareholders, but touched on such subjects as Cornish metallurgy, working costs, and his new setting system, all of which are interesting to the County as a whole. This policy of speaking frankly on such matters must surely be regarded as a step in the right direction, and will, I hope, do much to break down the reticence of the average manager and lead him to consider the value of conferences on subjects of mutual interest. During the six months, 41,670 tons of ore was crushed, with a production of 440 tons black tin, or an average recovery of 23.64 lb. per ton. The total receipts amounted to £51,885, or 24s. 10d. per ton milled, while the working cost, exclusive of 5.29d. per ton for capital expenditure, was £47,505, or 22s. 4d. per ton, showing thus a profit of 2s. 6d. per ton, or £5298 for the six months. Another feature of the report is that an intelligible analysis of working costs is given, and I hope the other large mines will follow suit. Below are given the more important figures:

	— Per ton milled. —			
Mining:	s.	d.	s.	d.
Breaking ore	6	11.59		
Trucking and raising ore	1	8.59		
	—	—	8	8.18
Treatment:				
Rock breaking	0	5.02		
Ore transport	0	8.17		
Milling	2	0.18		
Concentrating	1	4.04		
Roasting	0	3.11		
Dressing	1	3.53		
Fine grinding concentrate	0	1.69		
Magnetic separator	0	1.91		
Disposal of residue	0	0.62		
	—	—	6	4.27
Re-treatment			0	6.47
Pumping			2	7.95
General charges			1	4.08
Development			1	10.50
Royalties			0	10.86
			—	—
			22	4.31

The Mysore Gold M. Co. property continues to hold its position as premier mine of the Kolar district of India and the developments still disclose large bodies of ore. The results for 1911 show that the tonnage crushed and the gold extracted both presented record figures. On the other hand, the dividend was less than during the years 1903 to 1907. This fact is explained partly by the lower grade of the ore and partly by the charging of all costs to revenue instead of issuing new shares to meet extraordinary expenditure. The ore crushed during the year totalled 291,477 short tons, and by amalgamation and cyanidation, chiefly the former, gold worth £896,651 was recovered. The working cost was £335,341, royalty £53,201, income tax £26,318, depreciation £13,173, allocation to reserve fund, and £44,344 expended on new plant. The dividend absorbed £366,000, being at the rate of 120%. During the year 31,766 ft. of development work was done, and on December 31, the reserve was calculated at 1,300,369 tons, being an increase of 67,862 tons during the year. The development in depth is extremely satisfactory at many points. Edgar's shaft has been put in commission, and is an important factor in decreasing the cost. It is intended to commence the sinking of a similar shaft in MacTaggart's section. Additional ground has been acquired to the west of the property on the dip of the lode, so as to protect the deep levels.

For several years the Bwana M'Kubwa Copper M. Co. has been searching for a method of treating its carbonate ore. This mine is situated in northwestern Rhodesia, not quite so far north as the more celebrated Katanga deposits. The company now announces that it is about to erect a "plant on the spot to treat 75 tons per day." With the usual contempt for the public shown by Rhodesian companies, no information is given as to the nature of the plant or the process, and specific questions on this point put by me at the offices of the company remain unanswered. I asked whether it was a smelter that was to be erected, or whether a wet method was proposed; as a further alternative I suggested that perhaps the plant was a concentrator and that the concentrate would be shipped elsewhere for treatment. In spite of these leading questions, the reply was invariably that the official circular contained the whole of the available information, and that the office could not commit itself as to the nature of the plant.

Three months ago I recorded that the general meeting of the Famatina Development Corporation, working the copper mine at Chilecito, Argentine Republic, was adjourned for three months in order that R. F. Bury, the director, who was then visiting the mine, should be able to address the shareholders, and also that the board's recommendations as to the future policy should be discussed. The company has now published the new plan for the re-arrangement of capital, whereby the income bonds, profit-sharing bonds, and selling commission are extinguished. The reconstructed company will have a capital of £400,000 in 5s. shares and £200,000 6% debentures. Ordinary shareholders will receive one new share in place of each old £1 share, the total being 563,074. Holders of profit-sharing bonds will receive one new share for every three bonds, the total being 170,338. Holders of income bonds will receive 257,200 shares, and the International Copper Co. will receive 60,000 shares as part purchase of the selling contract. The debentures will be allotted as follows; £156,000 to be exchanged for the present 10% debentures, and £24,000 allotted to the International Copper Co. as the balance of the purchase price, £20,000 remaining in reserve. The report of Hooper, Speak & Co. on the progress at the mine and smelter shows that transport difficulties have continued to seriously interfere with mining and metallurgical operations during the year, and that there are severe losses of the copper and silver during smelting owing to their escape as dust. Walter G. Perkins, late of Steptoe, has recently left for the mine in order to improve the smelting operations. The negotiations of Mr. Bury on the spot have resulted in many reforms, and the outlook is now much more favorable than before.

I have referred before to the absorption of the Einasleigh Copper Mining Co. by the Chillagoe company, in North Queensland. It is now announced that the latter company is about to call up the shilling liability on the 1,160,000 shares, in order to provide additional capital for various purposes. In the first place £10,000 has to be paid as part

purchase price of the Emasleugh property, and further expenditure will be required in connection with the development of that mine; secondly, the damage done by fire to the Chillagoe smelting plant has to be made good; and, thirdly, money is being spent in developing the Mount Mulligan coalfield and providing a railway thither.

The laying of the track of the railway between Arica on the Chilean coast and La Paz in Bolivia was completed on March 4 and the line should be ready for traffic in six months time. The railway is 275 miles long and in passing over the Andes rises to an elevation of 14,000 ft. above the sea. The new line will be of great benefit to the tin industry in the neighborhood of La Paz and Oruro, as it will afford a short cut to the seaboard, and avoid the roundabout and expensive routes to Mollendo in Peru and Antofagasta in Chile.

It is announced that the Aroa Copper mine in Venezuela has been successfully reopened, and that the syndicate having the matter in hand is intending to ask for public subscriptions in order to provide the necessary capital for extending the scale of operations. This mine was worked from 1866 to 1894 by the Quebrada company, one of the Matheson, or Rio Tinto and Mountain Copper group, but in 1894 the workings collapsed and the property was abandoned.

The commercial application of nitrogeneous compounds produced by fixation of the nitrogen of the air is proceeding rapidly. Calcium cyanamide or 'nitrolim' is proving acceptable as a fertilizer, and the Alby Carbide company is consequently greatly extending its factory at Odda on the Hardanger fjord, Norway. Hitherto, this company has been producing calcium carbide chiefly for acetylene manufacture and its present capacity is about 32,000 tons per annum. The works are to be extended to a capacity of 80,000 tons. The process used for making cyanamide from carbide was invented by Frank and Caro, and consists of heating the carbide at high temperatures with nitrogen that has been obtained by the fractional distillation of liquid air.

BOSTON

COPPER SITUATION PROMISING.—NEW ENGLAND SEEKS PLACE ON ANACONDA DIRECTORATE.—LAWTON CONSPICUOUS BY QUIETUDE.—LAKE AND OLD DOMINION NOTES.

The copper-metal situation appears to be about all that could be reasonably expected from it from the standpoint of the producers. Despite the talk of the disappointing report by the Copper Producers' Association covering February there has since been an advance of nearly one cent per pound in price. Sales at this writing have been made both in this country and abroad at 15½c. The talk of 16c. copper is now stronger than was that for 15c. copper. When copper was coquetting around 14c., it was staple talk from the producing interests that they were concerned lest the price should run away with the market. That sort of talk was received with mental reservation. Many people have wondered why the copper producers were lying awake nights because of the menace of 16c. copper or better, but such was the line of talk given out by these gentlemen, and it evidently served the purpose for which it was intended.

While the Amalgamated-Anaconda situation is strong the status of the Butte independent companies is equally strong, and this also attracts attention. Outside of Anaconda there are eight active producing independent companies at Butte; North Butte, East Butte, Butte Central, Butte & Superior, Tuolumne, Davis-Daly, Butte-Alex. Scott, and Elm Orlu. Raven, Butte-Ballaklava, and one or two others are active in development.

North Butte has increased its quarterly dividend rate from 30 to 40 cents per share. An attorney here by the name of Barry has been advertising to get correspondence from North Butte stockholders for the purpose of starting a crusade to get strong New England representation on the North Butte board. The market course of North Butte has not commended itself to Boston for several years, and there is a desire to place a New England balance wheel on the company. This desire is largely the same as was the one in the Davis Daly case when Heinze was running that company to suit himself. The New England interests, long suffering to a fault, put up with Heinze's fantastic administration until they could stand it no longer. Then they made a demand for a larger hand in its management, and after being 'stalled' by Heinze for two or three years they finally got what they asked for, including Heinze's abdication. New England interests believe that the control of North Butte lies in the hands of the public—the New England public—and does not reside with the interest that own the largest blocks of stock. They believe that North Butte, like Davis-Daly, has been exploited to some extent for the benefit of other mining properties. The attorney is gathering proxies made out to himself, and the chances are that a lively fight will be started. The New England people plan to send an engineer to make an examination of the North Butte mines. It has been a complaint on the Street that the publicity by North Butte has been tainted. The mining share market will be all the better for the clearing of the atmosphere which the New England investigation of North Butte promises.

The long lapses into silence of Thomas W. Lawson in market affairs are a mystery to the Street. For two or three years Lawson has largely abstained from his customary methods of blatant self-advertising. Can it be that he finds silence to be golden, whereas speech was only silver—or copper? Nobody believes that Lawson has permanently retired or that he has given up the fight—for his own pocket. He has lived a strenuous life, and as he approaches 60 years of age probably feels like slowing down a bit. It is difficult to account for Lawson's silence on any score—save age and natural desire for relaxation. The latest bit of advertising given him is the suggestion that he run as a candidate to the Chicago convention as a Roosevelt man. Politics and finance make strange bedfellows. Lawson, however, has been more consistent as an ardent admirer and supporter of Roosevelt than in any other way which can be recalled at the moment. It would be appropriate for him to go to Chicago as a booster for Roosevelt, and market interests here would be glad to see them doing battle side by side in a convention. It would be worth going miles to see.

Ordinarily, blessings brighten as they take their flight, but with Lake Copper the glow increases as the time approaches for regular shipments. Lake is already selling at double its low selling price of last year and it is steadily moved upward in a favorable copper market. The first week's mill run shows a recovery of 23.62 lb. copper per ton. This mill-run comes from the stock pile, and the management says does not represent the average of the Lake mine. The present management is handling Lake, both as a mine and on the market in a radically different manner from the old regime, when the stock was inflated to $94 per share. Nobody expects to see the stock sky-rocketing again, now that the control has changed, but Lake is regarded as a rich and promising property, though not yet out of the prospect stage, and its career will be watched with great interest. It will begin its regular production period in the early summer.

Now that the sceptre has passed from Harry F. Fay to the St. Mary's Mineral Land Co., a company with a history coincident with that of the Lake district, the public will watch with interest the course of Mayflower. Mr. Fay, as president, mustered up the strongest showing of any faction at the annual meeting, receiving proxies from over 75% of the individual stockholders and represented over 40% of the stock. But with St. Mary's and an allied Stock Exchange interest against him he was outvoted and deposed. The statement was made that with the passing of Fay the spectacular career of Mayflower would come to an end. So far as the tape tells the story, this predicition has come true since the meeting. Mayflower has scarcely held its own in the quotations and has yielded to other stocks in activity, whereas a few weeks ago it held the centre of the stage. However, it is assumed that the program of drilling carried on by Mr. Fay with such brilliant results in the last few

months is to be continued, and it is said that Mayflower and Old Colony, which may be physically classed as one property, though they are separate and distinct companies, will have four drills operating at an early day. The St. Mary's company is a large factor in the Lake mining situation, but its action in taking over the management of a mine is a new departure in its history and will be watched with interest and suspended judgment.

Renewed buying of Old Dominion trust receipts has given rise to some interesting comment. These trust receipts represent a beneficiary interest in the litigation for the recovery of something over $2,000,000 for the Old Dominion company of New Jersey from A. S. Bigelow. This case is now pending before the United States Supreme Court. The Massachusetts Supreme Court decided against Bigelow, and the case is now before the court of last resort for review and final action. But the comment is to the effect that the defendant, Mr. Bigelow, in anticipation of an adverse decision is 'hedging' by accumulating the trust receipts. He formerly was considered a great obstructionist in the Lake district, but has been apparently quiescent there for several years. His mantle seems to have fallen upon Godfrey M. Hyams, who is now opposing Calumet & Hecla's plan to enlarge the milling facilities for Isle Royale.

PORCUPINE

Mild Weather Promotes Development.—North Dome to Enlarge Shafts.—General Notes.

The mild weather has enlivened the district. The properties in northeast Tisdale are, on the whole, proceeding systematically with development, though the management of the Dobie has decided to discontinue operations in North Tisdale for the present. The Hughes property, under the management of Mowry Bates, is continuing development, sinking the shaft to the 100-ft level, and diamond-drilling to seek the orebody underground. The Mulholland, in charge of David Allen, is sinking the shaft to the 200-ft. level, from its present depth of 125 ft. About 350 ft. of driving has been done on the 90-ft. level.

The Crown Chartered Co., under the management of C. W. Dike, is sinking from the 150 to the 200-ft. level, and proceeding with the blocking out of the orebodies at each level. New boilers are being placed, and a seven-drill Rand compressor is being erected. The Scottish Ontario is still closed down, pending the return of Peter McHaren. The West Dome, managed by J. B. Cleveland, is cross-cutting at the 100-ft. level in No. 1 and 3 shafts to find orebodies.

Two diamond-drill holes have been put in 1100 ft. apart on the Dome Extension property, showing good ore along the contact between quartz porphyry and slate. A third hole is being put in midway between these to cut the same contact at a vertical depth of about 450 ft. The cross-cut on the 200-ft. level in No. 1 shaft is being pushed in a northerly direction toward the main Dome vein, the face of the cross-cut showing some good ore. The North Dome, in charge of Bert Wolfram, is cross-cutting and driving in ore in No. 1 shaft. The management plans to enlarge No. 1 shaft, and possibly No. 2 shaft, and then sink to the 100-ft. level. The northeast drift in No. 1 shaft went through 35 ft. of quartz showing free gold.

The Three Nations, under management of J. N. Agrignon, has finished sinking the shaft to a depth of 100 ft., and after cutting out a station and sinking 10 ft. for a sump, will cross-cut to intersect the main vein. The vein dipped out of the shaft at a depth of 42 ft. to the south. From 70 to 85 ft. in depth the shaft cut several quartz stringers, varying two inches to two feet in width, showing free gold. The LaPaline, Porcupine, Xiora, and Porcupine Tisdale are not operating at present, pending the erection of machinery. The Bewick-Moreing interests have discontinued underground work at No. 1 camp, and will continue assessment work on several of their claims. Owing to the cessation of the power from Sandy Falls, the McIntyre management has ordered a plant for operating the mill, among other things a 40-hp. boiler and a high-speed engine. The company will operate the mill by steam in the future.

REPUBLIC, WASHINGTON

Ferry County Against Tariff Reduction.—District Production for January and February, 7222 Tons.—Development Notes.

The Northwestern Mining Convention, held at Spokane in February, struck the keynote of interest in Ferry county in its strong opposition to a reduction in the lead tariff, as proposed in the Underwood bill in Congress; in its condemnation of the Government's restrictions on the utilization of water-power sites, and of the Roosevelt, Pinchot, and Taft policies of Federal conservation of public lands as discouraging national development. As to the lead tariff, while it does not affect the Republic district, it assuredly does every other district in Ferry county.

During the months of January and February the ore shipments from the mines of Republic district amounted to 7222 tons, as follows: From the Republic Mines Corporation, 5195 tons; Knob Hill company, 1080 tons; San Poil Consolidated, 604 tons; Insurgent Leasing Co., 252 tons; and Imperator-Quilp company, 91 tons. The Hope company has straightened the shaft of the Blacktail mine, and equipped it with hoisting machinery. The company is now planning for more extensive development. Since the main shaft of the Surprise mine was completed to the 600-ft. level, a saving of expense has been effected, by direct hoisting through the Quilp shaft. The Surprise mine is now sending out to the smelters five carloads of ore every other day from above the 500-ft. level and a carload daily from below it.

The San Poil Consolidated company expects to have its mill complete and in operation not later than May 1. The Knob Hill company has interseeted the northerly continuation of the Pearl-Surprise vein in the north drift on the No. 4 level of the Knob Hill mine, but found ore of only very low grade. The company lately has been shipping from three to four carloads of ore per week, of an average value of about $100 per ton. The Quilp G. M. Co. has paid its fifth dividend of one cent per share on its capital stock, making a total of $67,500 to date. W. D. Timm, superintendent for the Republic Gold Coin M. Co., has worked alone on its property, the Morning Glory mine, during the winter, following a very narrow streak of ore, which assays $5000 to $30,000 per ton, and another orebody which assays about $1500 per ton. About 20 tons have accumulated and will soon be shipped to the smelter. W. J. Delbridge and associates have taken a lease and bond on the Knob Hill Extension claim, the bond calling for $20,000. The San Poil Consolidated company is putting the San Poil mine in shape for stoping ore, to supply its mill, and is shipping only such ore as is necessarily broken for that purpose—about ten tons per day. The Belcher mine is employing about 22 men and sending from 50 to 60 tons of ore per day to the smelters. The Phoenix G. M. & M. Co., operating in the Curlew district, 20 miles north from Republic, owns three separate groups of claims, but is now confining its attention to the Panama group, on which it is driving a 1500-ft. adit. The old Republic mine, which was bought in by Ferry county at a tax sale, about three years ago, was afterward leased and bonded to the New Republic company for two years, the purchase price having been $40,000, payable in installments. The Rathfon Reduction Co. succeeded the New Republic company and has had the lease and bond extended for another two years. The Rathfon Reduction Co. has worked over the tailing from the mill formerly operated by the Republic Power & Cyaniding Co. on the ore from the Republic mine and is now preparing to put in fine-grinding machinery and treat the ore from the mine. The tailing treatment is said to have yielded a fair profit, but nothing definite can be learned in relation to the milling. Cyrus W. Bradley, president of the Meteor M. Co., is directing work at the Meteor mine, in the Moses district. The ore assays as high as $300 per ton, mostly gold. C. L. Fish & Co. have purchased a mill-site on Hall creek, and will put up a mill for the New York and Montana mines.

General Mining News

ALASKA

The Koyukuk

News despatches report a rush from the Tanana and other districts to the Koyukuk. Hastings & Sebrey, who discovered rich ore last summer, abandoned their prospect shaft, which caved in, and sank a working shaft 200 ft. away. The latter intersected the same rich orebody which the original shaft had cut.

The Ruby City Improvement Association has applied for $150,000 cash from the Alaska Road Commission for the construction of a highway from Ruby to the various creeks in the district. Anderson & Bark found pay-ore recently in their prospect shaft at Dome City.

The Tanana

Press despatches state that the richest gravel ever found in the Tanana valley has been discovered by Smith brothers on the Daly bench at the mouth of Eva creek.

ARIZONA

Cochise County

The Boeckler Mining Co. is planning to use automobile trucks for transporting ore from its property to the station at Rodeo, a distance of 15 miles, says a recent report from Portal. The mine, which is in the Paradise district, formerly was operated by the Old Homestead company. The ore is shipped to the concentrator at Douglas.

Gila County

(Special Correspondence.)——The work of enlarging shaft No. 2 at the Live Oak mine has been completed. The third compartment was added by raising from three different points and the total distance of 925 ft. was accomplished in 40 days. The east drift on the twelfth level at the Superior & Boston has passed out of the ore-shoot in which it has been for some distance. For a distance of 25 ft. the drift was in ore for its full width, but the ore gradually narrowed down and pinched out. Hole No. 1 on the Barney group has been discontinued at a depth of 1450 ft. and is the deepest hole ever drilled in the district. The hole is bottomed in schist formation and is a flowing well. The strong flow of water in the dacite formation at a depth of 960 ft. is sufficient to supply the churn-drilling machines and for domestic use at the camp. Hole No. 3 will be started at once. Hole No. 2 is 370 ft. deep. Work will not be resumed on the Inspiration dam across Pinal creek until the present rains are over. The test mill will be started again in a few days, after the alterations have been completed. Topographic surveys are being made.

Globe, March 29.

Yavapai County

Reports from Prescott state that the Clara Consolidated company is being reorganized.

David Kile, C. J. Kimball, and J. H. Leibold have discovered a vein of vanadium, molybdenum, bismuth, and nickel ore on their property, two miles southwest of Crown King, according to newspaper despatches. The owners will thoroughly prospect the deposit.

CALIFORNIA

Amador County

(Special Correspondence.)—The Lincoln Con. M. Co., of this place, has acquired the Wildman-Mahoney properties from W. J. McGee, the consideration being 200,000 shares of the Lincoln stock, which has been increased from 400,000 shares to 800,000 shares, par value 50c. Stockholders and holders of preliminary certificates who have paid and are paying the company at the rate of 50c. per share have the option, up to May 1, of purchasing from Mr. McGee shares equal to their fully paid stock and preliminary certificates at the rate of 20c. per share, provided they purchase from the company an equal number at 50c. of the shares now in the treasury. If all of Mr. McGee's shares are not taken by May 1, he will return 10% of the remainder, which may be used, if necessary, as a commission fund by the company in selling any of its shares not taken under the present offer. Both the Wildman and Mahoney mines have 10-stamp mills and other equipment. The Wildman has an assay office. It is planned to drive on the Wildman vein from the Lincoln shaft.

Jackson, March 30.

The suit brought by R. H. McGowan against the Original Amador Mines Co. et al., asking for an accounting and the appointment of a receiver, has been dismissed. A stipulation conceded that there was no cause of action against the company, its officers, or the directors. The case was in the Oakland courts.

Work is to be resumed in the South Amador mine as soon as the concrete foundations for the surface machinery is laid. A new 15-ft. vein was discovered recently on the 500-ft. level. C. D. Porter is general manager for the company.

Calaveras County

The East Belt Development Co. has acquired the Tanner mine, near Murphys, and is shipping from the recently

CALIFORNIA BY COUNTIES.

discovered orebody, assays of which run as high as $300 per ton. J. A. Campbell is superintendent for the company. G. S. Taylor has found rich float in his Legal Tender mine.

Kern County

The topographic map of the Randsburg quadrangle lying just south of the Mojave desert in southern California, has been reissued by the U. S. Geological Survey to conform with the revision survey made last year. The field work for the revision was done by T. P. Pendleton. The original map was prepared in 1900. In the map 50-ft. contour intervals are used, and a scale of one mile to the inch. Maps are for sale by the Geological Survey at 5c. each or $3 per 100.

Modoc County

It is reported that Francis A. Smith and D. F. Sampson are planning to develop three veins on their Red Top and Hidden Treasure properties in the Lake City districts. The Red Top group has a 3-ft. vein assaying about $14.90 per ton, and the Hidden Treasure a 6-ft. vein assaying between $5 and $7 per ton gold. The third vein has been only superficially prospected.

Plumas County

The Feather River Con. Mines Co., composed largely of

Cripple Creek men, has taken a bond on the Gold Leaf mine in the Argentine district. The 5-stamp mill on the Bluff City property will be moved to the Gold Leaf, and used as a testing plant. H. D. Thompson is president and Richard Blanchard superintendent for the company.

SIERRA COUNTY

The Sierra Standard G. M. Co. has been incorporated to develop the old Standard quartz mine in Sailor ravine. The capitalization is $250,000.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—The West Griffith mine on Griffith mountain has been taken under bond and lease by W. O. Robinson, representing a syndicate of Eastern men. Work has been put under way through the adit. The Josephine mine on Kelso mountain, West Argentine district, was sold by Fermor J. Spencer, trustee in bankruptcy, a few days ago for $7500. J. C. Bell was the purchaser. The defunct company had debts totaling $27,000. It is stated that work will start April 1. Oklun brothers, owners of the Scott property on Republican mountain, are shipping 10 tons of zinc per week. The ore mills 50% zinc and 30 oz silver per ton. Occasional shipments of lead are being made.

Georgetown, March 29.

OURAY COUNTY

(Special Correspondence.)—The report of the Camp Bird, Ltd., for the quarter ended January 31 shows that the mill crushed 15,760 tons of dry ore. Receipts from bullion and cyanide products amounted to $293,551, and from concentrate sold to $172,998, making a total of $466,549. Operating expenses amounted to $115,867, leaving a net profit of $350,682, or £71,861. The profit from the company's holdings in the Santa Gertrudis Co., Ltd., was £53,924, making the net profit £125,785. In addition to the above items, there was expended on construction $388, or about £79, and on London and general expense of management about £900. A dividend of 2s. per share, for the six months ended January 31 was paid February 12.

Ouray, March 25.

The properties of the Revenue Tunnel Mines Co. and the Wheel of Fortune M. Co. are being operated under lease by the Revenue Leasing Company.

TELLER COUNTY (CRIPPLE CREEK)

Gildea & Prentice, lessees in the Gold Coin shaft of the Granite G. M. Co.'s property, have discovered high-grade ore on the 800-ft. level, where they intersected the Dorothy vein. Mrs. Jeannette McLean Williamson, of Colorado Springs, has bought the Black Hawk claim on Grouse mountain for $700. The property, which formerly belonged to the Matt France M. & M. Co., was sold by the public trustee.

Cutting a water-course on the 1500-ft. level of the Vindicator No. 1 shaft necessitated a temporary suspension of work there a short time ago. An air-lift made the resumption of work possible. Recent reports stated that the cross-cut on this level had 400 ft. to go before reaching the orebody. J. E. Graves and associates, lessees on the Little Mary claim, have discovered ore assaying $20 to $63 per ton. It is rumored that a sub-lessee in the Gold King mine has found exceptionally rich ore, but no details have been announced.

IDAHO

LATAH COUNTY

Aerial tramways furnished the subject of an illustrated lecture by R. S. McCaffery, head of the mining department of the University of Idaho, at the meeting of the Associated Miners of that institution on March 19. The association plans to visit British Columbia in the spring.

SHOSHONE COUNTY

Eugene R. Day, president of the Tamarack & Chesapeake M. Co. has confirmed the report that the Day interests have purchased the Brien holdings of 200,000 shares, also a number of claims on the same hill adjoining the property. As the Tamarack ore-shoot extends into the Custer mine, also controlled by the Days, it is understood the two properties will be consolidated. G. H. Martin, president of the Carbonate Hill M. Co., has received from the Department of the Interior, patents for the Carbonate Hill fraction and the Long John claims. This makes ten patented claims in the Carbonate Hill group. The total area now controlled by the company aggregates 200 acres. At the Carbonate Hill mine, according to advices received by Mr. Martin, a 10-ft. vein of ore, running $80 to $85 per ton has been found. The deposit was discovered about 1260 ft. from the entrance to the main adit, at a depth of 850 feet.

MONTANA

SILVERBOW COUNTY

(Special Correspondence.)—A report has been received here of a rich find in the Robert Emmet mine of which W. Q. Ranft is general manager and which is largely controlled by Boston and New York interests. In running a cross-cut on the 500-ft. level an 18-ft. vein of high-grade silver-lead ore was discovered. Work on this property had been suspended during the winter, but was resumed a week ago.

Mining interests in this district for more than a week were in a somewhat unsettled condition, due to an attempt on the part of the Socialists to make political timber of the fact that a number of men had been discharged from mines of the Anaconda company supposedly because they were affiliated with that party. Being in control of the offices of the miners' union, a committee was appointed to demand the reinstatement of the men discharged. This committee, on waiting on C. F. Kelley, resident director and vice-president of the company, was informed that there being no complaint as to violation of union rules on the part of the company, the men would not be put back, the company reserving the right to hire and discharge men at will, always of course hiring union men and paying union wages. This committee, which was composed of 23 Socialists and 2 conservative members of the organization, reported back to the union recommending a strike, the report being signed by the 23 Socialists. The report was rejected by an overwhelming majority and a report by the minority members was adopted recommending a referendum vote on the question. This vote was taken and the motion to go out on a strike was defeated by a big majority. The Socialists are now engaged in endeavoring to stir up trouble with the mine-owners over the question of wages. The five-year contract expired on April 1, but there is a clause which provides that 30 days notice must be given before it can become inoperative, so that whatever the radical element may decide on may be delayed. However, one thing has been pretty clearly established, that the conservative element is still in the majority by at least several hundred members and that nothing will be done to disturb the agreeable relations existing between the company and the union.

Butte, April 1.

NEVADA

ELKO COUNTY

George Wingfield is quoted in the *Elko Free Press* as stating that he abandoned his option on the Success group of claims largely because the owners did not permit him to make further exploration. He said that $15,000 was due on the Success group on March 5, and as the lower adits had not intersected ore of commercial grade, he did not feel warranted in making the payment without first making further exploration. He also told the owners that he considered the price set too high. The owners declined his offer of making further exploration if the owners granted a "reasonable extension of the option and a satisfactory reduction in the purchase price." The option, together with options on the Bluster, was forfeited.

ESMERALDA COUNTY

(Telegraphic Correspondence.)—The Goldfield Con. M. Co. produced in March, according to the official estimate published by A. H. Howe, secretary of the company, 30,132 tons of ore, with a value of $685,000. The operating ex-

penses of the month amounted to $200,000, leaving a net profit of $185,000.

Goldfield, April 3.

The Darms Coal M. Co. has been incorporated to develop the six claims owned by H. A. Darms at Coaldale. The incorporators include, besides Mr. Darms, Henry Darms and John J. Lauder.

LYON COUNTY

(Special Correspondence.)—The smelter of the Mason Valley Mines Co. is treating about 600 tons of ore per day from the Mason Valley and Nevada Douglas mines. The ore from the former consists largely of sulphide, and from the latter of carbonate, with some sulphide present. The ores are practically self fluxing, only about 5% of lime being employed in charging. The furnace is of the water-jacketed drop-bottom type. The matte is tapped into a casting machine and shipped to Garfield, Utah, for refining. Blast is furnished by two Connersville blowers. The second furnace probably will remain idle until facilities have been provided for larger shipments of ore from the mines. The Nevada Douglas mines, in the Ludwig district, reports increasing activity. A suction pump has been installed on the seventh level of the inclined shaft, and sinking will soon be resumed. The present vertical depth is 750 ft. Three shifts are driving on the east vein to open the ore below the stope on the sixth level. In the Copper Casting portion of the property ore averaging 8 to 12% copper is said to be in evidence. In the Douglas Hill part about 20,000 tons is reported broken and ready for shipment.

GOLDFIELD CON. CLERMONT SHAFT.

Yerington, March 30.

NYE COUNTY

(Special Correspondence.)—The report of an important ore discovery in the Halifax mine has been confirmed. It is said the miners have penetrated 8 ft. of excellent ore, but the width of the orebody has not yet been determined. The new vein recently cut on the 1100-ft. level of the Belmont shows a width of 9 ft. It was intersected by south crosscut No. 6 and lies west of the Belmont vein and east of the Belmont fault. No attempt will be made to mine the vein at this time, as the 40-stamp mill at Millers is operating at top capacity to handle the quartz from main workings. It is expected the new 600-ton mill will be ready for operation by June 1. It is officially stated that the Tonopah Extension Co. will immediately commence the sinking of a new main shaft, about 1600 ft. west of the present avenue. The shaft will have three compartments, each being 4½ by 5 ft. in the clear, and will make accessible the reserve recently opened in the westerly portion of the Tonopah Extension ground.

Tonopah, March 30.

The Manhattan Chamber of Mines has been organized to promote the interests of the Manhattan district. Homer L. Ross is president, Charles Kirchen vice-president, and Percival Nash secretary and treasurer of the organization. The management of the Steffner lease on the Manhattan Consolidated property, has announced that the shaft, now 200 ft. deep, will be sunk to a depth of 720 feet.

The production of the Tonopah district for the week ended March 30 is summarized as follows by the *Tonopah Miner*: "The Tonopah M. Co. sent 3250 tons of ore, the Belmont company 2100 tons, the Montana Tonopah 1014 tons, the Tonopah Extension 1065 tons, the West End 750 tons, and the MacNamara 365 tons, making the total production for the week 8544 tons of ore of which the estimated value was $213,600."

The recently reorganized Tonopah Merger M. Co. is planning to start development soon on its property, which formerly was known as the Golden Anchor M. Co. mine.

STOREY COUNTY

The Ophir last week produced about 186 tons of ore, valued at $5195. The Con. Virginia extended the three-compartment raise from the 2400-ft. level 7 ft., making the total length 23 ft. Two chutes were placed there. From this work about 31 tons of ore, averaging $26.52, was saved. The Mexican mill ran 94% of the time during the week and crushed 553 tons of ore, the gross value of the 'heads' being $12,874. The apparent extraction was 90%. The north drift from the south boundary in the Union Con. has been cleared from timbers, and seven sets were placed. Other repair work was done. The Crown Point continued production of low-grade ore from the 1400-ft. level, hoisting 491 cars of ore, of which 237 cars averaged $7.31 per ton. The Comstock Pumping Association report shows that last Saturday the water was 291 ft. below the 2200-ft. station of the C. & C. shaft.

WHITE PINE COUNTY

The Zack shaft will be sunk 200 ft. more, giving it a depth of 800 ft. A station will be cut at the 600-ft. level and a pump placed at that level. The pump is to have a capacity of 500 to 600 gal. per minute. The present pumps, raising 100 to 200 gal. per minute, are able to handle the present flow. The water, although having a trace of copper, is used in the boilers. Press reports state that the Steptoe smelter is treating about 10,000 tons of ore per day, eight units running at capacity. The Giroux company has paid the estate of each of six of the seven men killed in the fire last August $1200. The heirs of D. F. Drea, the seventh man, refused, demanding a larger amount. On a compromise the heirs were given $2000.

NEW MEXICO

SOCORRO COUNTY

(Special Correspondence.)—The Ernestine M. Co.'s bullion product for the first 20 days of March was 13,790 oz. gold and silver, and concentrate for the period amounted to 21,000 lb. The ore treatment for the past two weeks was 1410 tons. The framework is being erected for a new Blake crusher, which will do away with the belt conveyor. It is probable that the Deadwood mill will not be able to resume operation before the first week in April.

The Oaks Co.'s platforms at the Pacific mine are filled with ore awaiting delivery to the Deadwood mill for treatment as soon as the engine at the latter is in commission. The South shaft is yielding fine ore as sinking progresses.

It is reported that a deal is pending whereby the entire holdings of the Mogollon Gold & Copper Co. will be taken over and active development started in a number of the mines.

Development in the Iron Group property has disclosed a large vein of low-grade ore.

Mogollon, March 29.

OREGON

SUMPTER COUNTY

The pebble mill formerly at the Cougar mine, near Granite, is to be erected soon at the Red Boy property, says a report from Sumpter. As the mill at its former situation was little used, the Red Boy's ore treatment will furnish the first thorough test of the equipment in eastern Oregon. Andre A. Groves has taken a lease on the Eppinger placer mine on Cow creek.

SOUTH DAKOTA

LAWRENCE COUNTY

(Special Correspondence.)—The Golden Reward company has given a number of leases on some of its smaller properties in the Bald Mountain district. One of the clauses in

all of the leases provides that the milling ore extracted shall be treated in the company's mill at Deadwood. The Mogul company is making regular shipments to the L. D. & W. mill at Terry. The ore supply is being drawn from the Lucille and Ben Hur mines, and it is the intention of the company to open the Hardscrabble property also. Mr. Dorr, the general manager, is planning to lease the Dakota mill at Deadwood in order to find an outlet for the ores. This plant has 30 stamps, and is well equipped in all departments except that for handling slime. The New Reliance company has placed 10 additional stamps, making 30 in all, and is awaiting good weather in order to get the new machinery in commission. E. M. Hiltner has resigned as superintendent, and William Weigand is now running the property. The Western Federation of Miners is planning to take over the property of A. H. Olson, which adjoins the Homestake on the south and east, and in the event that the deal is perfected will engage in mining on its own account. The property is partly developed by means of a 300-ft. shaft. The deal has progressed so far that the Federation is now endeavoring to secure funds to commence work.

Deadwood, March 28.

UTAH

Juab County (Tintic District)

The Centennial Eureka recently disbursed $150,000 in dividends at the rate of $1.50 per share. All but 136 shares of the stock is held by the United States M. Co. Last year two dividends of similar size were paid. The Grand Central and Gold Chain mines now have W. D. Loose as superintendent, August Wetterstrom having resigned. The Grand Central has been temporarily shut down to permit lengthening the cable and repairing the shaft. The Eagle & Blue Bell is now below the 1300-ft. level.

Summit County

(Special Correspondence.)—The Crowther Leasing Co. has a lease on the dump and practically all the workings of the old Ontario mine. It has been working on the property for some time, but the operation so far has been largely metallurgical experiments. Now the new mill, the construction of which is the result of numerous test runs, is approaching completion, and will be started next June. The Ontario is one of the oldest mines in Utah. The ore contains principally silver, although some of the veins have lead ore. Nearly all of the $13,000,000 disbursed in dividends was paid from the profits from treatment by the chlorination process. In the early days the ores averaged $100 and more silver per ton, and $40 ore was declared unprofitable. Ore of this class was thrown over the dump, or used to fill in stopes. The Crowther company has been using the cyanide process with excellent results, and now is installing cyanide equipment in the old Ontario mill to make possible the treatment of 300 tons per day at the outset, with prospective increase to a capacity of 500 tons per day. Exhaustive sampling of the old stopes and dumps shows that the ore available will average about $12 per ton.

Park City, April 2.

Tooele County

(Special Correspondence.)—The new lead plant of the International S. & R. Co. has increased its capacity to 500 tons per day by blowing in the second lead stack. The plant is handling 200 tons per day from the Bullionville tailing at Pioche, and has recently added to its contracts. Work has started on the ten-mile branch of the Salt Lake railroad from St. John to Ophir. This branch is being built primarily to handle the ore from W. A. Clark's Ophir Hill mine, but it will greatly aid the Cliff, Lion Hill, and other properties in the district.

Tooele, April 2.

WASHINGTON

Ferry County

The Factor M. Co., operating at Orient, elected officers as follows, at the annual meeting in Spokane: President, G. R. Horley; vice-president, J. M. Gunning; secretary and treasurer, J. E. Pickrell; general manager, A. O. Evans. A. J. Bell was elected to the board of directors. The secretary's report states the company and property are in good condition. Development will be continued throughout the year.

Stevens County

The Liberty Copper M. & M. Co. is planning to build a 100-ton concentrator on its property at Blue Creek, north of Chewelah. S. G. Neff, manager of the mine, has announced that the company plans to sink from the 270-ft. level a depth of 50 ft. and to stope from that level.

BRAZIL

Minas Geraes

(Special Correspondence.)—The Diamond King Mining Co., the only dredging company at work in this district, reports that within a few months a railroad will be built which will reduce its wagon haul from 100 to 12 miles. Placer mining has been carried on in this district since 1600, and there are also many excellent opportunities for gold mining in quartz. During the time of the Portuguese these were worked as open-cuts, but little has been done since 1878, when the slaves were freed. Many of these slaves have since been mining for themselves, with varying degrees of success.

Diamantina, February 20.

CANADA

Ontario

The American Eagle M. Co. has been incorporated at Toronto. The provisional directors are W. A. Chase, J. B. Taylor, and E. R. Thompson. The Smith & Durkee Diamond Drilling Co., capitalized at $40,000, has been incorporated at Sudbury. The directors of the company are O. P. Smith, C. A. Durkee, and E. T. Lansdowne.

MEXICO

New York Associated Press despatches on March 28 reported that all wire communication with Mexico City had been cut off. Whether the suspension was due to censorship or wire-cutting was not known.

Jalisco

The murderers of Thomas Murphy, late manager of the El Favor mine, Hostotipaquillo district, were arrested at the Zopilote mine on March 24. The murderers, two brothers, Cervantes by name, shot Mr. Murphy in April 1911. Since then they worked under assumed names at the Purisima and Zopilote properties.

Sonora

(Special Correspondence.) — Intervention would be a great calamity, it is believed here, and the general hope is that the Madero government will survive. Sonora is happily free from open disturbances by the Vasquista and Pasqualista forces, but there is, or has been, much pillaging by bands of 'horseback hoboes.'

Yzabal, March 29.

Mexican 'high-graders' have been stealing ore from the Cinco de Mayo and other properties, asserts a despatch from Douglas by way of El Paso, and in some cases boldly send the filched ore to the smelters. Usually the thieves concentrate it themselves with crude apparatus. The first shipment of ore from the San Nicholas, near Nacozari, under bond to Frank U. Borgeson and associates of Bisbee, recently passed through Douglas. Mr. Borgeson is superintendent of the property, on which about 20 men are employed.

NICARAGUA

(Special Correspondence.)—The Topaz M. Co. has intersected the Mico vein on the No. 4 level, 292 ft. from the surface. Where cut, the vein is about 20 ft. wide, and assays average $15 per ton. The ore is oxidized. At a point 100 ft. above and 100 ft. east, the ore ran about $22 per ton. The company, which was organized under the laws of the Republic of Nicaragua, has its main office at Bluefields. It has a 20-stamp mill, the stamps being 850 lb. each. The property is in the Rama district.

Bluefields, March 15.

PERU

Ferrobamba, Ltd., has over 7,500,000 tons of ore partly developed in two mines, according to a recent announcement by W. F. Stevens, mine manager for the company. The property is at Ferrobamba, Catobambos, Apurimac. Adits No. 1 to 18 in the Ferrobamba No. 1 mine have shown 6,000,000 tons of ore assaying about 4½% copper and over 1¼% sulphur. Adit No. 1 of the Sulfobamba has about 778,000 tons assaying 2¼% copper and 2¼% sulphur. Adit No. 2 of the same mine has 532,400 tons carrying a little more than ¼% copper and 33⅜% sulphur. Satisfactory tests proving the suitability of Ferrobamba No. 1 ore to treatment by a modified concentration have been made.

Among the Copper Mines

The UTAH COPPER CO. will have thirteen sections in the Arthur mill completed by August 1, according to recent reports. The ninth unit is about ready now. If the production from the mines can be increased the mill will be run at capacity in August, treating 20,000 tons of ore per day.

The BUTTE-ALEX SCOTT is shipping 150 tons of ore per day to the East Butte smelter, and it is more than likely that in the next two weeks the output will be increased to 200 tons per day, which will be the capacity of the hoisting machinery. The ore is all coming from the 1600 and 1700-ft. levels and averages 6% copper.

GREENE-CANANEA produced 2,948,000 lb. of copper in February, as compared with 3,552,000 lb. in January, the falling off being due to trouble with the machinery which has since been remedied. The silver production in February was 104,512 oz., against 100,681 in January, and the gold 526 oz. in February and 493 oz. in January. It is stated that so far the operations have not been affected on account of the disturbed political conditions in Mexico.—*Boston Commercial.*

The OHIO COPPER report for February shows a profit of $37,117. Copper production amounted to 757,207 lb., obtained from 51,924 tons of ore averaging about 1.3% copper. Losses in tailing were 43.71%. An examination of the property is being made by Henry Krumb, which it is believed will have an effect on future financing. The mill treated an average of 1790 tons per day during February, with two units in operation. The completion of two more units will double its capacity.

The NORTH BUTTE dividend of 40c. per share, just declared, clearly puts at rest all questions as to its earning capacity. While nothing is being done on the 2800-ft. level just now, nor will be until connection is established with the High Ore in order to provide good ventilation, the 2200-ft. level of the Snowball is providing all the high-grade ore required for shipment. Between it and the Berlin vein the reserve supply is being constantly added to and the company could today easily increase its production at least 500,000 lb. of copper more per month than was produced in February or March.

BINGHAM MINES had on hand December 31, $76,593, this amount remaining after $32,655 for bond interest had been deducted from the $109,248 earned by the company last year. Under the terms of the mortgage the only use to which this $76,593 can be put is the purchase and retirement of first-mortgage bonds. It will be recalled that $33,000 of these bonds were retired last year with the surplus net earnings of 1910, leaving $536,000 outstanding. As at least $3000 will be available from other sources, the management expects to purchase and cancel $80,000 or more of the remaining bonds in April or May.—Walker's Letter in *Boston Commercial.*

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

A. C. VEATCH is here.

T. LANE CARTER is in Mexico.

N. GUNDY was in San Francisco.

A. P. WILSON has gone to Alaska.

W. F. POWELL is in San Francisco.

A. D. MCRAE is visiting San Francisco.

JAMES R. HAYDEN is at the St. Francis.

R. L. BEALS has returned from Mexico.

VICTOR VON GROOT is visiting California.

E. B. KIMBALL is on his way to London.

F. O. JASMER is in San Antonio, Texas.

A. CHESTER BEATTY is in San Francisco.

EDWIN ARKELL was here during the week.

F. G. COTTRELL has returned to San Francisco.

W. H. ALDRIDGE was at Miami, Arizona, recently.

STEWART BLACKBURN is now at Mineral Hill, Nevada.

R. H. ELLIOTT is on his way to California from the Gold Coast Colony.

T. A. RICKARD is in Denver and will leave for New York early in the week.

PALMER CARTER has resigned from the management of the Ferreira mine.

VICTOR G. HILLS has returned to Denver from Moose river, Nova Scotia.

ROSCOE H. CHANNING was recently in San Francisco and is now in Arizona.

VICTOR E. TULL has gone to Seattle for the summer and is at 211 Coleman building.

GEORGE W. STARR has gone to Panama and New York, and will visit Arizona and Nevada.

C. COLCOCK JONES has returned to Los Angeles from a trip to Douglas county, Nevada.

GEORGES LE ROYER has returned from Buenos Ayres and will spend several months in Paris.

LAWRENCE N. WAGNER will leave during the week for a trip to Europe by way of Panama.

R. B. LAMB has gone to Porcupine to inspect the properties there with which he is connected.

F. C. SHRADER has completed a preliminary geological examination of the Antelope district, Nevada.

E. E. GLEDHILL has left for Ungava to make explorations for the Ungava Exploration Company.

W. L. SAUNDERS will make the address at the annual commencement of the Colorado School of Mines, May 24.

F. L. SIZER, who is now at Doz Cabezos, New Mexico, has become consulting engineer for the Mascot Copper Company.

S. F. SHAW is superintendent of the Tiro General mine of the American Smelting & Refining Co. at Charcas, San Luis Potosi.

ALBERT L. WATERS, recently manager for the Pioneer Smelting Co. of Tucson, is now chancellor of the University of Arizona.

JOHN C. DERN has resigned as manager for the Lower Mammoth Mining Co. at Tintic, Utah, to be succeeded by JAMES C. DICK.

EDWARD L. HAFF has been appointed superintendent of the Amalgamated Nevada mine in the Blackhorse district near Ely, Nevada.

FRANK H. PROBERT announces that the firm of Weed & Probert has been dissolved by mutual consent, and that he will continue practice at Los Angeles.

Market Reports

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building)

	Closing prices Apr. 4		Closing Prices Apr. 4
Adventure	[illegible]	Mohawk	[illegible]
Allouez	[illegible]	North Butte	[illegible]
Calumet & Arizona	[illegible]	Old Dominion	[illegible]
Calumet & Hecla	[illegible]	Osceola	[illegible]
Centennial	[illegible]	Quincy	[illegible]
Copper Range	[illegible]	Shannon	[illegible]
Daly West	[illegible]	Superior & Boston	[illegible]
Franklin	[illegible]	Tamarack	[illegible]
Granby	[illegible]	Trinity	[illegible]
Greene Cananea, ctf	[illegible]	Utah Con	[illegible]
Isle Royale	[illegible]	Victoria	[illegible]
La Salle	[illegible]	Winona	[illegible]
Mass Copper	[illegible]	Wolverine	[illegible]

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, April 4

Atlanta	[illegible]	Mayflower	[illegible]
Belmont	[illegible]	Mexican	[illegible]
[illegible]	[illegible]	Midway	[illegible]
[illegible]	[illegible]	Montana-Tonopah	[illegible]
Booth	[illegible]	Nevada Hills	[illegible]
Challenge	[illegible]	Ophir	[illegible]
Combination Fraction	[illegible]	Pittsburg Silver Peak	[illegible]
Con. Virginia	[illegible]	Round Mountain	[illegible]
Florence	[illegible]	Savage	[illegible]
Goldfield Con.	[illegible]	Tonopah Extension	[illegible]
Gould & Curry	[illegible]	Tonopah of Nevada	[illegible]
Jim Butler	[illegible]	Union	[illegible]
Jumbo Extension	[illegible]	[illegible]	[illegible]
MacNamara	[illegible]	West End	[illegible]

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, April 4

Associated Oil	[illegible]	Peerless	[illegible]
[illegible]	[illegible]	Pinal	[illegible]
Caribou	[illegible]	Premier	[illegible]
Claremont	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	Republic	[illegible]
Con. Midway	[illegible]	[illegible]	[illegible]
Empire	[illegible]	Sterling	[illegible]
[illegible]	[illegible]	S. W. & B.	[illegible]
Maricopa N	[illegible]	Turner	[illegible]
Midway Premier	[illegible]	Union	[illegible]
Monte Cristo	[illegible]	United O	[illegible]
Palmer	[illegible]	W. K. Oil	[illegible]

MINING STOCK QUOTATIONS—NEW YORK

(By wire from [illegible], New York.)

	Closing Prices Apr. 4		Closing Prices Apr. 4
Amalgamated Copper	[illegible]	Miami Copper	[illegible]
[illegible]	[illegible]	Mines Co. of America	[illegible]
Braden Copper	[illegible]	Nevada Con.	[illegible]
[illegible]	[illegible]	Nipissing	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Chino	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	Ray Con.	[illegible]
Esperanza	[illegible]	[illegible]	[illegible]
First National	[illegible]	Tenn. Copper	[illegible]
Giroux	[illegible]	Trinity	[illegible]
Goldfield Con.	[illegible]	Tonopah Belmont	[illegible]
Greene-Cananea	[illegible]	Tonopah Ex.	[illegible]
Hollinger	[illegible]	Tonopah Mining	[illegible]
Inspiration	[illegible]	[illegible]	[illegible]
Kerr Lake	[illegible]	Tuolumne Copper	[illegible]
La Rose	[illegible]	Utah Copper	[illegible]
[illegible]	[illegible]	West End	[illegible]
McKinley-Darragh	[illegible]	Yukon Gold	[illegible]

ASSESSMENTS ON COMSTOCK MINES

[illegible]

LOCAL METAL PRICES

San Francisco, April 4

[illegible]

METAL PRICES

(By wire from New York.)

[illegible]

SILVER

[illegible]

LEAD

[illegible]

ZINC

[illegible]

QUICKSILVER

[illegible]

TIN

New York prices control in the American market for tin since the metal is almost entirely imported. San Francisco quotations averaging about ½c per lb higher than New York are quoted weekly in this column. Below are given average monthly New York quotations in cents per pound:

	1911	1912		1911	1912
Jan	41.25	42.53	July	42.40	..
Feb	41.61	42.96	Aug	43.32	..
Mch	40.16	42.59	Sept.	39.75	..
Apr	42.18	..	Oct	41.18	..
May	43.11	..	Nov.	43.12	..
June	44.61	..	Dec.	44.65	..

COPPER

Daily quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb more. Below are average monthly quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan	12.29	14.09	July	12.47	..
Feb	12.26	14.08	Aug.	12.41	..
Mch.	12.14	14.68	Sept.	12.20	..
Apr.	12.02	..	Oct.	12.19	..
May	11.99	..	Nov.	12.61	..
June	12.39	..	Dec.	13.55	..

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months.

	U. S.	European.
January 1910	141,766,111	241,961,280
January 1911	122,030,195	230,264,280
July "	157,434,161	195,937,280
September "	133,441,501	191,215,360
October "	140,891,856	191,915,600
November "	134,997,642	176,816,640
December "	111,785,188	164,151,680
January 1912	89,454,695	178,329,920
February "	66,280,643	153,820,800
March "	62,939,988	141,142,400

UNITED STATES PRODUCTION AND CONSUMPTION

(Compiled from reports of the Copper Producers' Association)

	Production.	Domestic deliveries.	Exports.
March, 1911	130,532,080	66,080,789	59,081,127
April	118,185,223	52,407,650	62,129,599
May	126,962,544	64,543,963	61,078,557
June	124,554,312	61,655,561	71,460,519
July	112,167,934	56,982,582	74,880,658
August	125,493,667	59,935,364	69,885,660
September	115,588,950	57,311,584	50,824,011
October	118,255,442	64,068,656	60,084,349
November	111,876,601	68,039,776	67,019,279
December	122,896,697	65,988,474	79,238,716
Total for 1911	1,431,938,338	709,611,945	754,932,733
January 1912	119,337,753	62,313,901	80,167,904
February	116,035,809	56,228,368	63,148,096

Current Prices For Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ℔ 100 lb	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ℔ 100 lb	1.00	1.50
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ℔ lb	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ℔ lb	0.09½	0.12
Acid, muriatic, com'l, carboy, ℔ 100 lb	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ℔ lb	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ℔ lb	0.10½	0.15
Acid, nitric, com'l, carboy, ℔ 100 lb	5.25	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ℔ lb	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ℔ lb	0.12½	0.15
Argols, ground, bbl., ℔ lb	0.20	0.25
Borax, cryst. and conc., bags, ℔ 100 lb	2.75	3.85
Borax, powdered, bbl., ℔ 100 lb	3.00	4.00
Borax glass, xd, 20 mesh cases, 100 lbs., ℔ 100 lb	10.00	13.00
Bone ash, 60 to 80 mesh, bbl., ℔ 100 lb	4.50	5.50
Bromine, 1 lb. bottle, ℔ lb	0.75	1.00
Candles, adamantine, 12 oz., 10 sets, ℔ case	4.50	4.75
Candles, adamantine, 14 oz., 10 sets, ℔ case	4.60	4.75
Candles, Stearic, 12 oz., 10 sets, ℔ case	4.85	5.50
Candles, Stearic, 14 oz., 10 sets, ℔ case	4.65	5.20
Clay, domestic fire, sack, ℔ 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100 lb. case, ℔ lb	0.20½	0.24½
Cyanide, 98 to 100%, 200 lb. case, ℔ lb	0.20	0.24
Cyanide, 120 to 130%, 100 lb. case, ℔ lb	0.27½	0.28½
Cyanide, 120 to 130%, 200 lb. case, ℔ lb	0.26½	0.27½
Lead acetate, brown, broken casks, ℔ 100 lb	8.75	9.00
Lead acetate, white, broken casks, ℔ 100 lb	10.00	10.25
Lead acetate, white, crystals, ℔ 100 lb	11.75	12.25
Lead, C. P., test., gran., ℔ 100 lb	14.00	15.00
Lead, C. P., sheet, ℔ 100 lb	15.00	18.00
Litharge, C. P., silver free, ℔ 100 lb	10.50	13.00
Litharge, com'l, ℔ 100 lb	7.50	8.00
Manganese ox., blk., dom. in bags, ℔ ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ℔ ton (85% MnO_2—1% Fe)	42.50	50.00
Nitre, double ref'd, small cryst., bbl., ℔ 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., ℔ 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., ℔ 100 lb	7.25	8.00
Potassium bicarbonate, cryst., ℔ 100 lb	12.00	15.00
Potassium carbonate, calcined, ℔ 100 lb	15.00	18.00
Potassium permanganate, drum, ℔ lb	0.11	0.12½
Silica, powdered, bags, ℔ lb	0.03	0.05
Soda, carbonate (ash), bbl., ℔ 100 lb	1.50	1.75
Soda, bicarbonate, bbl., ℔ 100 lb	2.00	2.50
Soda, caustic, ground, 98%, bbl., ℔ 100 lb	3.15	3.50
Soda, caustic, solid, 98%, drums, ℔ 100 lb	2.65	2.85
Zinc shavings, 850 fine, bbl., ℔ 100 lb	11.50	12.25
Zinc sheet, No. 9—18 by 84, drum, ℔ 100 lb	10.00	11.25

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, ℔ ton	*$20.00	$22.50
Arsenic, white, refined, ℔ lb	0.03¼	0.03½
Arsenic, red, refined, ℔ lb	0.08	0.09
Asbestos, according to length and quality of fibre, ℔ ton	100.00	350.00
Asbestos, lower grades, ℔ ton	10.00	90.00
Asphaltum, refined, ℔ ton	15.00	20.00
Barium carbonate, precipitated, ℔ ton	42.50	45.00
Barium chloride, commercial, ℔ ton	42.50	45.00
Barium sulphate (barytes), prepared, ℔ ton	20.00	30.00
Bismuth ore, 10% upward, ℔ ton	*75.00	upward
Chrome ore, according to quality, ℔ ton	10.00	12.50
China clay, English levigated, ℔ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ℔ lb	2.50	
Coke, foundry, ℔ 2240 lb	13.50	15.00
Diamonds:		
Borts, according to size and quality, ℔ carat	2.00	15.00
Carbons, according to size and quality, ℔ carat	50.00	90.00
Feldspar, ℔ ton	5.00	25.00
Firebrick:		
Bauxite, ℔ M	175.00	
Magnesite, ℔ M	190.00	275.00
Silica, ℔ M	42.50	47.50
Flint pebbles for tube-mills, ℔ 2240 lb	16.50	22.50
Fluorspar, ℔ ton	10.00	15.00
Fullers earth, according to quality, ℔ ton	20.00	30.00
Gilsonite, ℔ ton	35.00	40.00
Graphite:		
Amorphous, ℔ lb	0.01½	0.02½
Crystalline, ℔ lb	0.04	0.13
Gypsum, ℔ ton	7.50	10.00
Infusorial earth, ℔ ton	10.00	15.00
Magnesite, crude, ℔ ton	7.50	10.00
Magnesite, dead calcined, ℔ ton	23.50	27.50
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ℔ ton	10.00	25.00
Manganese, prepared, according to quality, ℔ ton	30.00	70.00
Mica, according to size and quality, ℔ lb	0.05	0.30
Molybdenite, 95% MoS_2, ℔ ton	400.00	500.00
Monazite sand (5% thoria), ℔ ton	150.00	200.00
Nickel metal, refined, ℔ lb	0.45	0.60
Ochre, extra strength, levigated, ℔ 100 lb	2.25	3.25
Platinum, native, crude, ℔ oz	40.00	45.00
Sulphur, crude, ℔ ton	15.00	25.00
Sulphur, powdered, ℔ ton	40.00	45.00
Talc, prepared, according to quality, ℔ ton	20.00	50.00
Tin ore, 60%, ℔ ton	450.00	475.00
Tungsten ore, 65%	390.00	455.00
Vanadium ore, 15%, ℔ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, ℔ ton	*15.00	20.00

Company Reports

AMERICAN SMELTING & REFINING COMPANY

This company was incorporated in New Jersey in 1899, and has an authorized capital of $115,000,000 in 500,000 7% cumulative preferred shares and 650,000 common shares of $100 each. All the preferred and 500,000 shares of the common stock have been issued. This company owns all the capital stock of the United States Zinc Co. and all the common stock of the American Smelters Securities Co., which has a capital of $77,000,000. For this reason the balance-sheets of the two companies have been combined in this report, which covers the year 1911. As the last published report covered the period April 30, 1910, to April 30, 1911, it has been necessary to readjust accounts by deducting from the balance for April 30, 1911, the earnings for the calendar year included therein, and other profit and loss items. During the year, $2,131,692 was expended on new properties and construction, of which $600,000 was for the uncompleted smelting plant at Hayden, Arizona. During the year $1,429,066 was written off for depreciation of property. The consolidated income account is as follows:

Earnings of Smelting and Refining Plants and Industries immediately dependent on their operations:		
Total before deducting Ordinary Repairs and Replacements	$14,045,334.56	
Less Ordinary Repairs and Replacements	1,944,573.38	
		$12,100,761.18
Earnings from Mining Properties	2,000,186.79	
Other Earnings and Income	1,011,177.33	
Gross Income		$15,112,125.30
Deduct:		
Corporate and Excise Taxes	114,198.06	
Administrative Expense	767,982.19	
Appropriation for Depreciation and Amortization of Property	1,887,399.07	
Total Deduction		$ 2,769,579.32
Net Income before deducting Fixed Charges and Dividends		$12,342,545.98
Deduct Fixed Charges and Preferred Stock Dividends:		
Interest and Discount on American Smelters Securities Co. 6% Debenture Bonds (Feb. 1 to Dec. 31, 1911)	870,833.34	
Dividend American Smelting & Refining Co. Preferred Stock 7%	3,500,000.00	
Dividend American Smelters Securities Co. Preferred A Stock 6%	1,020,000.00	
Dividend American Smelters Securities Co. Preferred B Stock 5%	1,500,000.00	
		$ 6,890,833.34
Net Income in excess of Fixed Charges and Preferred Stock Dividends		$ 5,451,712.64
Deduct:		
Dividend on American Smelting & Refining Co. Common Stock 4%	2,000,000.00	
Surplus Income for the year carried to Profit and Loss Account		$ 3,451,712.64
PROFIT AND LOSS ACCOUNT		
Surplus at January 1, 1911, adjusted as to changes made in 1911 directly applicable to prior period		$11,148,223.67
Surplus Income for calendar year 1911, as shown on statement of Income Account	3,451,712.64	
		$14,599,936.31
Deduct:		
Special Appropriation for Depreciation in value of Investments	$ 900,210.00	
Surplus at December 31, 1911, as per Consolidated General Balance Sheet		$13,699,726.31

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

MICROPETROLOGY FOR BEGINNERS. By J. E. W. Rhodes. Pp. 126. Ill. Longmans, Green & Co., London, 1912. For sale by the *Mining and Scientific Press*. Price $0.90.

Of textbooks on petrography there is no lack, and the American student is commonly introduced to the volumes by Lúquecr, Winchell, or Iddings at the outset of his petrographical career. But the last two of these are large volumes and all three discussed the subject upon so high a technical plane that many students find the pace too hard going, while a beginner who may wish to teach himself something of the elements of the subject, is likely to be completely swamped in a terminology beyond his comprehension. Mr. Rhodes has earned the gratitude of all such by affording them a simple brief outline of what is now an essential phase of the study of geology, and the moderate price at which it is published is also an advantage. The book is simply written and well illustrated, but has the two drawbacks of employing terms not current in America and of portraying a typical set of British rocks, rather than universal rock types. For this reason the American beginner should proceed as early as possible to correct his first ideas by a study of the more extended treatises by American writers.

APPLIED METHODS OF SCIENTIFIC MANAGEMENT. By Frederic A. Parkhurst. Pp. 314, index, 39 illustrations. John Wiley & Sons, New York. For sale by the *Mining and Scientific Press*. Price $2.

As stated in the preface, this work is an amplification of the author's articles published in *Industrial Engineering* during 1911, and is based primarily upon the experience and results obtained by the organization of the Ferracute Machine Co., makers of presses and dies at Bridgeton, New Jersey. The application of scientific management in this particular instance is an excellent example of what may be accomplished in the way of improved factory organization when the product manufactured is comparatively homogeneous in its character. Each section of the company organization is treated individually and its functions specifically and clearly defined in order to prevent the frequent encroachment of one department upon the duties of another, which is one of the most glaring faults of the old-time systems (if they may be so called). The importance of standardizing shop methods and tools is rightfully emphasized. The tabulated labor cost comparisons of the old and new methods make a striking exhibit of the thorough practicability of scientific management, showing in many cases a saving of from 50 to 80%, while wages, on the other hand, increased from 15.9c. per hour to 26.7c. per hour, and the average working day reduced to 8.2 hours. The various forms, blanks, and memoranda used for shop purposes and interdepartment communication are illustrated in full and their use and application described at length.

While we do not know of an instance where an attempt has been made to apply the principles of scientific management to a manufacturing plant turning out a heterogeneous product or engaged in a general jobbing business, we know of no reason why the fundamental principles involved should not ultimately find a ready application to any set of conditions when labor is employed in the fabrication of material. Mr. Parkhurst rightfully emphasizes the fact that each specific case must be the subject of individual study and attention, and that no set rules could possibly be laid down that would be applicable to each case, but a thorough understanding of principles involved may be acquired through study of the results attained by experts, and the manufacturer can then either work out his own salvation—or, better, secure the services of a specialist who has been successful in the introduction of scientific management elsewhere. The general reader will find helpful suggestions throughout the work.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

FIREPROOF wash that is cheap and fairly good may be made by dissolving 1½ lb. salt in 1 gal. whitewash.

WHITENING powder consists of 4 lb. magnesium carbonate, 4 lb. chalk, and 4 lb. rouge, intimately mixed.

CELLULOID can be fastened to wood or tin by the use of the following compound: Shellac, 2 parts; spirits of camphor, 3 parts; strong alcohol, 4 parts.

FINE solder is an alloy of two parts of block tin and one part of lead. Glazing solder is equal parts of block tin and lead. Plumbing solder, one part block tin and two parts lead.

NORMAL price of a metal may be defined as the price which will induce a steady increase in production, and also a reasonable amount of expenditure in discovering and developing new deposits.

HAND-DRIVEN ventilating fans are employed in the salt mines of Hungary, the air being carried to the face through 4.5-in. zinc or canvas pipes. The latter are cheaper, but soon wear out and allow a good deal of air to escape.

CYANITE is a basic metasilicate of alumina which occurs in long bladelike triclinic crystals of a blue color, usually paler along the edges. The name should be pronounced as though spelled kyanite, in order to distinguish it from syenite, the rock.

PIPE VISES can be easily made from old carpenter's vises. Take an old coarse rasp, break it in two, and draw the temper at the ends to allow drilling and countersinking for screws, which should be used to fasten the two halves to the jaws of the vise. Fasten one with the teeth pointing up and the other with the teeth down.

A SMALL cartridge containing ammonium carbonate, 65%; potassium bichromate, 33%; and camphor, 2%, used in holes containing high explosives, will render the gases inoffensive, according to S. W. Young. A somewhat cheaper composition which he proposes is a mixture of 65 parts ammonium carbonate and 35 parts of manganese dioxide.

FOREIGN coins are sometimes of very small value. In Russia the quarter-kopek contains 0.819 gm. copper and is worth 0.124c., and the Japanese 5-rin piece, which is 95% copper, 4% tin, and 1% zinc, weighs 0.711 gm., is worth 0.249c. The modern Chinese cash, which is a small round coin, without any hole in the centre, is worth about 0.04 cent.

PERILLA oil is somewhat similar to linseed, and is used in Japan for waterproofing umbrellas and for preparing transparent paper for windows. Compared with linseed oil it has equal spreading power, dries slower, and gives a better film. Experiments tried in Ohio indicate that the yield per acre is less than with flax and there are no useful by-products.

GLASS can be drilled by tempering the drill by heating to a cherry-red and plunging in mercury. Drill part way through from one side, and then finish from the opposite side. This will make a good clean cut and prevent chipping the edges of the hole. Apply sufficient pressure to make the drill 'bite' at all times, and keep the drill-point moistened with a mixture of two parts turpentine to one part sweet oil.

CUSTOM smelting in Colorado was started by N. P. Hill, who built a smelter at Blackhawk in 1867, consisting of a calcining furnace and a small reverberatory. The fire brick were shipped by rail from St. Louis to the terminus of the road, and then 600 miles by wagon. The iron cost 22c. per pound and skilled labor $8 to $10 per day. The smelting charges were $20 to $45 per ton and the matte was hauled to the Missouri and shipped by way of New York to Swansea for resmelting. The plant was in operation until 1887, when it was removed to Argo, near Denver.

LUBRICATION is one of the most important uses of graphite. The addition of graphite to oil results in a lower frictional resistance than would be obtained by the use of oil alone. The quantity of oil required for a given service is also reduced and a lighter grade of oil or one of inferior quality may be employed without decreasing the quality of the lubrication. A small quantity of graphite only is required, and the benefits derived from its use persist long after the application has ceased. In light bearings of machinery where oil cannot be used on account of the danger of soiling delicate textiles, graphite can be used alone as a lubricant. Both the amorphous and the crystalline varieties of natural graphite are extensively employed for lubrication. The artificial graphite manufactured at Niagara Falls is also largely utilized in this way, and the Acheson company has secured a product termed 'deflocculated graphite' which it is claimed shows little or no tendency to sink when mixed with oil or water, and when suspended in water will pass through the finest filter paper made. The suspension is obtained by adding small quantities of gallotannic acid and other substances to the medium carrying the graphite. Some attempt has been made to utilize a mixture of graphite and water for lubricating purposes. Such a mixture, although perhaps less liable to produce rust than water alone, is not a rust preventive and is not so safe for steel bearings as a mixture of oil and graphite.

MILL-SITES shall not be adjacent to the vein or lode, according to the statute. The Land Department has interpreted this as being an attempt to prevent the obtaining of further mineral ground under an improper location or entry, and has ruled that a mill-site may be in contact with the side line of a claim if it is clearly not an appropriation of more mineral ground—that is, the mill-site must be strictly non-mineral. A further application of this principle would allow locating and patenting mill-sites in contact with the end lines, where it can be conclusively shown that the mill-site is non-mineral and that its entry should be allowed. Since the statute is silent regarding the method of locating mill-sites, it is customary to follow very much the same methods as in making a lode location. Mill-sites should be square or rectangular, with a post at each corner. A single mill-site cannot exceed five acres in area. Five acres equals a tract 466.7 ft. square, or 217,800 sq. ft. A location notice should be placed upon the ground and also recorded. Mill-sites are usually named after the claim or group to which they are appended. When a claim or group including a mill-site, is surveyed for patent, the same survey number is used for both, but the number on the lode locations is followed by A, as '4785 A', while the same number used on the mill-site is followed by B, as '4785 B'. Letters are also used in patent surveys in some surveyor-general offices when lodes and placers are included in the same application. Mill-sites may be located at the time of location of their lode claim or claims, or at any time thereafter, even after patent. A single mining claim is entitled to a mill-site location. A group of mining claims, according to the rulings of the Land Department, is entitled to as many mill-site locations as it actually and reasonably needs, and no more. Consequently not more than one mill-site location should be made in connection with a group of lode claims, unless the locator is able to show, in subsequent entry for patent or adverse suits, that all of such claims are necessary.

Recent Publications

PAPERS AND REPORTS RELATING TO MINERALS AND MINING. Pp. 155. Index, ill., maps. Wellington, New Zealand, 1911.

PRELIMINARY STATEMENT ON THE MINERAL PRODUCTION OF QUEBEC, DURING THE YEAR 1911. Pp. 9. Quebec, 1912.

TRANSVAAL CHAMBER OF MINES. Report of the Executive Committee for the year 1911. 25 pp. Johannesburg, 1912.

MINERAL RESOURCES OF THE UNITED STATES. Calendar Year 1910. Part I. Metals. 796 pp.; index, map. Washington, 1911.

REPORT ON THE MINING ACCIDENTS IN ONTARIO. By E. T. Corkill. Bull. No. 9, Bureau of Mines. 25 pp.; index. Toronto, 1912.

MINERAL RESOURCES OF THE UNITED STATES. Calendar Year 1910. Part II. Non-Metals. 1005 pp.; index, maps. Washington, 1911.

POTASH SALTS SUMMARY FOR 1911. By W. C. Phalen. Department of the Interior, U. S. Geol. Surv. 31 pp.; index. Washington, 1912.

BULLETIN OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY. Vol. 47, No. 2. President's Report, January, 1912. Pp. 152. Boston, 1912.

PRELIMINARY REVIEW AND ESTIMATE OF MINERAL PRODUCTION FOR YEAR 1911. By Wm. Fleet Robertson. 29 pp. Victoria, B. C., January 1912.

TRIASSIC FISHES. By Charles Rochester Eastman. Bull. 18, State of Connecticut, State. Geol. and Nat. Hist. Surv. 75 pp.; index, ill. Hartford, 1911.

WEST VIRGINIA GEOLOGICAL SURVEY. Jackson, Mason, and Putnam Counties. By Charles E. Krebs. 387 pp.; index, ill., maps. Wheeling, 1911.

METHODS OF ANALYZING COAL AND COKE. By Frederic M. Stanton and Arno C. Fieldner. Technical Paper 8, Bureau of Mines. Pp. 21. Washington, D. C., 1912.

THE CARNEGIE FOUNDATION FOR THE ADVANCEMENT OF TEACHING. Sixth Annual Report of the President and the Treasurer. 154 pp.; index. New York City, 1911.

A GEOLOGICAL RECONNAISSANCE OF THE ILIAMNA REGION, ALASKA. By G. C. Martin and F. J. Katz. Bull. 485, U. S. Geol. Surv. 138 pp.; index, ill., maps. Washington, 1912.

PRELIMINARY REPORT ON THE MINERAL PRODUCTION OF CANADA DURING THE CALENDAR YEAR 1911. By John McLeish. Canada Department of Mines. Pp. 24. Ottawa, 1912.

LIQUEFIED PRODUCTS FROM NATURAL GAS, THEIR PROPERTIES AND USES. By Irving C. Allen and George A. Burrell. Technical Paper 10, Bureau of Mines. 23 pp. Washington, 1912.

OFFICIAL REGISTER OF PRINCETON UNIVERSITY. Vol. III. No. 3, February 1, 1912. Department of Geology, Announcement for 1912-1913. Pp. 30. Princeton University, Princeton, New Jersey.

GEOLOGY OF GREYMOUTH SUBDIVISION, NORTH WESTLAND. By P. G. Morgan. Bull. No. 13 (new series), New Zealand Department of Mines, Geol. Surv. Branch. 159 pp.; index, ill., maps. Wellington, 1911.

THE PHYSIOGRAPHY AND GEOLOGY OF THE COASTAL PLAIN PROVINCE OF VIRGINIA. By Wm. Bullock Clark and Benjamin LeRoy Miller. Virginia Geol. Surv., Bull. IV. 274 pp.; index, ill., map. Charlottesville, 1912.

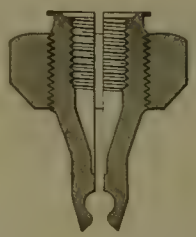
PAWPAW-HANCOCK FOLIO, MARYLAND-WEST VIRGINIA-PENNSYLVANIA. By George W. Stose and Charles K. Swartz. Geologic Atlas of the United States, Folio No. 179. United States Geological Survey, Washington, D. C., 1912.

TESTS OF THE ABSORPTIVE AND PERMEABLE PROPERTIES OF PORTLAND CEMENT MORTARS AND CONCRETES. By Rudolph J. Wig and P. H. Bates. Technologic Papers of the Bureau of Standards. 127 pp.; index, ill. Washington, 1912.

A New Mine Suspension

The type B-3 mine suspension recently introduced by the Westinghouse Electric & Mfg. Co. of East Pittsburg, Pennsylvania (described in folder 4224) is unique in the simplicity of the clamp used. This clamp has only three parts, which cannot be taken apart, and therefore are never dropped or lost.

Because of its simplicity the clamp can be installed quickly and cheaply. The clamp complete, with nut loosened, is screwed on the insulator stud; the wire is inserted in the lips of the clamp and slips freely into place without the



least forcing; then the nut is tightened. Screwing down the nut clamps the wire firmly and also clamps the stud, so that the ear can be placed in any direction and yet be tight on the stud. This makes it unnecessary to twist the insulator after screwing the ear up tight.

The wire can be drawn through for taking up slack by simply loosening the nut. This does not permit the wire to drop out.

All parts of the clamp are sherardized, and perfect clearance for the trolley wire is provided. A wrench is the only tool required, making the installation as simple as possible.

This clamp doubtless will appeal to mine operators who are on the lookout for a device of this nature that is absolutely fool-proof.

Commercial Paragraphs

C. H. SHAMEL is engaged in a revision of his book, 'Mining, Mineral and Geological Law,' which is to appear soon. He requests that any readers who may have discovered errors, or have any suggestions for additional topics, communicate with him in care of his publishers, the McGraw-Hill Book Co., 239 West Thirty-ninth street, New York.

THE WATT MINING CAR WHEEL CO., in our issue of March 2, 1912, announced the discontinuance of the Chicago office. It now appears that some persons understood that all branch offices had been abandoned. Such is not the case, as the company still maintains an office in Denver, Colorado, being represented there by Lindrooth, Shubart & Co., and an office in San Francisco, being represented by N. D. Phelps, Sheldon building, and by Carlos Romero in Etzatlan, Jalisco, Mexico.

The BUCYRUS CO. has taken over the manufacture of the Atlantic type shovel, heretofore built by the American Locomotive Co., and under a license from the patentee, A. W. Robinson, it is the expectation to continue building all of the sizes previously built, and to eventually have a complete line of Atlantic wire-rope shovels, in addition to a complete line of Bucyrus chain type shovels, which the company has been building for thirty years. The building of the Vulcan shovels has been transferred, by the Bucyrus Co., from Toledo, Ohio, to the new plant at Evansville, Indiana. A stock of repair parts for all shovels will be carried at Montreal, New York, San Francisco, Spokane, in addition to a very full supply at the South Milwaukee and Evansville plants. Particular attention will be given to the prompt filling of repair orders, and communications can be addressed either to the company's district sales offices, or direct to the general office at South Milwaukee, Wisconsin.

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L. A. GREENE - - - - - Business Manager

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EDITORIAL

AFFORESTATION in Korea is being stimulated by the Japanese Government, and in South Pyöng-an province some ten million seedlings will be distributed this year, while coöperation on the part of the natives is stimulated by the offer of numerous small prizes.

RAILROADS were not prosperous in January, according to the returns of the Interstate Railroad Commission. While operating revenues decreased 2.8 per cent, expenses increased 1.3 per cent and taxes 11.7 per cent, with a resultant decrease in net revenues of 15 per cent.

REPORT of the Copper Producers' Association for March, given on another page, shows a decrease of a half million pounds in the stocks available, the daily production during March having averaged 4.03 million pounds, as compared with 4.12 million pounds during February. Electrolytic has ruled at 16 cents per pound recently.

HANDLING mail usually is mentally associated with the postman and his bag, but actually it constitutes in the gross a transportation problem of the first order. This was emphasized last week when the *Tahiti*, due to sail for Melbourne and Sydney, was held in the harbor of San Francisco for three days to await the arrival of seventeen carloads of mail which were being rushed through from Omaha, after having been delayed by floods. A part of the 350 tons of mail in the shipment was destined for Australasia, hence the delay.

LEAD production for 1911 is announced by the United States Geological Survey as having reached 486,975 tons, or an increase of 3.5 per cent as compared with the preceding year. Missouri still holds first place as a producer, with Idaho a good second. Colorado shows a decrease of nearly 17 per cent, while Arizona produced 3450 tons as compared with 858 in 1910. The production from foreign ores showed a considerable decrease, due largely to the disturbed conditions existing in Mexico. The average New York price remained nearly stationary at 4.5 cents during the year.

SETTLEMENT of threatened labor trouble in the bituminous coal mining industry came as welcome news. A long strike would have raised the price of coal and attracted capital to an industry already overdeveloped, at the same time that it would have led either to a long bitter contest waged at heavy expense by the miners or intervention by the Government for political effect. Credit for avoiding these disasters is universally given Mr. John H. Walker, who as a result becomes the dominating figure among the miners and probable successor of Mr. John Mitchell in their affections. The two men are close friends and are not unlike. The miners this year, as in a former crisis, had the whip hand. Now under Mr. Walker's guidance, as then under Mr. Mitchell's, they have chosen the path of moderation, and in both cases it is interesting to note that the interest of the general public was urged as one consideration.

STATE bullion tax returns in Esmeralda county, Nevada, for the quarter ended March 31 amounted to $31,451, of which the Goldfield Consolidated paid $25,246, being the tax on 88,381 tons of ore worth $2,156,108. The preliminary estimate of the production of the Goldfield Consolidated for March is that 30,132 tons of ore of a gross value of $685,000 was treated at a net profit of $485,000.

INVESTIGATION of labor conditions in mining by means of a congressional commission is proposed in a bill introduced at Washington by Mr. Martin D. Foster. The text of the measure is printed on another page of this issue. There would seem to be a field for such an investigation, and the proposed mixed commission would be likely to bring out all points of view. That mining, in common with other industries in the United States, has been depressed recently is patent, and a first step to cure is always an accurate diagnosis. Not all the evils of which complaint is made can be remedied, but some may. If, however, any such commission be established definite authority should be given it to inquire into the need of change in the federal mining law. The paralysis of mining, of which much is heard in the West, has certain very direct relations to the need of revision of the law and regulations under which mineral land is located and held.

FUTURE position of the price of silver may be greatly modified by impending changes in the Far East. For many years India and China have been regarded as insatiable consumers of that metal, but recently India has manifested an appetite for gold, having absorbed $117,000,000 in 1911, as compared with about $20,000,000 in 1908. The Calcutta government has requested permission to begin coining gold 10-rupee pieces and the demand for gold therefore seems likely to increase rather than decrease. China has for some time been considering the advisability of putting its national coinage upon a gold basis, and the movement toward that end is likely to be accelerated by the foreign loans which will be a necessary part of the process of the reorganization of the government of that country, now under way. The production of silver has steadily increased during the past twenty-five years, while the gold output is a declining one. Many factors enter into the control of the price of silver, but, under the circumstances, it does not seem within the bounds of possibility that it can permanently appreciate within the next few years.

SPORT in the Far North is a serious matter, as is life. A mile-long race on a smooth track to the accompaniment of iced drinks and peanuts does not appeal to men who work through long winter months staking their labor against a rich clean-up in the spring. It is appropriate that the great sporting event of the year is the All-Alaska sweepstakes, a dog-race of 412 miles from Nome to Candle and return. This closed April 8 at 1:30 a.m., and despite the cold and early hour it is said that the whole population of Nome was in the grandstand to welcome Mr. A. A. Allan and the Darling team of malamute dogs when they crossed the line as winners by an hour, with a time of 87 hours and 32 minutes. No small task that, to run over the snow through a blizzard a distance equal to that from San Francisco to Los Angeles, or Chicago to Minneapolis, and all by way of sport. While this fierce race was on in Alaska (it was won by a speed spurt in the last 50 miles), crowds in California were watching the opening games of the base-ball season, and small boys in Chicago were counting off the days till the 'Cubs' and 'Sox' should meet 'Giants' and 'Tigers.' The character of sport varies round the world and with the season, but man must play or he cannot effectively work, and the men who work best have the greatest zest for play.

Government Railroads in Alaska

Washington despatches announce that a conference has been held at the White House between the President and the Secretary of Interior on the one hand, and Messrs. Daniel and Simon Guggenheim on the other, looking toward the sale of the Copper River & Northwestern railroad to the United States Government. We sincerely hope these negotiations may be brought to successful termination. To our way of thinking the importance of a trunk line from the coast to the interior of Alaska transcends all ordinary questions of cost and the building of such a line is a duty the nation owes Alaska. The Copper River route is at least as good as any that could be selected, and is probably the best for the building of a permanent road open the year around. It has the further advantage that many miles of the more difficult part of the line have already been built and that the road can be extended to Fairbanks for a reasonable sum. Furthermore, a fair local traffic is in sight or easily available. The approximate cost of the 197 miles of line already built, including present equipment, was $16,500,000. The immediate traffic barely pays operating expenses, and for any profit on the transaction the owners must either wait years, or must use the road as a club to obtain mines and other properties along the line at unfair prices. Since no profits are likely for years, all probable or possible losses are bound to be capitalized, and interest charges will form a permanent burden of the country served. As an indication of what that may mean it is interesting to note that the road now has outstanding stock to the amount of $5,000,000 and bonds to the amount of $50,000,000; the latter secured by first mortgage on the property and drawing 5 per cent cumulative interest. Probably the bonds have not been distributed, but they at least measure the minimum amount of profit that the promoters of the road will attempt to collect if the line be left in private hands. We believe that neither this nor the use of the road to enforce monopoly is in accord with sound public policy. At the same time capital cannot be expected to undertake hazardous ventures such as this, without reasonable profit, and if the Government is going to restrict such potential profits, it must in fairness assume some of the risk. In years gone by in the Western states the situation was met by giving to the railway companies large grants of public land and, in part, by guaranteeing interest on railway bonds. As a result a network of transportation lines was rapidly built and a series of great commonwealths came into being. As another result, certain venturesome individuals laid the foundations for large private fortunes. With public attention directed especially at the latter fact, it has become impossible to extend the same policy to Alaska. He would be a bold Congressman indeed who would advocate a land grant or a bond guarantee for a Morgan-Guggenheim road in Alaska, and yet, if anything, the risk is greater in railway building in Alaska now than it was in Nebraska when the Union Pacific was projected. Whether roads in the Far North will in the end justify themselves, as did roads in the Far West, is not certain. There are many similarities in the situation, and some important differences. The fact that it is North rather than West does not necessarily signify anything. Alaska, however, needs railways and the nation needs a developed Alaska—a new country as an outlet for surplus population and energy. As a business venture Alaska has paid handsomely, and now that more capital is required to meet legitimate demands for expansion, the nation should not be niggardly.

Whether the Copper River or the Matanuska route is the better is by no means certain; probably railways along both will be needed in time, while either would serve present needs. The Government is accordingly in good

position to negotiate. A fair price should be paid for existing properties, and if the Copper River railroad can be bought at a price based upon cost rather than hopes, completing it would sooner afford the needed transportation to the interior. If the railroad cannot be bought at a reasonable price, then the line from Seward should be extended, but the fact that the nation owes a duty in the case should be recognized, and prompt action is desirable.

The Mascot Mine

Upon two occasions we have criticized the Mascot Copper Company and called attention to the inadequacy of the information given stockholders regarding the property itself, and the financial operations of the company. In our issue of February 3 we called upon the management of the company to give to the public the following information:

1. On the word of a competent and known engineer, after thorough examination, not a mere visit, what are the ore reserves of the property, both as to quantity and grade, and what are the probabilities, if any, of additional reserves being developed?

2. What steps have been taken to determine the proper means of treatment of the ore?

3. What is the financial position of the company, and what will be the distribution of profits, if any, between buyers of the stock now being peddled about, and the promoters?

The announcement has recently been made that a start has been made by the company in the direction of getting the information called for, and the fullest publicity is promised as fast as the data become available. Following the publication of our criticism, Mr. T. N. McCauley, manager of the Mascot Copper Company, employed Mr. Frank L. Sizer as consulting engineer. Mr. Sizer's good work in Montana, and in California, is especially well known, and his familiarity with the type of deposit concerned makes his opinion regarding the Mascot orebodies of particular value. It is understood that Mr. Sizer assumes no responsibility for the financial affairs of the company, but will devote his attention to the technical work at the mine. He is now engaged in making a detailed study of the property. In the meantime we print in full Mr. Sizer's preliminary report and are glad to note that he finds so much to commend. We have never professed to know whether the property was good or bad, contenting ourselves with the statement that an intelligent opinion could not be formed on the basis of the information furnished. We stated that "What is needed is a thorough report upon the property and the company by a disinterested and competent engineer." That the first condition is to be met so satisfactorily emboldens us to hope for an equally frank account of the finances of the company.

Although the corporation was organized in 1907 no detailed financial statement has been given to the public, and in personal conversation the manager, Mr. T. N. McCauley, says frankly that it is not proposed to send out any such statement until the financing of the company has been completed. He states in justification that the stock is not underwritten, and that, the success of the enterprise being dependent upon the public market for the stock, it is not wise to furnish detailed information that would inevitably be accessible to those who might use it to the disadvantage of the stockholders. This raises a question of policy regarding which we are bound to disagree, in that we hold that stockholders in an enterprise are entitled to clear and definite statements regarding all phases of their investment at reasonable intervals, without the expense of a personal visit to headquarters. We hold that no corporation should accept a stockholder's money unless it is prepared to give him full details as to its use. It is regrettably true, however, that many large and old corporations fail to take this view, as well as small and new ones. According to information furnished our representative at the office of the Western Finance Company in San Francisco in 1909, the whole of the stock in the Mascot Copper Company was issued to the Western Finance Company in payment for the properties, and 250,000 out of 1,000,000 shares were then returned to the Mascot Copper Company to be sold for developing and equipping the property. We are now informed that this was an error and that in fact 475,000 shares were returned, leaving the Western Finance Company the holder of 52½ per cent of the stock of the Mascot company. For this there was given to the latter 35 claims to which title was complete and 3 upon which $50,000 remained to be paid. It is stated that up to that date $200,000 had been expended on the property and that since the transfer and up to March 1, 1912, about $400,000 additional has been expended. So far as we are aware this is the most complete financial statement yet made public, and while it leaves something to be desired, it indicates a larger participation in profits by minor stockholders than did the statement formerly given us and materially modifies the force of our criticism.

We confess frankly to a prejudice against the company because of the theatrical methods of promotion employed, but a good dog should not be condemned because he has a bad name, and we are sincerely glad that evidence indicates the probability of the Mascot company having the first essential of a successful mining company—a good mine.

Cooks and the Panama Broth

Truth of the epigram, 'many men, many minds,' is well exhibited by the present diversity of opinion regarding the maintenance and operation of the Panama canal. A recent writer in the *Saturday Evening Post* has gathered together, in an amusing way, authoritative and equally convincing opinions supporting both the negative and affirmative view of every question that has been broached regarding that great waterway. It is reasonably clear that no one knows anything about the matter and that opinions are based upon the slightest substratum of information. To the thoughtful engineer this does not appear remarkable, being rather what might *a priori* be expected. Americans have had no experience in the operation of a canal of even a fraction of the size of that at Panama, and in regard to the future development of trade through the canal, an accurate estimate can, in the present absence of information, no more be made than can the probable achievements of an unborn child be prophesied. About the fixing of the proper toll rate discussion chiefly centres; much of it but little to the point. The maximum rate should immediately be fixed, so that shipping companies can make plans for the future, but there is no necessity for fixing the exact rate, or indeed for imposing any toll, until precise information is available to guide action. What should be done now is to announce a maximum rate, that will not be exceeded, and provide that no toll shall be imposed before the end of 1916 or later. Millions have been spent upon a canal which is to serve future generations; whether any income be derived from it for the first few years is a matter of the least importance. What is desirable is to develop traffic through the canal as rapidly as possible, and if no toll were charged for even five years and then the proper rate imposed, it is unquestionable that the total return to the end of 1950 will be greater than if a series of readjustments are made during that period. The canal has been constructed quickly and well by capable men using intelligent methods; now let it be operated by intelligent methods.

Birth of the American Mining Act—I

By H. W. MacFarren

Discovery of Gold

When gold was found by John Marshall and his workmen January 19, 1848, no thought was probably more distant from their minds than that of mining rights and the ownership of the precious grains lying in the creek-bed sands. Fourteen days later, February 2, 1848, the treaty of Guadalupe Hidalgo was signed, and the right of conquest begun with the hoisting of the American flag at Monterey on July 7, 1846, was completed. Colon Mason, then military governor of California, visited the gold diggings in June following Marshall's discovery. They at that time were populated by a few thousand people from the surrounding parts of California, a population that rapidly grew and spread day by day. Colonel Mason, who had previously declared the Mexican mining laws to be repealed, was impressed, and reported: "It was a matter of serious reflection with me how I could secure to the Government certain rents or fees for the privilege of securing this gold; but considering the large extent of country, the character of the people engaged, and the small scattered forces at my command, I resolved not to interfere, but to permit all to work freely, unless broils and crime call for interference."

As the Argonauts poured across the summits of the Sierras and through the Golden Gate to occupy the foothill ravines of the gold belt, California must have meant to them a land so boundless in extent, so removed from their heretofore world, so unknown and unpopulated, that they would be free to mine its rich treasure without hindrance. The sobering thought may have come to them later that they were trespassers upon the public domain, appropriating it and its mineral content without the sanction of any law, in fact, against the express intent of the law. For this they probably found solace in the thought that it was the most expedient thing for them to do, and that the national Government was under a moral obligation to make provisions for them to mine. As time passed and no provision was made, the miners came to consider that the national Government acquiesced in their actions and would protect them therein. This idea has permeated all of our public-land history—that the Government is a protective and benevolent institution, a wise father who will care for his children that have gone forth into the wilderness to carve out fame and fortune for themselves. Settler, preëmptor, homesteader, and miner have clung to this principle with simple-minded faith, and evil will be the day in which it is forgotten or abandoned.

Though the miners gave no heed to the ownership in fee of the land, they found it necessary to take steps that each might have an equal chance, and in this way arose the miner's customs and regulations. The details and history of these are not a part of the present subject. It is my purpose merely to show the conditions under which was passed the first and original mining act of 1866 relating to lode claims, the second act of 1870 relating to placer claims, and the third and final act of 1872—the present mining law—superseding and perfecting the acts of 1866 and 1870.

First Land Laws

The preëmption act of September 4, 1841, to enable a settler upon public land to obtain 160 acres at $1.25 per acre in deferred payments, contained the clause, "and no lands on which are situated any known salines or mines, shall be liable to entry under and by virtue of the provisions of this act." This and similar previous reservations of mineral lands established the organic principle that mineral land was not to be obtained under agricultural-land laws, but no law for the disposal of mineral land and mines was provided. Consequently, when gold was discovered in California there was no law by which the mines or mineral land could be taken up. This condition was intensified by the act of March 3, 1853, providing that no preëmption right could be obtained on mineral land; also by the refusal of the Land Department to have surveys made in the mineral-land districts. In 1850 California was admitted into the Union and in the following year legalized the district rules and regulations of the miners by an act reading: "In actions respecting mining claims, proof shall be admitted of the customs, usages, or regulations established and in force at the bar or diggings embraced in such claims; and such customs, usages, or regulations when not in conflict with the constitution and laws of this state, shall govern the decision of the action." The Federal courts followed the rule laid down by the state of California for the guidance of its courts, while the same manner of procedure was followed in the later mining states and territories. This makes clear the working of the early mining law. There was no fee title or real ownership to the land known to contain mineral. It remained in possession of the national Government, for it was reserved from the operations of the agricultural-land laws and there were no mineral-land laws. The miner was simply holding the land by right of possession, by 'possessory right.' He was protected by no national statute, he had no vested right, he could be evicted from his possessions at any time Congress might pass an act for that purpose. The miners met in mass-meetings in the different districts and adopted rules and regulations regarding the manner of taking up and holding mining claims and mineral land. When disputes arose over mining claims, a court of local miners was held, or the matter was taken into the recognized local courts after these were formed. In these courts the matter was decided upon the mining customs and regulations of the district and the principles of equity.

Miners Regulations

The miners' rules and customs varied greatly, notwithstanding that they had the same general tenure. J. Ross Browne, in his official report of 1866 upon the 'Mineral Resources West of the Rocky Mountains,' estimated that there were not less than 500 mining districts in California, 200 in Nevada, and 100 each in Arizona, Idaho, and Oregon, each with its set of written regulations. John S. Hittell, in his 'Bancroft's Handbook of Mining for the Pacific States,' published in 1861, gives the regulations of many districts. From these we shall select two brief representative sets: Tuolumne county in California and Virginia mining district in Carson county, Nevada. The quartz miners of Tuolumne county adopted the following code of regulations in 1858, and they are still in force:

Art. 1. The jurisdiction of the following laws shall extend over and govern all quartz-mining property within Tuolumne county.

Art. 2. Each proprietor or locator of a quartz claim shall be entitled to 150 ft. in length of the vein, including all its dips and angles; also 150 ft. on each side of said vein, together with the right of way on either side of said vein, to run tunnels and drifts any distance that may be necessary in order to work said vein. Provided, that the right to 150 ft. granted on each side of the vein, shall not be deemed to conflict with or detract from the right of any subsequent locator, who may discover a vein outside of said 150 ft., from following his vein through said ground.

Art. 3. The original discoverer of a vein shall be entitled to hold 300 ft. in length on said vein, by virtue of discovery.

Art. 4. No man shall, by virtue of pre-emption, be entitled to hold more than one claim on the same vein, except as provided in article three.

Art. 5. All quartz claims hereafter taken up or located shall be plainly marked by notices posted, containing the claimants' names and number of feet claimed.

Art. 6. The parties locating a quartz claim shall put at least one full day's work on said vein in every 30 days, in order to hold the same. A day's work shall be eight hours' labor. Provided, however, that the sum of $100

expended on said claim, shall hold the same for six months from date of its expenditure.

Art 7. Any individual, company, or companies erecting machinery for working quartz shall, by virtue of said machinery, hold the vein or veins belonging to said individual, company, or companies.

Art 8. These laws shall be in full force and effect from and after the first day of September, A. D. 1858.

At a meeting of the miners of Virginia district, held at Virginia City, Nevada, September 14, 1859, the following rules were adopted for the government of the mines of said district.

Art. 1. All quartz claims hereafter located shall be 200 ft. on the lead, including all its dips and angles.

Art. 2. All discoverers of new quartz veins shall be entitled to an additional claim for discovery.

Art. 3. All claims shall be designated by stakes and notices at each corner.

Art. 4. All quartz claims shall be worked to the amount of $10 or three days' work per month to each claim, and the owner can work to the amount of $40 as soon after the location of the claim as he may elect; which amount being worked, shall exempt him from working on said claim for six months thereafter.

Art. 5. All quartz claims shall be designated and known by a name and in sections.

Art. 6. All claims shall be properly recorded within ten days from time of location.

Art. 7. All claims recorded in the Gold Hill record and lying in the Virginia district, shall be recorded free of charge in the record of Virginia district, upon the presentation of a certificate from the recorder of Gold Hill district, certifying that said claims have been duly recorded in said district; and said claims shall be recorded within 30 days after the passage of this article.

Art. 9. Surface and hill claims shall be 100 ft. square, and designated by stakes and notices at each corner.

Art. 10. All ravine and gulch claims shall be 100 ft. in length, and in width extend from bank to bank, and be designated by a stake and notice at each end.

Art. 11. All claims shall be worked within 10 days after water can be had sufficient to work said claims.

Art. 12. All ravine, gulch, and surface claims shall be recorded within 10 days after location.

Art. 13. All claims not worked according to the laws of this district, shall be forfeited and subject to relocation

Art. 14. There shall be a recorder elected, to hold his office for term of 12 months, who shall be entitled to the sum of 50c. for each claim located and recorded.

Art. 15. The recorder shall keep a book with all the laws of this district written therein, which shall at all times be subject to the inspection of the miners of said district; and he is furthermore required to post in two conspicuous places a copy of the laws of said district.

Most of the mining states and territories passed state mining acts. The Arizona statute of 1865 contained 53 sections, and was a long and formidable document, drawn up with much legal ability and mining experience.

The Fremont Bill

On September 14, 1850, John C. Fremont, senator from the newly admitted state of California, introduced into the Senate 'a bill to make temporary provision for the working and discovery of gold mines and placers in California, and for preserving order in the gold mining districts.' On September 24 and 25 it was debated at considerable length and amended. The bill was in the nature of police regulations levying a tax or ground rent upon the miners. As amended it provided for six Government agents who were to travel about the mining districts. They were to issue annual permits to work placers at the rate of one dollar per month for a placer 30 ft. square, and $50 per month for a placer of the maximum size of 210 ft. square or one acre. The permits were to be marked upon the ground by the Government agents. No permits were to be issued to aliens, except to those of good character from Europe. Such men as Benton and Seward declared themselves in favor of not attempting to derive revenue from the gold mines, but nevertheless helped to pass the bill. It was passed by the Senate on September 25, 1850, and was brought up in the House of Representatives, but was not considered and thereby failed to become a law.

Before any further legislation was proposed, the miners rules and customs had developed into a serviceable instrument of law, especially under its recognition by the legislature and statutes of the state of California. Congress now wisely concluded that it was too little informed on the subject to make any suitable laws, and made no further attempts at legislation for the gold mines. This state of affairs continued until 1864, when, in casting about for means to pay off the enormous national debt incurred by the Civil War, it was proposed to sell the mineral lands of the West. George W. Julian, of Indiana, introduced into the House of Representatives on February 2, 1865, a bill to provide for selling the mines, and made an extended speech upon it. On December 5 of the same year, John Sherman, senator from Ohio, presented a bill of the same purport to the Senate. Similar bills had been and were being proposed, and Western miners were commencing to realize that they were dangerously near the parting of the ways; their laws and the assumed rights under which they had grown and prospered were about to be swept away, their possessions were about to be sold over their heads, and they were to be driven out as mere trespassers. Indignation meetings were held and memorials were prepared by civic bodies and state legislatures protecting against such unthought-of action. It is only fair to state that the proposed bills did not intend to take away bodily the mines from those who were in possession of them. The possessors were to have a preferred right to acquire them. But Mr. Sherman's bill proposed that the minimum price should be $50 per acre. All provided that as high a price as possible should be secured through public auction, and the land should be sold in blocks similar to agricultural land. They sounded the death knell of free mining as it was then understood.

Proposal to Sell Mineral Land

One of the senators from California was John Conness, who had introduced a bill into the Senate in 1864 to permit miners to locate and purchase mineral land. Upon the admission of Nevada into the Union in 1865, he presented to the Senate the credentials of William M. Stewart as one of the senators to represent the new state. These two men were the fathers of the American mining acts. In this they responded to the appeals of their constituencies and the Western miners. Mr. Conness brought to bear on the subject his knowledge of mining in California and his experience with his first bill. Mr. Stewart came with full knowledge of the conditions then existing on the Comstock, where, through the fabulous richness of the lodes and the insecurity of possessory titles, the business of producing and continuing litigation had been perfected to a state perhaps higher than it ever reached before or since. He was, in addition to being a lawyer, a miner who had attained wealth, only to have it swept away by unforeseen accident, by flood. A bill was carefully framed by the combined efforts of these two men as members of the Senatorial Committees on Mines and Mining and on Public Lands, of the Treasury Department, and John Sherman as representing the contingent which was seeking to lighten the load of the national debt, and of the Land Department as representing the office in charge of the public lands which had repeatedly urged that some disposition of the mineral lands should be made to enable agricultural land in mineral-land areas to be segregated. This bill was to become the first mining act, and by the extension of the act of 1870 and the amplification of the act of 1872, to become our present mining act. Messrs. Stewart and Conness dominated in its framing, and it was virtually their handiwork. John Sherman introduced the bill into the Senate on April 9, 1866, as Senate bill No. 257, with the title of 'A bill to regulate the occupancy of mineral lands and extend the right of preëmption thereto.' Its purpose was to recognize and to confirm for all time to come the possessory rights of the miners, to confirm water and ditch rights, to enable lode or quartz claims to be purchased from the Government, and to enable agricultural land in mineral-land areas to be segregated and patented. On June 18 it was discussed by the Senate as a committee of the whole, nearly the entire day being given to discussing it. It was again considered at length on June 28. Mr. Stewart opened the discussion on the floor of the Senate

with an able defense of the rights of the miners and the necessity of the act, saying in part:

Mr. Stewart's Speech

Upon the discovery of gold in California in 1848, a large emigration of young men immediately rushed to the mod ern Ophir. These people, numbering in a few months hundreds of thousands, on arriving at their future home found no laws governing the possession and occupation of mines but the common law of right, which Americans alone are educated to administer. They were forced by the very necessity of the case to make laws for themselves. The reason and justice of the laws they formed challenged the admiration of all who investigate them. Each mining district, in an area extending over not less than 50,000 square miles, formed its own rules and adopted its own customs. The similarity of these rules and customs throughout the entire mining region was so great as to attain the beneficial results of well digested, general laws. These regulations were thoroughly democratic in their character, guarding against every form of monopoly, and requiring continued work and occupation in good faith to constitute a valid possession.

After the admission of California as a state in September, 1850, Mr. Fremont, then senator from that state, introduced a bill, the purpose of which was to establish police regulations in the mines. It imposed a small tax upon the miners to defray the expenses of the system. Many senators, when the bill came up for consideration, expressed the opinion that the mines ought to be sold or some means devised by which a direct revenue might be obtained from that source. Various amendments were offered to effect these purposes. But Mr. Benton took a leading part in the discussion, and contended throughout that good policy required that the mines should remain free and open to exploration and development. Mr. Seward sustained Mr. Benton. The arguments of senators in favor of free mining finally prevailed, and all amendments looking to sale or direct revenue were voted down, and the bill finally passed the Senate, without material amendment, in its original form, but failed in the House for the want of time to consider it. This solemn declaration on the part of the Senate in favor of a just and liberal policy to the miners was hailed by them as a practical recognition of their possessory rights, and greatly encouraged and stimulated mining enterprise and laid the foundation for a system of local government now in force over a vast region of country inhabited by nearly a million men.

Legislation by California

The legislature of California, at the following session, in 1851, had under consideration the subject of legislating for the mines; and after full and careful investigation wisely concluded to declare that the rules and regulations of the miners themselves might be offered in evidence in all controversies respecting mining claims, and when not in conflict with the constitution or laws of the state or the United States, should govern the decision of the action. A series of wise judicial decisions moulded these regulations and customs into a comprehensive system of common law, embracing not only mining law (properly speaking), but also regulating the use of water for mining purposes. The same system has spread over all the interior states and territories where mines have been found, as far east as the Missouri river. The miner's law is a part of the miner's nature. He made it. It is his bantling, and he loves it, trusts it, and obeys it. He has given the honest toil of his life to discover wealth, which, when found, is protected by no higher law than that enacted by himself under the implied sanction of a just and generous government. Miners as a community devote three-fourths of their aggregate labor to exploration, and consequently, and ever will remain, poor, while individuals amass large fortunes, and the treasury of the world is augmented and replenished.

Senators who have not given this subject special attention can hardly realize the wonderful results of this system of free mining. The incentive to the pioneer held out by the reward of a gold and silver mine, if he can find one, is magical upon the sanguine temperament of the prospector. For near a quarter of a century a race of men, constituting a majority by far of all the miners of the West, patient of toil, hopeful of success, deprived of the associations of home and family, have devoted themselves, with untiring energy, to making deep shafts, running tunnels thousands of feet into solid granite, traversing deserts, climbing mountains, and enduring every conceivable hardship and privation, exploring for mines, all predicated upon the idea that no change would be made in this system that would deprive them of their hard earned treasure. Some of these have found valuable mines and a sure prospect of wealth and comfort when the appliances of capital and machinery shall be brought to their aid. Others have received no compensation but anticipation, no reward but hope.

Work of the Prospector

While these people have done little for themselves, they have done valuable services for this Government. They have enhanced the value of the property of the nation near one hundred per cent, as I shall hereafter show, and they have converted that vast unknown region, extending from British Columbia on the north to Mexico on the south, and from the eastern slope of the Rocky Mountains to the western decline of the Sierra Nevada, into the great gold and silver fields of the United States, surpassing in richness and extent the mines of any other nation on the globe. I assert, and no one familiar with the subject will question the fact, that the sand plains, alkaline deserts, and dreary mountains of rock and sagebrush of the great interior would have been as worthless today as when they were marked by geographers as the 'great American desert' but for this system of free mining fostered by our neglect and matured and perfected by our generous inaction. No miner has ever doubted the continued good faith of the Government, but has put his trust in its justice and liberality, traversing mountain and desert as incessantly and as hopefully as the farmer of the West has ploughed his field. What he now occupies he has discovered and added to the wealth of the nation.

This faith of the Government (promised, as it were, by the actions of this Senate sixteen years ago) not only inspired enterprise and led to discoveries the magnitude and importance of which cannot be overestimated, but in the time of the severest trials of the Union, no people were more loyal than the miners. They lost no opportunity to enlist in the armies or contribute to the support of the Government. Their liberal donation to the sanitary fund was but a slight manifestation of their deep love of the Union and sympathy for its suffering heroes. The little town in which I reside (Virginia City) contributed in gold coin over $112,000, being at the time about thirty dollars to each voting inhabitant, and a like liberality was displayed by the whole Coast. The people are truly grateful to a generous Government, and time seems to have strengthened the tender regard they feel for their native land and their early homes, but they look with jealous eyes upon every proposition for the sale of the mines which they have discovered and made valuable. Any public man who advocates it, with whatever motive, is likely to be condemned and discarded as an unfaithful servant. The reason is obvious. It is their all, secured through long years of incessant toil and privation, and they associate any sale with a sale at auction where capital is to compete with poverty; fraud and integrity with truth and honesty. It is not because they do not desire a fee-simple title, for this they would prize above all else; but most of them are poor and unable to purchase in competition with capitalists and speculators, which the adoption of any plan heretofore proposed would compel them to do; and for these reasons the opposition to the sale of the mineral lands has been unanimous in the mining states and territories.

Occurrence of Veins

To extend the preëmption system, applicable to agricultural lands, to mines is absolutely impossible and absurd. Nature does not deposit the precious metals in rectangular forms descending between perpendicular lines into the earth, but in veins or lodes varying from one to three hundred feet in width, dipping from a perpendicular from one to eighty degrees, and coursing through mountains and ravines at nearly every point of the compass. In exploring for vein mines it is a vein or lode that is discovered, not a quarter section of land marked by surveyed boundaries. In working a vein more or less land is required, depending upon its size, course, dip, and a great variety of other circumstances not possible to provide for in passing general laws. Sometimes these veins are found in groups, within a few feet of each other, and dipping into the earth at an angle of from 30° to 50°, as at Freiberg in Saxony, or Austin in Nevada. In such a case a person buying a single acre in a rectangular form would have several mines at the surface and none at 500 or 1000 ft. in depth. With such a division of a mine, one owning at the surface, another at a greater depth, neither would be justified in expending money in costly machinery, deep shafts, and long tunnels for working the same. Nor will it do to sell the land in advance of discovery, for this would stop explorations and practically limit our mining wealth to the mines already found, for no one would prospect with much energy upon the land of another, and land speculators never find mines. The mineral lands must remain open and free to exploration and development, and while this policy is pursued our mineral resources are inexhaustible. There is room enough for every prospector who wishes to try his luck in hunting for new mines for a thousand years of exploration, and yet there will be plenty of mines undiscovered. It would be a national calamity to adopt any system that would close the region to the prospector.

The question then presents itself, how shall the Govern-

ment give title so important for present prosperity, and avoid these intolerable evils? I answer, there is but one mode, and that is to assure the title to those who now or hereafter may occupy according to local rules suited to the character of the mines and circumstances of each mining district. The importance of legislation of this kind is daily increasing by the agitation of the subject, by the introduction of bills looking to what the miners regard as a general system of confiscation, destroying all confidence in mining titles, and by the absolute necessity of some system guaranteeing to capitalists security for their investment. The system proposed by this report may be improved by experience, but your committee would apprehend evil consequences from any material change of the plan at this time. It continues the system of free mining, holding the mineral lands open to exploration and occupation subject to legislation by Congress and local rules. It recognizes the obligations of the Government to respect private rights which have grown up under its tacit consent and approval. It is also in harmony with the rules of property, as understood by a million men, with the legislation of nine states and territories, with a course of judicial decisions extending over near a quarter of a century and finally ratified and confirmed by the Supreme Court of the United States. In short, it is in harmony with justice and good policy.

The plan further proposes to allow the miners who have and who may hereafter occupy and improve mines in good faith, and according to local rules, to purchase at the rate of $5 per acre and receive a patent therefore in such a form as shall grant the mine with its dips, spurs, and angles to any depth, with such a reasonable amount of surface as the miners shall determine by local rules to be necessary for the working of the same. It also provides, in the case of dispute as to the right of possession, for the determination of that question in the local courts where the miners' laws are understood and fairly administered. It makes the public surveys conform to nature, not nature to the surveys. It furnishes the means to actual settlers of acquiring title to their homesteads by segregating the agricultural from the mineral lands, and confirms the rights to the use of water and the rights of way for ditches as established by local law and the decisions of the courts. In short, it proposes no new system, but sanctions, regulates, and confirms a system to which the people are devotedly attached, and removes a cloud of doubt and uncertainty which recently has depressed and retarded the growth and prosperity of our mining communities. In my opinion this bill will furnish homes to thousands of families, give stability to mining titles, invite capital, and greatly increase the production of the precious metals.

Development of Mineral Lands

The primary conditions upon which the development of our national wealth depend are: (1) transportation; (2) a scientific knowledge of mining; (3) security of titles; and (4) abundance of capital. The first question is involved in the speedy completion of the Pacific railroad. We need mining colleges in the mining districts where the youth of America may study the science of mining with the laboratory of nature before him as a guide, and where theory and practice may be combined. We want a law of the character of the bill under consideration to establish and secure mining titles. While these are in doubt, a feeling of insecurity will paralyze all our efforts. Let a just, liberal, and definite policy be adopted toward the miners. Add to their possession the absolute right of property, and you will have laid a solid foundation for large and increasing yields. The feeling of security and independence produced by the right of property in the soil is the real foundation of our stability and prosperity as a people. A nation of freeholders is a nation of sovereigns, but a nation of tenants is a nation of slaves. Let not our free system of mining be degraded into miserable monopolies or disastrous confusion, but let it be confirmed, enlarged, and perfected, and the great national bank of redemption in the West will never refuse specie payment.

(To be Continued)

Murua, a small island 100 miles east of British Papua, produces a considerable amount of gold, the output for December last being estimated at $30,000. It is reported that ore containing as much as 20 oz. per ton is found, a modern mill which has recently been erected there commonly treats 10 to 15-oz. ore. A few miles south is the island of Misima, having an area of 7 sq. mi., where a large mill has been erected and good returns are confidently expected. A local dredging company has been formed and expects to reap large returns from working the rivers of the northern portion. A neighboring island, Sudest, is reported to have, next to the Klondike, yielded the largest output of gold per square mile of alluvial working.

A Bill to Create a Commission on Mining

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that a commission is hereby created, to be called the Commission on Mining Industry. Said commission shall be composed of eleven persons, to be appointed as follows: two members of the Senate (including the chairman of the Committee on Mines and Mining and one member to be appointed by the President of the Senate), two members of the House of Representatives (including the chairman of the Committee on Mines and Mining and one member to be appointed by the Speaker of the House), two representatives of mine operators, two representatives of miners, two mining engineers, and one representative of the Bureau of Mines, to be appointed by the President of the United States.

Sec. 2. That the members of this commission shall be paid actual traveling and other necessary expenses, and in addition a compensation of ten dollars per diem shall be paid those who are not officials of the Government during their service on said commission and while engaged on the work of the commission and while going to or returning from such work. The commission is authorized, as a whole or by subcommittee of the commission duly appointed, to hold sittings and public hearings anywhere in the United States, to send for persons and papers, to administer oaths, to summon and compel the attendance of witnesses and to compel testimony, and to employ such secretaries, experts, stenographers, and other assistants as shall be necessary to carry out the purposes for which such commission is created, and to authorize its members or its employees to travel in or outside of the United States on the business of the commission.

Sec. 3. That said commission may report to the Congress its findings and recommendations from time to time, and shall make a final report not later than two years after the date of the approval of this Act, at which time the term of this commission shall expire unless it shall previously have made final report, and in the latter case the term of the commission shall expire with the making of its final report, and the commission shall make at least one report to the Congress within the first year of its appointment and final report at the end of two years.

Sec. 4. That the commission shall inquire into the general condition of labor employed in the mining industry of the United States, and especially as to the safety of mining and the methods of more efficient mining and the conservation of the mineral products of the United States; into existing relations between employers and employees; into the growth of associations of employers and of wage-earners and the effect of such associations upon the relations between employers and employees; into any methods which have been tried in any State or in foreign countries for maintaining mutually satisfactory relations between employees and employers; into methods for avoiding or adjusting labor disputes through peaceful and conciliatory mediation and negotiations; and into the scope and methods and resources of existing bureaus of labor and of mines, and into possible ways of increasing their usefulness so far as the mining industry is concerned. The commission shall seek to discover and to point out the underlying causes of dissatisfaction in the mining situation.

Operating costs at the East Rand Proprietary have risen from 14s. 9d. in January 1911 to 19s. 4d. in December. This is due, according to a recent report by H. Ross Skinner, the superintending engineer, to an alteration in the basis of calculating tonnages, decrease in tonnage milled, revision of the classification of development work, the exclusion from tonnage milled of such items as 'accumulated slime' and the increase of fixed charges due to curtailment of development.

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*A bill (H. R., 22342) introduced in the House of Representatives on March 26 by M. D. Foster, chairman of the Committee on Mines and Mining.

Elevating Ten-Cent Gravel at a Profit

By C. S. Haley

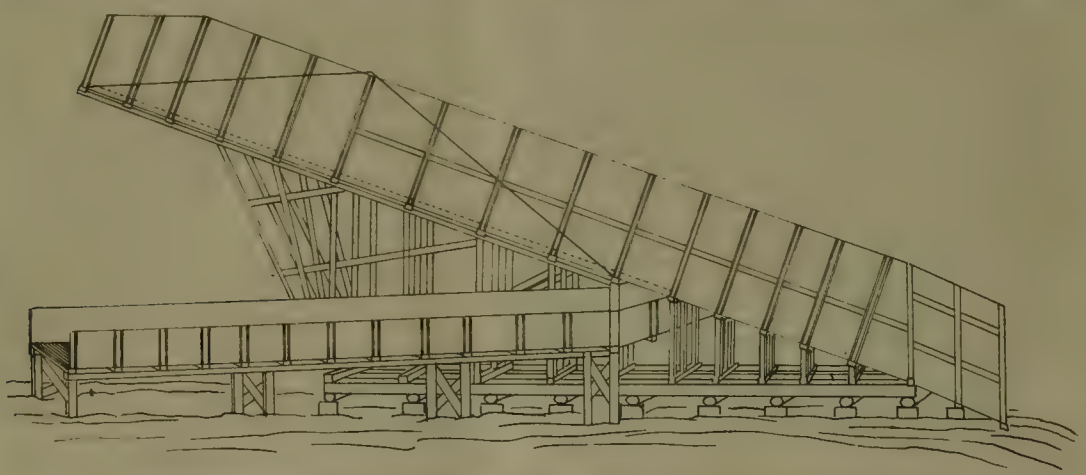
California, from the very first discovery of gold, in 1848, has well deserved the title of the Golden State. The early production from surface deposits of gravel, when individual prospectors poured a golden stream into the coffers of the nation from the pan, the rocker, the long-tom, and the ground-sluice, was later given a longer lease of life by the adoption of high-pressure giants, which uncovered the deeper and, in many cases, richer gravels. Coincident with the rattle of the boulders through the sluices came the development of lode mining, and the roar of many hundred stamps along the Mother Lode evidenced the healthy condition of a flourishing industry.

Later, when the agricultural interests began to predominate, and the ravages of the mud-swollen Sacramento forced the curtailing of the hydraulic output, it seemed as though, when the richer quartz veins were exhausted, with them the golden flood would cease. In fact, in the later eighties and early nineties, a decline in production set in which was so obvious that on all sides it was freely predicted that the dawn of the new century would find the state shorn of the title which was her early pride. By this time, the hydraulic division of the industry was practically confined to the northern portion of the state, whose streams, tributary to the Klamath and the Pacific, were unaffected by the débris law. In the eastern and central portion, such gravels as were worked were mainly handled by drifting, as in the ancient channels of the Sierras, whose gravels were mostly capped by prehistoric lava flows.

But the beginning of the new century saw the development of a new industry, which was destined to restore the production to respectable proportions. The utilization of bucket dredges opened a new and hitherto untried field to the miner. The broad stream beds of the Yuba, the Feather, and other tributaries of the Sacramento became a prolific source of wealth, and the waning production soon began to advance by leaps which offset the decline of quartz mining, until in 1910 the dredges produced more than 38% of the entire gold output of the state.

Naturally, the marked success of the gold dredges attracted the attention of gravel miners all over the coast. In the northern counties of Siskiyou, Trinity, and Humboldt, as well as Del Norte, the hydraulic mining industry has been for some years on the wane. The richer bars, with good 'dumps,' or storage space for the disposal of tailing, have been gradually worked out, and aside from those which are so difficult of access with water that their extent does not justify the necessary expenditure, the only gravels remaining are the broader lower-grade river bars which are, in the main, very slightly above the beds of the present rivers.

Every experienced miner knows that in handling low-grade gravel capacity is the main essential, in so far as it is consistent with saving the gold. In cutting down operating expenses and reducing overhead cost per cubic yard, lies the secret of success with gravels of this type. It is equally evident that capacity is limited by facility in the disposal of tailing, other conditions being favorable. This, in the past, has been the great advantage of the dredge over the hydraulic giant for the low river bars. In spite of the large initial cost and the consequent overhead expense, the increase in capacity has more than made up. However, it is my purpose to show, from facts in my own experience, first, that by the employment of very simple means, the giant can compete with the dredge for the banks of more moderate depth (say up to 50 ft.); and, second, that on bars of this type which are now closed by the débris law, the hydraulic giant can be operated at its best capacity, where the slightest impounding room is available at the start, without disturbing the well-earned repose of any farmer in the Sacramento valley.



SIDE ELEVATION OF ELEVATOR. THE DOTTED LINE INDICATES THE POSITION OF THE GRIZZLY.

The dredge has its limitations, and this fact is nowhere more clearly evidenced than in operation on the river bars of northern California. The gravels of the Scott, the Trinity, the Salmon, and the Klamath rivers are for the most part, on account of geological and topographical reasons, of a different type than those of the great dredging fields of the east-central portion of the state, and in most cases the distribution of the gold is different. Ideal dredging ground is free from large boulders, has fairly smooth soft bedrock, and, more important than all else, the gold is evenly distributed through the gravel, and does not lie chiefly on the bedrock. Besides this, the bars must be of sufficient extent to justify the initial expense of installation, with its subsequent yardage cost in depreciation and interest.

To these conditions the productive low-grade gravels of Yuba, Butte, and Sacramento counties very largely conform. On the other hand, the bars of the more mountainous northern streams, with their greater grades, present, in the main, conditions decidedly the reverse. The bars average from twenty to one hundred acres in extent, although they may be in frequent succession on opposite sides of the same river. The ground is decidedly heavy, and boulders weighing from one to five tons are common. And, most important of all, in many cases the gold which goes to make up even the low yardage average, lies chiefly, or in very

large part, on or near the bedrock. This necessitates, of course, exposure and careful cleaning of the bottom of the channel. In case of a hard uneven bedrock, this is something which would be beyond the powers of the best dredge made. Failure to understand these conditions has 'given a black eye' to dredge operation in many instances, where a careful investigation of the ground in the first place should have precluded its adoption.

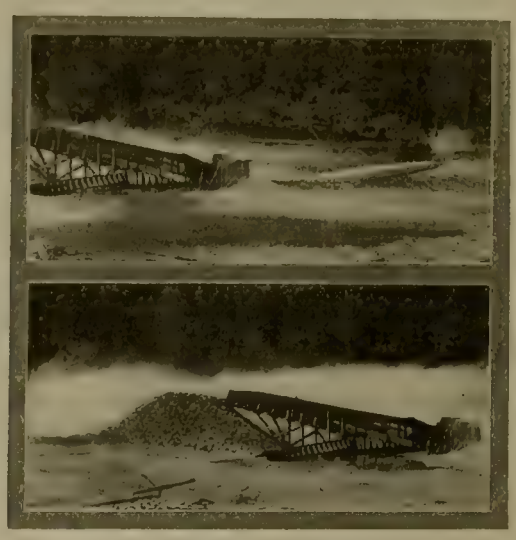
However, this does not imply that dredge installation upon these rivers is a waste of money in all cases. In the valley of the Scott, for instance, where the river has a more gentle grade and has formed large bars, there is no question but what there is a considerable quantity of ground available for dredging purposes. It is not the purpose of this article to deal with ground of this type, but with ground which from its nature can better be handled by an adaptation of the hydraulic process to its needs.

Obviously, in bars of the type described, available for hydraulic installation and yet too low on the river bed for the easy removal of tailing, some method of elevation must be adopted which will stack the tailing fast enough to allow a tremendous yardage during the water season. I have discussed, very briefly, in a former article in the *Mining and Scientific Press*, some of the methods in use in northern California, and have since had occasion for a more or less extended study of one of these methods which has only recently been put in general practice, and which seems likely to furnish a solution for the problem of handling profitably the low-grade, poor dump bars of rivers of this type, as well as the problems of operating some of the richer gravels of the Sierras without running afoul of the débris law. In fact, the low yardage cost possible by an application of this method comes dangerously near to competition with the dredging industry in its own chosen field.

The elevating system described was developed several years ago and patented by an operator on Coyote creek, in Josephine county, Oregon. Installations have been made as far distant as Alaska and South America, but it is only of late years that it has begun to attract attention in the land of its birth. The principle of the machine is very simple. It consists of an approach, or apron, running from the bedrock up into the elevator, and the main elevator, which is an inclined trough about 8 ft. wide, with sides tapering from 12 ft. high at the bottom to 6 ft. at the upper end. The pitch of the incline is about 17°, and the total length varies from 80 to 100 ft. Besides the apron, which is about 10 ft. long, the first 20 ft. of the incline is solid, and lined with ⅜-in. steel, as are the sides. Above this, and extending clear to the top of the incline, are grizzly-bars made of 2½ by 6-in. timbers covered with 3-in. steel ⅜ in. thick. Beneath the grizzly-bars is the bottom, sloping down to the sluice-box, which runs out directly beneath the grizzly-bars, and is trussed for the first 10 ft. to the framework of the elevator. The bottom beneath the grizzly is lined with No. 14 steel, as is the sluice-box. The bottom of the solid portion of the incline, beneath the lining, consists of double 1¼-in. boards; that below the grizzly of a single thickness of the same. The sides of the elevator are double boarded. The space below the line of the grizzly is about 16 in. deep, and the grizzly-bars are about 2½ in. apart. Supporting the bars are 2 by 8-in. stringers, running from the sluice-box up to the top of the grizzly. The riffles in the sluice-box, which is made in sections and built out from the elevator, are made of 2 by 4-in. scantling, covered with ¼-in. steel strips, about 4 ft. long, and set crossways in the box about 2 in. apart. Larger and heavier riffles are set lengthways at intervals. As nothing but the fine goes through the sluice, these riffles are amply durable. The construction of the framework, together with details of bracing and supports, is shown in the drawing. Braces may be made of 6 by 6-in. or even heavier timber, but if it is convenient to procure them, iron tie-rods for tension members make a lighter construction. Some improvements in detail of design may also be suggested by experience, but the drawing shows the construction of an elevator now in actual use at the Red Hill mine, the property of the Michigan Salmon Mining Co. at Forks of Salmon, California. The illustrations show the same machine.

In operating with this elevator, the chief loss in dead work consists in moving the machine, as it is somewhat cumbersome. Also, of course, a bedrock cut and drain-boxes are necessary to drain the channel. However, the use of a derrick is not necessary, as boulders up to 5 ft. diam. can be driven up over the grizzly and out on the dump with fairly good pressure and a moderate head of water. Wings must be conducted at every move to draw and drive against, as shown in the illustration. These figures of actual operation of the machine at the Red Hill will give some idea of the capacity to be obtained. Depth of bank, about 20 to 25 ft.; average dump, 10 ft.; gravel, heavy, containing boulders up to five tons in weight; capacity when running, about 1200 cu. yd. per day; amount of water required, about 1200 inches in two No. 3 giants, operating under 450-ft. pressure. When water is light, by shifting from the field giant to the elevator giant at intervals, 600 in. will give a duty of nearly 1000 cubic yards.

The method of operation is as follows: The elevator drive giant is set fairly in front of the elevator, at a distance from the apron of from 80 to 100 ft. This remains fixed in its position throughout the run, and a shed may be built over



THE ELEVATOR AT WORK.

it to protect the elevator 'piper' from chance flying gravel from the field giant. The latter giant is used to cut down and drive up the gravel from behind and to one side of the elevator giant, and will easily keep the elevator giant busy. The operation of the elevator giant is the most important part of the whole thing, and requires a skilled piper, who by careless work can lose several times his wages in a very little while. As the mixed gravel is driven up to him by the field giant and stacked in front of the elevator, he drives it up on the apron and the solid portion of the elevator below the grizzly. Here the fine and the gold must be 'boiled out' upon the grizzly, and the utmost care must be taken not to throw the gold clear through upon the dump. Carelessness in this respect caused, in one case of which I know, the condemnation of this elevator and the installation of a hydraulic system which will give nowhere near so great capacity. After the fine has all been boiled out into the boxes (an operation which does not require a great deal of time), the dry boulders are then driven out over the grizzly upon the dump. As the width of the machine is about 8 ft., its capacity exceeds that of a 3-ft. sluice-box on an 8-in. grade with the same water and the same type of gravel, necessitating throwing out the water and wasting time with a derrick. In fact, it so far exceeds the capacity of the latter that I have seen 10,000 cu. yd. of gravel, averaging about 5c. per yard,

put through the machine with 600 in. of water, the dump piped out of the way by moving the elevator giant forward for that purpose and then resetting, and everything in shape for another run in the same position within twenty days. This includes cutting down and all the innumerable details of handling which necessitate dead work. At any rate, gravel worth 5c. paid all expenses during the time of handling, under conditions which by any other process I know would have been absolutely assured of a dead loss.

After the dump is filled up to the top of the grizzly, extensions can be built out upon it by laying stringers, or sills, and covering with ordinary 1-in. boards in two thicknesses. This extending process may be repeated several times before it becomes necessary to pipe the dump. A giant run specially for the purpose of piping the dump would, of course, save a good deal of time. By this means an acre per month, 20 ft. deep, could readily be put through without moving. Another good feature, if the water were available, would be to have a ditch along the side of the bar, parallel with the direction of working, which would supply about two hundred inches as a constant feed for the sluice-box. As in all gravel mining, care must, of course, be taken that the box does not clog up with sand and run over. About 50 or 60 ft. of riffles of the type described is amply sufficient for any sluice-box. The grade of the box should be steep.

The length of run that can be made with the elevator in one position depends, of course, on local conditions, and the length of drive available with the pressure and water. Good pressure is highly desirable with this type of machine. Care must be taken in each move to see that there is plenty of dump room. The fine dump, of course, piles up in front of the sluice-box and must be piped back every hour or so. This occupies more space than the coarse boulder dump at the back of the elevator, and it is advantageous to run it off into the river if possible. But by piping it back with a dump giant, where the water is available, after the first run has been made, the machine clears its own room so fast that with the slightest impounding space to start with, the entire detritus can be stacked back on the ground as neatly as any dredge in existence could do it.

After a run has been made, comes the chief loss in dead work; that of moving the elevator. The wings must be torn down, to be rebuilt when the elevator is again in place. Skids are then prepared, made of peeled poles blocked up level at intervals of about 8 ft. apart along the line of motion. Care must be taken to have the blocking firm and the skids braced. The apron is removed from the front end, and is handled separately. The elevator itself rests on long stringers running its full length, made of about 12 by 12-in. timber. These stringers slide over greased skids. Four men, together with a mule and a capstan for motive power, with $\frac{3}{4}$-in. cable and triple blocks, can move one of these machines and set up the wings ready for operation in eight or nine days, including moving the giants and pipelines.

This dead work necessitates loss of water season. This can readily be obviated by having two machines on different parts of the bar. In fact, if the property is large enough, four machines would just about occupy the entire time of a moving crew, and gravel could be kept moving continuously over three of them, thus bringing down overhead cost caused by capital invested in original water equipment. In even the most isolated mountain regions, where timber is available, a machine of the size indicated can be built at a cost not to exceed $3500, which is, of course, very slight compared to the cost of the average water installation. Four machines, on a 20-ft. bank, even of the heaviest gravel, should have no difficulty in moving ten acres of ground in a five-month water season. The operating cost, exclusive of overhead expense, in a country such as that of the Salmon river, would be about $15,000, or in the neighborhood of 5c. per cubic yard.

These figures are based on actual operating experience in the Salmon river country, where the gravel is usually low grade and variable. With one machine in operation, 100,000 yd. is handled annually at the Red Hill, at an actual cost of about $6000, or 6c. per cubic yard. Overhead cost, including amortization of capital, of course, brings this up. In short, the advantages of the system are these. Ground which would ordinarily require a derrick and a good dump can be worked to advantage, and ample room be found for the disposal of tailing, thus ensuring capacity, essential in working low-grade bars. Such ground, if worked by hydraulic elevator, would require constant clearing of pits, a great head of water (the average amount of solid matter handled being only 4% by weight compared to the weight of water necessary) and much more time lost in moving, as well as giving much less duty to the miner's inch. By using a large number of machines, and thus conserving the water season and cutting down overhead yardage cost, gravel of the type described can be handled at a total cost of between 6 and 7c. per yard, and gravel of the dredging type at a much lower figure.

Now for the second point. The use of machines of this type need not be confined to the Klamath and its tributaries, in this state. Locked in the gravels of the Sierras and of the northern tributaries of the Sacramento is a tremendous wealth, unavailable by reason of the nature of the ground for the dredge, and barred by the débris law from recovery by ordinary hydraulic processes without the use of costly impounding dams. Attemps have been made to handle some of this by hydraulic elevators, but they have failed for various reasons. As stated before, the hydraulic elevator in any given time moves but four parts in one hundred of solid matter. The remaining 96% consisting of water used in the operation of the elevator and in driving the material to it, represents a tremendous waste of power which should be used in tearing down and driving material. This excess water, further, is bound to carry a large proportion of the débris down to the rivers, and bring the operator at once into conflict with the law. On the other hand, a box elevator of the type described uses much less water, requires a much smaller drain, and deposits the tailing in piles similar to a dredge, so that by the use of a dump giant, the entire débris, with the exception of a small amount of silt, can be kept on the bar. In view of the enormous wealth which is at present tied up in these bars, cannot some ground be found, under these circumstances upon which the mining interests of the Sierras and the agricultural interests of the Sacramento valley can unite on a common footing? I can see no reason why they should not.

Of course, there are many improvements which will probably suggest themselves to the practical operator; improvements in rigidity and lightness of construction, tending to facilitate moving, as well as improvements which tend to eliminate the personal equation brought in by careless piping, and prevent loss of fine gold, jamming with boulders and similar evils: also to conserve all the water for the boxes. The machine as it stands, however, certainly deserves more general use than it has as yet received, and will be a means of solving the problems of many hydraulic operators confronted with a lot of poor-dump, low-grade gravel, as well as being of great assistance under more favorable conditions.

PETROLEUM IN ARGENTINA.—According to the report of the British Consul at Buenos Ayres, the discovery of petroleum in the north of Argentina has been confirmed by the result of a Government survey, and the Department of Mines has satisfied itself that the petroleum field is an extensive one, that the oil is of good quality, and that it lies near the surface. The entire district is being reserved for Government exploitation.

THE Union of South Africa exported, during 1911, gold to the value of $170,000,000, diamonds worth $40,000,000, coal to the value of $5,250,000, and copper in ore and matte worth $3,000,000. The value of the tin exported was $1,190,000, while it is interesting that ostrich feathers worth $11,000,000 were exported during the year.

The Economics of Tube-Milling

By S. J. Truscott

*Referring to the original paper on this topic by S. H. Ball, the table (see below) registers the feed tests, among which Mr. Ball points to A as indicating the most efficient feed. The figures given under A, however, are not the actual figures of the test, but those after correction from the application of the moisture curve, whereby Mr. Ball would bring them from a condition of 33% moisture to one of 38%, at which the other tests were made. As I have pointed out, in making the correction for power the number of tons crushed through 120 mesh per 24 hr., and it will be seen that for the experiment A Mr. Ball gives the highest figure of 3.96 tons. But this is a figure which can be shown to be entirely wrong. All the other results in that column were obtained directly from the actual figures of the different tests. With that for A, however, this was not the case. This was obtained by measurement from the curve where, between the points O and R, Mr. Ball has not ventured to put in the actual results for A, but has drawn a freehand curve which places A as high as he thought from his efficiency curve it ought to be.

Using the figures given by Mr. Ball, it can be directly calculated that the amount of material which would be

GENERAL SUMMARY OF TESTS.

Remarks.	Test.	Pebble load.	Pebble vol.	Rev. per min.	Peripheral speed min.	Moisture. %	Feed. Tons per 24 hrs.	Hp.	Work done per unit.	Net output "–120grade" (tons 24 hrs.)	Rel. mech. eff. per hp.
		lb.									
Feed tests	P	1200	0·5	41	369 ft.	38·0	7·2	6·3	3·89	2·27	4·45
	C	1200	0·5	41	369 „	38·0	9·6	5·0	3·86	2·34	6·45
	B	1200	0·5	41	369 „	38·0	12·6	5·1	2·82	2·95	7·02
	O	1200	0·5	41	369 „	38·0	14·4	5·6	2·91	3·31	7·48
	*A	1200	0·5	41	369 „	38·0	18·6	5·8	2·58	3·96	8·29
	R	1200	0·5	41	369 „	38·0	23·0	6·6	2·09	3·79	7·28
Moisture tests	D	1200	0·5	41	369 ft.	30·0	12·6	5·7	2·99	2·93	6·61
	*B	1200	0·5	41	369 „	37·7	12·6	5·0	2·82	2·95	7·11
	E	1200	0·5	41	369 „	50·0	12·6	6·2	3·05	2·95	6·16
	F	1200	0·5	41	369 „	58·0	12·6	6·0	2·84	2·97	5·96
Pebble load tests	*G	900	0·37	41	369 ft.	38·0	12·6	4·9	2·75	2·65	7·07
	B	1200	0·50	41	369 „	38·0	12·6	5·1	2·82	2·78	7·02
	H	1500	0·68	41	369 „	38·0	12·6	6·9	3·31	3·40	6·04
Speed tests	T	1200	0·5	33	297 ft.	38·0	7·2	6·8	4·19	2·45	4·43
	*Q	1200	0·5	37	333 „	38·0	7·2	5·1	4·17	2·59	5·89
	P	1200	0·5	41	369 „	38·0	7·2	6·3	3·89	2·27	4·45
	S	1200	0·5	46	414 „	38·0	7·2	7·5	4·03	2·48	3·87

* Most efficient test of series.

Mr. Ball has made a serious mistake. The actual power consumed at 33% moisture is given as 5.3 hp. At 38% moisture, from the moisture power curve, it should certainly be less. However, Mr. Ball has increased it from 5.3 to 5.8 instead of decreasing it, noting with satisfaction that this figure conforms so well to the power-curve which he drew without its help. It will be seen that if this power had been logically corrected it would, on the contrary, have destroyed that curve.

It may be argued that in any case the results of test A, as they actually stand and without the advantage of the correction for moisture, still indicate the most efficient feed, the relative mechanical efficiency of that test being 7.76. By reference, however, to the table of crushing efficiency given in the original paper, it can be shown that that statement is open to very great doubt. In that table, which is derived from the feed tests, there is a column giving crushed through 120-mesh, in that experiment, in 24 hr., is 2.79 tons, or, if it be increased to the greater efficiency of 38% moisture, 2.97 tons. With these figures—and they are the only ones which can be justified from the data given—the crushing efficiency of experiment A is far from being the best of the lot. It may be argued that crushing efficiency is not a measure of mechanical efficiency, since it does not take the power into account, but it is in any case an effective measure of the work done, and Mr. Ball in more places than one has not failed to recognize the correctness of the indication it affords as to efficiency. The relatively low crushing efficiency of this test A, therefore, subjects to considerable doubt Mr. Ball's conclusion that his results show a critical feed in the experiment A. In this connection I take the word "critical" to mean a position from which a small departure will cause a serious change of efficiency. To show the difficulty, however, of checking Mr. Ball's figures here and elsewhere throughout the paper, I would refer to the number of tons for the experiment C in this table of crushing

*From the *Bulletin* of the Institution of Mining and Metallurgy. A discussion of the article by H. Standish Ball, *Mining and Scientific Press*, September 23, 1911.

efficiency. This is given as 2.54, whereas in the general summary of tests near the end of the paper it appears as 2.34, and if it be worked out from the data on page 22 the figure 2.68 is obtained.

After the tests on feed come those for moisture. As Mr. Ball remarks, the outstanding feature of these tests is the great efficiency of a moisture of 37.7% above all others, this being the percentage of moisture in test B. It is seen, however, that this efficiency is due entirely to the lower power recorded. Further inspection shows this low power to be so singular as to require confirmation. This view is strengthened by reference to the moisture diagram. The black dots with circles around them in that diagram represent the power readings, and it is seen how entirely unsupported the position of B is, and how entirely isolated. So much is this the case, that there are, I think, few who would be bold enough to include it in drawing any power-curve. Mr. Ball appears to take comfort and confirmation from the fact, which he considers notable, that the power curve is practically the efficiency curve inverted. But the fact that when the power is given low the efficiency appears high, is a natural and not a notable fact. He would again fill the gaps in his own experiments by bringing other authorities to his help.

Walter Neal, who from his experiments concluded that there was a definite critical point in the percentage of moisture, is the first one named. It was he, indeed, who first used the expression "critical" in this connection; but, if his results be carefully examined, it will be found that out of his eight experiments the one made in the neighborhood of 39% moisture had the advantage of the others in the largest and coarsest feed, two conditions which might well of themselves account for the greater efficiency at that moisture. I do not, however, wish it to be thought that I consider that Neal's experiments are thereby completely vitiated. I believe that they point to a greater efficiency in the neighborhood of 39%, but I do not think that they indicate any critical position. Sherrod is quoted as considering 40 to 45% moisture as the best under the circumstances of his equipment, thereby indicating that in his opinion a range of good efficiency existed.

Of Smart, it is stated that in the tests carried out upon the Rand he found 38.5% as the most efficient, but on examining the reference to this authority, it is seen that when speaking of the introduction of Caldecott cones at a plant in Mexico, he said: "As under the conditions of this plant 38% moisture gives a considerably higher tube-mill efficiency than higher or lower dilutions, a satisfactory tube-mill product was in this way secured." He was not speaking of any particular moisture tests made, certainly not of any made upon the Rand.

Lastly, there are the experiments of Fox, of whom Mr. Ball says that he "discovered that, taking the power consumed in conjunction with the fine grinding, the most efficient moisture would be 39.6." On examining the reference to that authority, it is seen that Fox says: "Comparing Fig. 3 and 4, it would seem that after the percentage of solution in the pulp has reached about 35%, both the fine grinding and the power consumption stay reasonably uniform," a statement which shows that he was quite unaware that his experiments had indicated a critical moisture, at 39.6. These two figures are those given in Fig. 10 on page 46 of Mr. Ball's paper, but in transcribing the curve marked 'moisture efficiency,' a serious alteration in its properties has crept in, which places the highest efficiency at the moisture of 39.6, whereas the real curve shows that an equally high efficiency was obtained at about 35% moisture, this being the percentage which Fox himself selects for comment. It is further to be noted that if the power be taken into account, the highest mechanical efficiency in these experiments by Fox occurs with a moisture of 28.57 per cent.

Concerning the pebble load, three tests were made which appear to indicate that a light load is mechanically more efficient, though a heavier load crushes more, these results agreeing with those made by Fox.

Concerning the speed, four tests were made, from which it would appear that Mr. Ball's tests confirm general experience. A remarkable and somewhat doubtful result is that which shows that it might take considerably more power to drive a charged mill at a certain lower speed than a higher one, Mr. Ball's experiments having shown this to have been the case as between 33 and 37 revolutions per minute. It is true that toward the end of the paper Mr. Ball gives results which would indicate a lubricating effect of the feed. Such internal lubrication of the feed can be conceived, but speed as a factor of lubrication is decidedly more difficult to grasp, and until further confirmation of such a property of speed is available, it would appear more easy to conceive that the power readings may have been wrong, a possibility mentioned by Mr. James. There is, in fact, some reason to doubt the power readings throughout. In addition to the considerations just given, I have already mentioned the singularly low and doubtful power in the case of experiment B of the moisture tests. It is further pertinent to remark that the power consumed in the condition of 'running light' throughout the experiments varies also very considerably. It is stated that the "motor was first run light for a few minutes to enable the power consumed by the shafting, belting, etc., to be ascertained." Seeing that this is a carefully specified duty, it is pertinent to ask whence come, then, the variations from 2733 watts to 8640 watts in the power consumed for this purpose.

Finally, Mr. Ball desires to test his work by first calculating what the efficiency under certain set conditions would be, and then running an actual test under those conditions. He wishes to know what the efficiency would be at 7.2 tons feed, 35% moisture, pebble load of half volume, that is, 1200 lb., and 37 r.p.m. By calculation he finds this efficiency to be 4.27. He then runs an experiment, designated U, to test this result, and an efficiency of 4.32 is obtained. These figures agree well, but unfortunately the test U was carried out at 41 r.p.m. If it be argued that in stating the problem the figure of 37 was by mistake given in the place of 41, and that this was obvious from Mr. Ball's calculation on page 50, that explanation may be accepted. But in such a case the problem represents, with only one variable, the conditions under which the test P was run, this variable being moisture, and the efficiency given to that test in the statement on page 13 has only to be corrected for moisture. This correction should therefore be carried out on exactly the same lines as the correction for the experiment A previously considered, the two positions being as follows:

Experiment A. Actual conditions.		Experiment P. Actual conditions.	
Feed	18.6 tons	Feed	7.2 tons
Moisture	33%	Moisture	38%
Pebble load.....	1200 lb.	Pebble load.....	1200 lb.
Rev. per min....	41	Rev. per min....	41
Efficiency	7.76	Efficiency	4.45
Required the efficiency at 38% moisture.		Required the efficiency at 35% moisture.	

It will be seen, however, when comparing the calculations, that the two were not conducted upon the same lines. In both cases reference was first made to the moisture curve, and a difference between the two moisture efficiencies was obtained. On page 14 of his paper this difference was treated proportionally to figures of tonnage, whereas on page 50 it was treated proportionally to figures of efficiency. One method or the other must therefore be wrong.

In conclusion, Mr. Ball made an experiment under conditions all four of which represented, according to him, critical conditions, and he obtained a result which, he says, surpassed expectations. It would have been thought that if Mr. Ball had had a clear conception of the problem in hand he would have essayed to calculate the possible result, and that he has not attempted to do so weakens the force of his arguments considerably; there is little doubt also that had he done so his calculated result would

have been very much higher than actually obtained. This final test gave an efficiency of 8.82, a figure the significance of which can be readily challenged. On page 54 the figures of the actual test are given, from which it can be calculated that the crushing efficiency developed under these four critical conditions was at the rate of 2.97 tons per 24 hr. Comparing this efficiency with those given on page 14, it is seen that, neglecting that of A, which is incorrect, it is surpassed by two others, namely, O and R. If, therefore, any gain of relative mechanical efficiency has resulted, it has been brought about at the expense of a loss in crushing efficiency. There is another side from which this result of 8.82 may legitimately be challenged. On page 4 Mr. Ball states the general experience, in saying that "high efficiency could be obtained only by feeding a sand containing a minimum of slime." Reference to the gradings of the sand fed in these experiments will show that, whereas the sand of this last experiment contained only 12% of material passing 120 mesh, the average amount in the case of the others was 18.8%, and there was not one which came nearer than 16.5%. In other words, the material fed in the case of the last experiment was appreciably coarser than in all others, and the result of 8.28 was obtained, therefore, under exceptionally favorable circumstances outside of the four conditions of the test.

Nigerian Tinfields

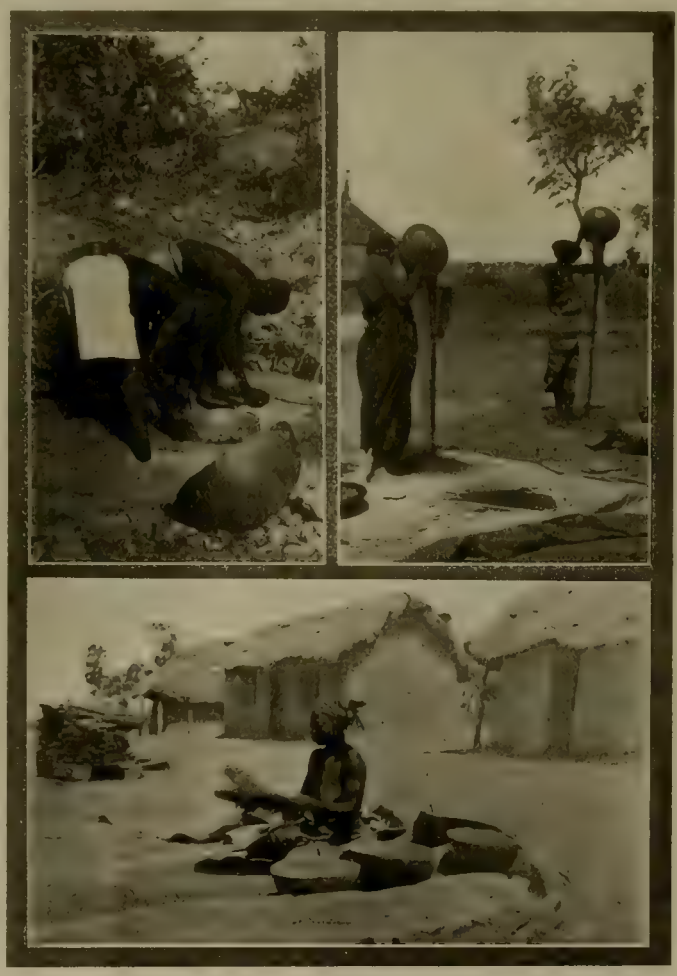
By A. M. Chamberlin

The Nigerian tinfields, which for the past three years have been attracting the attention of the English tin interests, are in northern Nigeria with Naraguta (Lat. 10°N., Long. 9°E.) as a centre, and covering a territory approximately 140 miles in diameter. They are reached by steamer from Liverpool to Forcados at the mouth of the Niger river. Thence by river steamer 450 miles up the Niger to Baro. Thence 225 miles up the Baro-Kano railroad to Riga Chikun. Thence by road 140 miles to Naraguta. Transport over this road is by carriers, and requires eight days. To avoid this delay a branch railroad is being built from Zaria, about 50 miles up the railroad from Riga Chikun, to Naraguta, which is expected to be completed this spring. Even with this road, the freight charges to England amount to upward of $120 per ton.

The attention of Europeans was first called to these deposits by natives bringing metallic tin to the trading posts of the Niger Co., Ltd., on the river. Investigation by H. W. Laws, the agent of the Niger Co., Ltd., showed that the natives were operating a primitive sort of smelter at Liruei, to which ore was brought from over a considerable territory. He located on, and began developing, what has since become the Naraguta mine, which has been shipping ore regularly for the past six years.

All the tin won so far has come from alluvial deposits bordering the streams and ranging in depth up to twenty feet, and most of it has been won by calabashing, though ground-sluicing is being introduced to some extent. The tin occurs as black cassiterite, generally associated with topaz, ilmenite, and magnetite. It has been found in place of granite in several places, but so far as developed (August 1911) has been of very low grade, not over 8 per cent.

The country is fairly well settled with three types of natives: (1) The pagans, who are the tillers of the soil and supply most of the native food. They make good workers when they can be obtained, but cannot be counted on for any length of time, as they consider their crops of first importance. (2) The Fulani, a much lighter colored race than the others, are the herders of the country, keeping cattle, sheep, and goats, as well as doing some trading. (3) The Hausa, the rulers of the country prior to the English occupancy, are principally traders. They, with the Fulani, furnish the bulk of the laborers, but as they have not yet learned the value of money it is difficult to get any hold over them, and the labor is expensive even at the prevailing price of 18c. per day.



NATIVE METHODS OF TIN RECOVERY, NIGERIA.

Mines and Minerals of Macedonia

By John L. Binda

*Since remote times the soil of Macedonia has had the reputation of containing many precious minerals. Not only was this stated by historians, but it is evident by the remains of great works undertaken by the ancients in the mining centres and especially on the peninsula of Chalcidice. These works reached the highest point of development under Philip of Macedon and Alexander the Great. These mines were worked for gold and silver, which were found in great quantities. During the medieval period and for a time under the rule of the Turks, mining was practically abandoned, except a little on the peninsula of Chalcidice at the beginning of the nineteenth century.

Forty years ago there was a revival of the mining industry of Macedonia, and many mines were opened by

*Abstract from *Daily Consular and Trade Reports.*

foreigners and natives. Attention was first paid only to the deposits of chromite, but later important discoveries of manganese, antimony, and arsenic were made. Of still greater importance was the discovery of deposits of pyrite and magnesite. The work undertaken for mining lignite and argentiferous galena was not successful. Since 1907 there has been a halt in the mining operations of Macedonia, caused by the discovery of great deposits in New Caledonia and in South Africa. Strong competition sprang up between these two countries, and in a short time the price of chromite dropped from $25 to $12.50 per ton c.i.f. On account of transportation difficulties, bad roads, and distance from the sea, the mines of Macedonia could not compete with these prices and were all forced to close down. The only company now working on a large scale is the Société des Mines de Cassandra, whose production of magnesite for the next eight years has been sold to German companies. The following is a descriptive list of the principal mines of Macedonia, most of which are not being worked on account of the low prices for the ore and high cost of production:

Mines of Cassandra

In the northeast of the peninsula of Chalcidice, near the shores of Stratoni, are the mines of the Société Ottomane des Mines de Cassandra, formed in 1892 with $675,500 paid-up capital. The concession includes the regions of Isvoro, Mahala, Horuda, Lipsada, and Varvara, districts in which minerals are abundant and which were worked in ancient times by Greeks. The principal mineral now being extracted is pyrite, of which large masses, estimated at about 3,000,000 tons, are available. About 1500 men, mostly Greeks, are now employed. The pyrite, which contains from 47 to 50% sulphur, is exported to Germany, Italy, and France, where it is used in the manufacture of acid. This company exports 130,000 to 150,000 tons per year, which is transported by the automatic Decauville railroad. As the pyrite must be delivered in powder form, the company has a modern plant for washing and treating the ore. An electric plant for the mine is being installed. At first the company gave its entire attention to the mining of manganese, but lately it turned its attention also to the iron pyrite and other minerals.

Chromite Mines

The *Ostrovitza mine* is 25 miles from the station of Ferisovik, the latter being 185 miles from Saloniki. Its ore is of a good quality, averaging 48 to 52%. This mine was worked from 1903 to 1907, during which time 9000 tons of chromite was extracted. Work has been suspended on account of low prices. The mineral was transported to the railroad on horseback and by small wagons. The cost of ore per ton f.o.b. Saloniki was $12.94, divided as follows: extraction, $1.32; transportation, from mines to Ferisovik, $5.06, from Ferisovik to Saloniki, $2.68; paid to holder of ancient concession, $1.20; customs duty and Government revenue, $1.93; charges for loading aboard steamer, 75 cents.

The *Roshdan mine* is in the Caza of Tikfesh, about 30 miles from Krivolak station, which is 90 miles by rail from Saloniki. The ore is excellent, containing from 50 to 54% chromite. During 1903 to 1906, while this mine was worked, about 5000 tons of ore was produced. All transportation to train was on backs of animals. The cost per ton f.o.b. Saloniki was $12.64, divided as follows: extraction, $1.54; transportation, from mine to Krivolak, $4.84, from Krivolak to Saloniki, $2; aboard ship, 75c.; customs duty and Government revenue, $1.93; paid to previous owners, $1.58.

The *Radousha mine*, in Vilayet of Kossovo, is 16 miles from Uskub, which is 152 miles from Saloniki. The quantity of ore in sight is very large and the quality is excellent, the assay showing 49 to 51% chromite. This mine has been very irregularly worked during the past 15 years on account of underground streams, which necessitated the installation of steam pumps. The ore is transported from the mine to Uskub by wagons. The cost of ore per ton f.o.b. Saloniki is $10.43, divided thus: extraction, $2.86; transportation, from mine to Uskub, $1.85, from Uskub to Saloniki, $2.25; on board ship at Saloniki, 75c.; paid to holders of ancient concession, 88c.; customs duty and Government revenue, $1.84.

The *Allshar mine*, in the Caza of Tikfesh, is 30 miles from Krivolak. Not much work has been done, but enough to show sufficient ore to warrant its further development and of a quality ranging from 50 to 52% chromite. During 1906 over 300 tons of ore was extracted. Its cost per ton f.o.b. Saloniki totals $11.07.

The *Loyan mine*, in Caza of Comanovo, is 5 miles from Tabanoftche station, which is 130 miles from Saloniki. On account of the large quantity of ore extracted, this mine is now of little importance, although engineers state that deeper diggings may show the continuation of old veins or bring new ones to light. From 1890 to 1896 this mine produced about 17,000 tons of ore. Cost of ore per ton f.o.b. Saloniki is $8.27.

The *Stiltche mine*, in Caza of Cosina, is 37 miles from Caraferia, which is 42 miles by rail from Saloniki. Three veins of good ore are visible, but in their present state they do not show evidence of great importance. There is, however, a vein of low-grade chrome ore, averaging about 45%, which is of value. About 2000 tons of ore has already been extracted. The ore is transported from the mines to Caraferia on horseback, the cost per ton f.o.b. Saloniki being $12.05, divided as follows: extraction, $2.20; transportation, from mine to Caraferia, $6.16, from Caraferia to Saloniki, $1.10, on board boat, 75c.; customs duty and Government charges, $1.84.

The *Varissa mine*, near the Stiltche. The workings to the present have shown good enough results. The ore can be delivered f.o.b. Saloniki for $11.18.

The *Goranza mine*, in Caza of Uskub, is about 12 miles from Eleshan station, which is 167 miles from Saloniki. The ore costs $9.37 f.o.b. Saloniki.

The *Tourhanli mine* is near the thermal baths of Sedes, about 10 miles from Saloniki. A vein of sufficient importance has recently been brought to light. The ore averages about 48%, and it is brought to Saloniki in wagons. The cost per ton f.o.b. Saloniki is $5.72, divided thus: extraction, $1.76; transportation, from mine to Saloniki, $1.54, on board, 66c.; customs duty and Government revenue, $1.76.

The *Ghiuredjik mine* (manganese and argentiferous galena), is situated in the Boz-Dag between Drama and Zirnovo. Two deposits have been found, a pocket of manganic oxide and a vein containing lead, antimony, copper, and iron. About 800 tons of manganese has been extracted by surface mining, and signs show that there are other deposits which could be reached by sinking. The Radibosh mine, containing a large amount of manganese, is in the immediate vicinity of the Ghiuredjik mine. The mines of Yanievo and Novo Bordo are in the Vilayet of Kossovo, Casa of Ghilan. They contain important veins of argentiferous galena.

Coal mined at Cambria, Wyoming, is interesting because it is claimed to be gold bearing. Some of the coal has contained as much as $2 per ton in gold and was sold for only $1.50 per ton. When coke made at Cambria was selling for $3.50 per ton, samples were taken from 31 cars during a period of three weeks and assayed. The samples showed an average of $2.46 per ton in gold and 28c. in silver. The explanation offered for the presence of gold in this coal is that the sands which submerged the old peat bog and now form the roof of the coal bed were derived in part from gold-bearing alluvium. While the sand was being deposited the gold worked down into the underlying bog and is now found in the coal. This is described in Bulletin 499, U. S. Geological Survey, 'Coal Near the Black Hills, Wyoming-South Dakota,' by R. W. Stone. Besides a description of the coalfield and coal-mining operations at Cambria, which is 7 miles north of Newcastle, Wyoming, the report contains a description of all known coal exposures around the Black Hills.

The Mascot Orebodies

By F. L. Sizer

*The following is the result of a preliminary examination of the property of the Mascot Copper Co. Because of the great extent of the holdings, I have considered only what I deem to be the most important features of the mine, both surface and underground, and it is not possible with so short a study of the conditions to present a full report. I am quite ready, however, to express my conception of the main points which need to be discussed, and here the salient features are briefly discussed.

Equipment.—The equipment is quite sufficient for the property in the development stage, and will not need to be materially increased until the company is prepared to make a regular daily output. The power-plant is specially well designed and situated, so as to command the mine requirements, and can be expanded by the addition of other units. The houses and boarding facilities, for men and officials, are comfortable and sanitary, well operated, and carefully supervised. The camp is clean and well supplied with good water and bodily comforts for the men, thus insuring the best class of employees.

Surface Conditions.—There are many large outcrops of mineral-bearing veins upon the surface of the claims owned by the Mascot Copper Co., and the size, extent, and mineral content of these outcrops are so favorable as to compel an opinion which is optimistic, while yet being conservative, as to the probable existence of large orebodies in depth. The appearance of copper sulphide ore, at and near the surface, is a most significant promise of persistence of the ore in depth, and the fact that profitable bodies of chalcopyrite have already been cut in the Consolidated adit-level, at a depth of 500 ft. below the surface, would seem to answer the query which has been in the minds of some people as to the kind of ore which will be found in underground development. In other words, the surface conditions are such as to influence one familiar with copper mines in saying that all indications point plainly to the existence of large commercial bodies of copper ore, carrying gold and silver, throughout a great extent laterally, as well as in depth, within the limits of the territory owned by the Mascot Copper Co. The management has wisely provided against any possible mining litigation by acquiring all surrounding and outlying claims that by any possibility affect apex rights, and are patenting the claims as rapidly as the necessary work upon them is completed.

Underground Development.—Although a large amount of driving and cross-cutting has been done, much remains to be accomplished before I can say that ore is 'blocked out' in the mine ready for extraction, and, as you well know, the labor of developing a copper mine is enormous and the time required to do it is long.

Smelter Returns.—The grade of the ore has been positively determined by several carload shipments, returns on which have been shown to me and the places from which the ore was taken designated by E. A. Ely, the superintendent, and I have confirmed these results, on different classes of ore, by my own sampling. The sulphides will, of course, prove to be the permanent orebodies of the mine, and must be critically examined and records kept of *all* grades of ore found, in any of the workings, wherever it occurs; not ignoring the low-grade ore, which may in time prove to be of sufficient quantity and importance to be treated by concentration, aside from those bodies which are known to be smelting ore.

Supervision.—The work of opening the mines has been intelligently planned and judiciously executed, and I wish to congratulate you upon the evident ability and devotion to the company's interest, evidenced by your consulting engineer, Captain Tibby, and E. A. Ely, the superintendent.

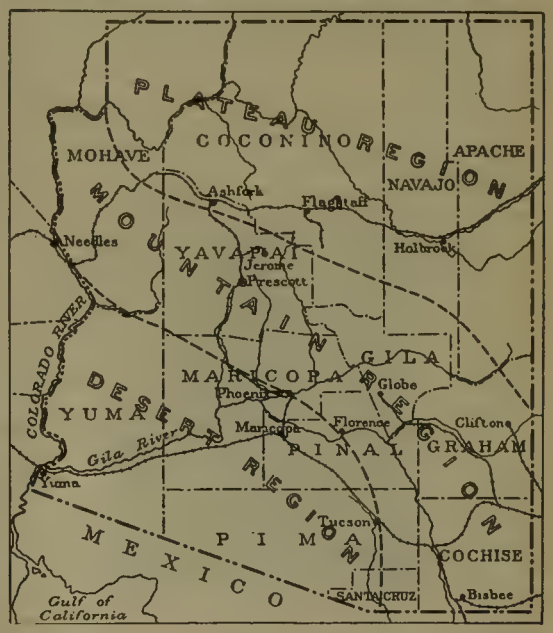
Recommendations.—Were I to undertake to advise you at this time on the whole field which necessarily must come under my observation later, you would rightly be suspicious of my judgment, but there are some points clearly in mind which are, in my opinion, of permanent importance, and my recommendations are therefore as follows:

(*a*) Trace and develop, by means of the raise now extended 60 ft. above the Consolidated adit level and the winze 200 ft. deep below it, the orebody which, to date, has yielded the highest-grade sulphide ore and has promised most favorably as to size and grade of copper contents.

(*b*) Undercut and develop the known orebody in the 100-ft. level of the Oregon shaft by a new level driven from this shaft at a depth of 220 ft. from the surface, and later by work over the collar of the winze, where some short crosscuts have already been driven.

(*c*) Ascertain full length of ore-shoot and total vein width at several points in the black oxide vein, above and below the No. 1 adit-level and trace a connection between this and other surface workings.

(*d*) Rush the diamond-drill work as rapidly as possible without interfering with other expenditures for development and determine the position, width, and value of ore-shoots in the copper vein at a depth of 900 ft. in No. 1 adit, and later such other diamond-drilling as may be consistent with the ideas gained in the near future, by studying all the workings accessible from the Consolidated adit.



MAP OF ARIZONA. THE MASCOT MINE IS AT DOS CABEZOS IN COCHISE COUNTY.

Conclusion.—If it were merely a matter of expressing an opinion as to the value of *one* metalliferous vein, I might say to you, in language more definite, my estimate of the property, but having to deal with so large a territory, showing as it does outcroppings of so many large and generously mineralized veins, situated so advantageously for cheap development, I can say with emphasis that in my opinion the continuation of the present policy of development will result in opening a large and profitable copper mine, which has now the ear-marks of one of the best of its class.

*From a report made to the management of the Mascot Copper Company.

ORE RESERVES of the East Rand Proprietary Mines on January 1, 1912, are given as 6,716,600 tons of 6.9-dwt. ore of stoping width, and 11,150,400 tons of 2.6-dwt. ore; a total of 17,867,000 tons averaging 4.3 pennyweights.

THE Aamdal copper mines, formerly worked by the Telemarken Copper & Smelting Co., have been taken over by the Bandak Elektrolytiske Kobbervaerk, which has a capital of 500,000 kroner.

The Boundary District in 1911

By William Fleet Robertson

*There was a comparatively large net decrease in the quantity of ore mined in the Boundary district—about 454,000 tons net, or 26.5% decrease. This was due mainly to the strike of the coal-mine employees in the Crows Nest district, which cut off the supply of coke for the Granby company's furnaces. The decreases were: Granby company's mines 469,000 tons, and Snowshoe 111,000 tons; the increases were: British Columbia Copper Co.'s mines 115,000 tons, and Hedley Gold Mining Co. 11,000 tons. The net decreases in metals recovered were, approximately: gold, 24,000 oz.; silver, 147,000 oz.; and copper, 6,592,000 lb. Against the large decrease in the production of the Granby company, and the much smaller one of the Snowshoe, must be placed the substantial advances of the British Columbia Copper Co. (including the New Dominion Copper Co., which it now controls) and the Hedley Gold Mining Co. There were fewer small mines shipping ore in 1911 than in 1910.

Granby Con. M. S. & P. Co.—This company shipped from its mines at Phoenix 605,880 tons of ore, as against 1,074,867 tons in 1910. There was also received at the company's smelter at Grand Forks more than 1200 tons of ore from other mines in British Columbia. Operations were resumed in December at the mines and smelting works after nearly six months inactivity. No great amount of development work was done during the year, yet it was kept ahead of ore extraction to the extent necessary for economical working of the mines. The chief exploration work was done with diamond-drills, which resulted in adding somewhat to the known reserves of ore. New ore was developed on the Victoria, Etna, Knob Hill, and Monarch claims, mainly on the upper levels, so that this ore can be extracted through existing main outlets from the mines. The general manager reported that during the fiscal year ended June 30, 1911, additional ore amounting to nearly 1,250,000 tons had been blocked out, while the quantity shipped in that period was 957,200 tons, so that the ore in sight had been increased by 291,000 tons, leaving 6,720,000 tons developed. The aggregate quantity of ore produced by and shipped from this company's mines at Phoenix during all years to the end of 1911 is approximately 7,250,000 tons. The ore continues to be about the average grade, though much lower in metal content than that mined ten years ago; however, it is now practicable to mine and smelt at a profit ore that would then have been thrown on the dump. The additions to plant and buildings in 1911 were chiefly those requisite to replace at the mouth of No. 3 adit those destroyed by fire in 1910. Construction materials used in several of the new buildings are fireproof brick, concrete, and iron.

At the Granby company's smelting works there was little new construction or additions to plant, other than a slag-disposal plant which was put in and was ready for operation by the end of September. The main features of this are: granulation of the slag by water; fluming of granulated slag to centrally situated storage-bins; dewatering of slag and carrying it on conveyor-belts up an incline to a maximum height of 100 ft. above the level of the present slag dump, and distributing it there. It is estimated that this change will provide dump room for from 6,000,000 to 10,000,000 tons of slag. It is noteworthy that in his report for the last fiscal year the general manager stated that "notwithstanding the lower tonnage shipped (950,563 tons as against 1,175,548 tons) and the disadvantages under which it was mined by starting and closing the operation of the mines at various periods, the cost of mining was only 1c. per ton greater than the year previous, while the cost of smelting was reduced 3c. per ton." The smelting costs were the lowest ever reached by this company, and are stated to compare favorably with any in the world. Late in the year the settlers below the blast-furnaces were changed from water-jacketed to dry, with larger settlers, retaining the two-settler arrangement. Copper losses were low, less than 5 lb. total; an average slag of 45% silica was run. The mining and smelting costs of the large companies in the Boundary district are extremely creditable to the managements and render possible the treatment of such low-grade ores.

The Granby company's mining costs for crushed ore f.o.b. cars was 84c. per ton, and the smelting, from ore to pig copper, was less than $1.29 per ton, on a quantity of 960,000 tons. Railway transportation is not included in this. The British Columbia Copper Co.'s costs, under somewhat differing conditions and on a smaller tonnage of 352,000 for fiscal year, were equally creditable, namely: mining, 90c. per ton f.o.b. cars; the smelting cost was $1.40.

British Columbia Copper Co.—This company increased its production of ore by about 25%, thus making the output from its mines (including those of the New Dominion Copper Co., which it also operates) about 550,000 tons. More than half this ore came from the Mother Lode mine, and the greater part of the remainder from the Rawhide mine. The Wellington group and adjoining Athelstan in one part of the district, and the Emma in another, together shipped between 40,000 and 50,000 tons. The company also obtained about 15,000 tons from its mines in the state of Washington. The most important work done in the company's own mines in 1911 was in connection with the method of breaking down and extracting ore initiated at the Mother Lode mine the previous year by E. Hibbert, mine superintendent, and continued in 1911. This consisted of dividing the ore-body into a series of transverse stopes of a maximum width of 25 ft. and breaking the ore down in large quantities. An idea of the extent of these stopes may be obtained from the following brief particulars of one blast, in preparing for which 2433 holes, averaging 14 ft. each in depth, were drilled. The explosive charge consisted of 425 boxes of 40% dynamite (equals 10⅝ tons), and 2525 electric detonators, low tension No. 7, were used. Connection was finally made to a 550-volt circuit. The result of this blast was to break down more than 100,000 tons of ore. Despite the high cost of Pennsylvania coke imported during the eight months that the Crows Nest coke was not obtainable, the company operated three blast-furnaces at its smelting works at Greenwood, except that in November the smallest one was cut out until Canadian coke should be again obtainable, the settlement of the strike having been then assured.

The British Columbia Copper Co. was active last year in its endeavors to secure more mines. The McKinley and Riverside groups, in Franklin camp, Grand Forks Division; the Voigt group near Princeton, Similkameen; and the L. H. group, in the neighborhood of Silverton, besides some claims near Greenwood in the vicinity of the Mother Lode mine, were bonded under option of purchase, should the results of development work warrant their acquirement. A group of 15 claims in Washington, a few miles from Grand Forks, was also bonded. In addition to this varied exploration work, diamond-drilling was done on the New Dominion Copper Co.'s Montezuma claim near Phoenix. The company's relations with the miners' and smeltermen's unions were harmonious throughout the year, consequently there were not any labor troubles to interrupt operations at the mines or smelter.

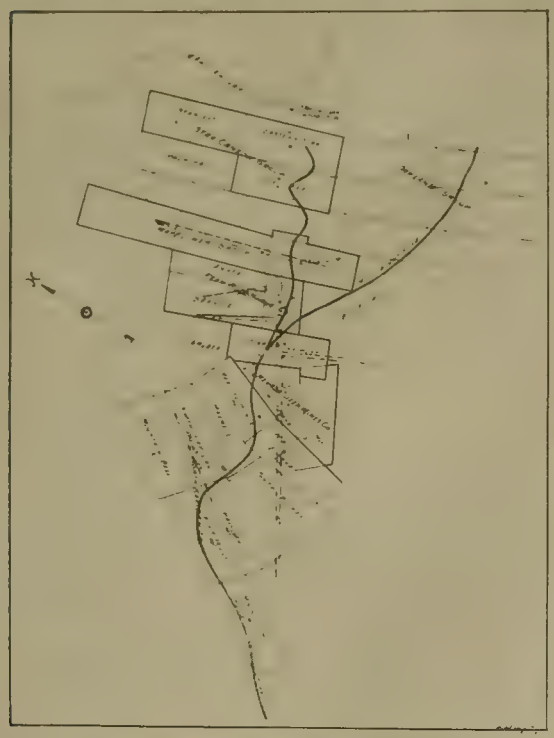
Consolidated M. & S. Co.—This company continued to work the Snowshoe mine under lease until April, and then closed it after having shipped in 1911 nearly 31,000 tons of ore, as compared with 142,600 in 1910. This alone will account for a decrease in production of copper of 1,800,000 lb. The Snowshoe lease has since been abandoned. Some 2200 tons of ore was shipped from the Phoenix Amalgamated, but at the then price of copper the grade of ore was too low for profitable working. Ore received at Trail from the company's No. 7 mine was 775 tons during the first quarter of the year; none was shipped afterward. Development work was continued until suspension for the winter. The ore-sorting plant was completed and ore-bins were erected at the lower end of the tramway.

*Abstract from a preliminary estimate by the Provincial Mineralogist.

Como, Nevada

By H. C. Cutler

Como is in the Pahuyta mining district, in the Pine Nut range, some ten miles in a southerly direction from the old town of Dayton, the nearest railroad point. It was discovered in the early sixties and its first boom was contemporaneous with that of Virginia City. At one time the population was several thousand and the busy main street was lined with stores and saloons; even a brewery, to keep the inhabitants from getting thirsty, could be found. Some surface work was done on the large quartz outcroppings, and several shallow shafts sunk, but the greater attractions of Virginia City gradually drew the whole population away before the area was thoroughly prospected. After this, mining was carried on in a desultory manner, with some success in one or two properties, until 1910, when there was absolutely no activity whatever. Guffy



COMO DISTRICT, LYON COUNTY, NEVADA.

& Galey, large Pennsylvania oil operators, after having spent nearly a quarter of a million in developing the Buckeye and North Rapidan properties to the point where they were ready to produce, got into financial difficulties in the East and went into the hands of a receiver. This resulted in the shut-down of the mines. The Como-Eureka, with a shaft down 300 ft., and a patched-up second-hand mill, produced over $250,000 in bullion, and then for several causes succumbed. During this general discouragement the Holly-Logan mine, bonded for a large sum, was abandoned, and the mine and 10-stamp mill have been idle ever since. A number of other promising prospects have been held for years with a minimum amount of work.

It was supposedly a dead district, with a bad past and an unpromising future, when Edwin Baruch and C. O. Erixson took a bond and lease on the old Como-Eureka in November 1910. The property was then owned by a Mr. Rea of Dayton, Nevada, who still had faith in the district and had hung on for years. The lessees started cleaning up the old workings, and by spring had opened some shoots of high-grade ore as well as a large amount of milling ore. In September 1911 control of the property was sold to H. L. Taylor, of New York and Toronto, for a figure approximating $75,000. The mine was then opened to the 300-ft. level by a shaft, but with no stoping below the 200-ft. Development work has shown that the old shoots are persistent, and has also disclosed new high-grade ore-shoots. At the present time the mine is opened by a double-compartment shaft 360 ft. deep, with levels at 115, 200, and 300 ft. Stoping is in progress above the 200-ft. level and the 300-ft. is being unwatered. The main power line of the Truckee River General Electric Co. crosses the property, and all the equipment is electric. A 50-hp. electric hoist, an Aldrich electric sinking pump, and the mill are run by electric motors. The old mill, consisting of one 3-stamp and one 5-stamp battery (750-lb. stamps), with plates and an outdoor cyanide tailing plant, is still used, although it is understood that the present owners will erect a complete up-to-date plant in the spring.

So far as I can learn, no complete geological survey of this district has ever been made, and no mention of it in any of the bulletins of the U. S. Geological Survey can be found. The principal properties lie in a basin at the head of the east branch of Eldorado canyon. This basin is surrounded on three sides by high ridges and peaks, the topography in some respects resembling that of Virginia City. There is considerable second-growth pine in the hills, and, unlike the desert country surrounding, water and verdure abound. The main mineralized zone, several hundred feet in width, strikes northeast. Cross-

HEAD-FRAME, PEER G. M. CO.

fissuring, as evidenced by north-and-south quartz dikes, is frequent. These quartz dikes are mineralized in several instances; in the North Rapidan and Ely properties, enough to make commercial ore.

The entire district is in the later eruptives, and the 'lode porphyry,' to use a Nevada term, is hornblende andesite, similar to that found in the hanging wall of the Comstock. Several later flows of andesite can be recognized in the higher portions of the range, and in many places these are capped by a still later flow of basalt. In the mineralized portion of the district, situated in the basin above mentioned, these later flows have been eroded, exposing the lode porphyry and the mineral-bearing veins. It has not as yet been determined whether the hornblende andesite is intrusive or a flow. The volcanic breccia, which is quite prominent in Gold canyon on the road from Dayton to Virginia City, shows again on the east side of the Pine Nut range below Como. It is believed that this range is contemporaneous with the Virginia range and the period of mineralization of both the same.

At Como the fissuring has been extensive, and at least two periods of ore deposition can be distinguished. The ore is similar to that generally found in the later eruptives, in that it is a silicified and replaced country rock. At and near the surface, gold is the chief valuable mineral. This is especially true of the main east-and-west veins. The silver minerals are more prominent in the north-and-south fissures, and the gold and silver are more nearly equal in the deeper ores. Some evidence of copper appears in spots

in the oxidized zone, but not enough to indicate a quantity sufficient to interfere with milling, even in depth. Plating and cyaniding now secure an extraction of over 90%, but it is quite probable that concentrating will have to be added to secure this percentage when the base ores are milled.

Having lain practically dormant for so many years, the district has now taken a new lease of life, considerable activity is being displayed, and, stimulated by the success of the Como-Eureka, which is now known as the Nevada Deep Mines Co., prospectors and mining men are investigating and in several instances developing some of the more promising prospects. The Star of the West claim, adjoining Nevada Deep Mines Co. on the northeast, is being developed, and high-grade ore showing considerable free gold is being taken out and sacked for shipment. Some of this ore assays as high as $1500 per ton.

The Peer mining claim, directly northeast of and adjoining the Star of the West, together with two adjacent claims, has been incorporated as the Peer Gold Mining Co., and development work is in progress. The northeast mineralized zone traverses this property for its entire length, and ore assaying up to $3000 per ton has been found on the surface. A 30-hp. electric hoist has been installed, a headframe, blacksmith-shop, and all necessary buildings erected, and a crew of ten men is working steadily. The shaft, 4 by 7 ft. in the clear, is down about 40 ft. and will be sunk to the 200-ft. level, at which point the veins shown on the surface will be cross-cut and driven.

The Paramore, Ely, Oakland, and Logan properties are all promising prospects, showing some good ore in strong veins, and no doubt will be developed this coming summer. This is an interesting district from a mining standpoint, and, judging from the amount of gold at the surface, the finding of extensive ore-shoots should be comparatively easy for the modern prospector. Supplies and wages are reasonable, and, as the district is situated at an altitude of 6500 ft., the summers are cool and the winters not severe. The road to Dayton is excellent and automobiles can be driven directly into town. Its accessibility is a great feature, and all indications point to a considerable boom this summer.

Copper Producers' Association Report

The Copper Producers' Association April statement shows a decrease during the preceding month in accumulation in this country of 572,431 lb. The details are as follows:

	Pounds.
Stock of marketable copper of all kinds on hand at all points in the United States March 1, 1912	62,939,988
Production of marketable copper in the United States from all domestic and foreign sources during March	125,694,601
Deliveries of marketable copper for consumption and export during March	67,847,466
Stock of marketable copper of all kinds on hand and at all points in the United States April 1.	62,367,557

The changes in surplus since April 1, 1911, have been as follows, in pounds.

	Increase.	Decrease.
April 1911	3,547,974	.....
May	440,024	.....
June	.....	8,561,768
July	.....	19,695,306
August	.....	4,297,357
September	7,453,355	.....
October	.....	5,897,214
November	.....	23,212,454
December	.....	22,330,493
January, 1912	.....	22,173,252
February	.....	3,301,944
March	.....	572,431

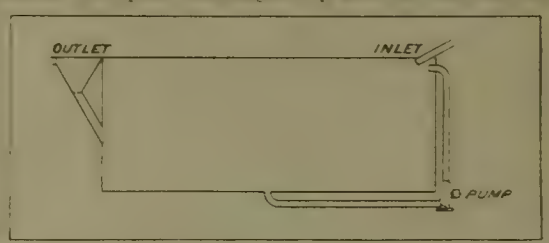
RECEIPTS of the United States Government from the sale of mineral lands in the Western states during the past ten years, according to the *Bulletin* of the American Mining Congress, have been as shown in the accompanying table.

Coal Lands, Separate.	Mineral Lands, Separate.	Coal and Mineral Lands, Aggregate.
$ 200,116.35	$ 162,516.50	$ 362,632.85
171,641.81	291,081.39	462,723.20
486,176.54	303,907.02	790,083.56
385,276.97	300,391.68	685,668.65
269,458.55	282,518.25	551,976.80
523,905.72	275,983.55	799,889.27
288,092.82	282,322.94	570,415.76
599,920.44	287,022.25	886,942.69
471,088.08	321,413.58	792,501.66
618,828.04	271,557.87	890,385.91
$4,014,505.32	$2,778,715.03	$6,793,220.35

During these ten years the entire fund arising from the sale of public lands has amounted to $65,357,107, which has been devoted to the upbuilding of agricultural interests in the public-land states. During this time the mining industry in these states has fallen far behind agriculture in progressive development.

Agitating and Circulating Solutions

Continuous agitation of solutions at the same time that a continuous flow through the system is maintained, can be easily effected by means of the arrangement sketched below. This plan was designed by John E. Rothwell and



TANK FOR CONTINUOUS AGITATION AND AERATION.

has been used at several mills. It has the advantage of simplicity and of being readily adapted to existing plant. The outlet should be very slightly below the inlet, and, as shown, material can be drawn off from near the bottom of the tank.

Housewarming at the Dome Mill

The 40-stamp mill of the Dome Mines Co., Ltd., was formally started on March 30, though the stamps had been dropping since March 21. The crowds of visitors were taken underground and through the mill, after which the management entertained the party at lunch. On Saturday evening the distinguished visitors were given a banquet at the Majestic theatre, South Porcupine, which was greatly enjoyed. Among the guests were A. Monell, president of the Dome Mines Co., Ltd.; W. S. Edwards, C. L. Denison, Captain De Lamar, John Wilson, W. W. Mein, C. W. Merrill, of the Dome staff; J. L. Englehart, Fred Dane, Denis Murphy, R. T. Shillington, C. B. Flynn, J. H. Black, H. C. Meek, A. T. Cole, Wallace Nesbitt, S. B. Clement, W. A. Griffin, and George Lee.

Addresses were made by Messrs. Monell, Merrill, and others. Mr. Merrill announced that it was expected to make a recovery of over 95% of the gold content of the ore. It is reported that the latest results show that this figure has been greatly exceeded and the mill bids fair to establish a record for high extraction. The flow-sheet of the first Dome mill was published in the *Mining and Scientific Press* of May 20, 1911, and during reconstruction after the fire no essential changes were made in the design. The principal features of the mill are forty 1250-lb. stamps, four Pachuca tanks, 8 by 40 ft., Dorr thickeners, and two 76-frame Merrill presses, making a 4-in. cake.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Who Is a Mining Engineer?

The Editor:

Sir—The following is a *verbatim* extract from a mine report signed by a man who writes 'E.M.' after his name:

"The quartsite underlying the capping of quartz and now tapped by the No. 6 shaft is finely impregnated with arsenical iron carrying good gold values, very amenable to treatment and will constitute the main bodies of ore in the properties, to what extent they exist in depth may be better assumed as zones, in dyke form, the upheval and general protrusion of the mountain itself would lead to such a theory, as the fine equal distribution of the arsenical iron with the other minerals on a minor scale contribute, indicate." Also this:

"The values of actual samples taken are in the hands of the assayers as this is written and not necessary to mention at all as far as this report does, my simple duty to speak of it as I found it and to what conclusion to come to." He then concludes by "recommending the proposition as a fine paying investment."

This is not supposed to be a joke, but an actual report that somebody paid for. Is it not about time that the public was protected from this sort of 'flim-flam' and the dignity of the profession also upheld? As it is now, any barber, horse-doctor, or sewing-machine agent can sign 'E.M.' after his name and is, *ipso facto*, a mining engineer.

J. V. RICHARDS.

Spokane, Washington, March 25.

Packing Supplies in Mining Regions

The Editor:

Sir—I was much interested in the article by James Davis, in the *Mining and Scientific Press* of March 23, 1912, concerning packing supplies. His methods are all right, when confined to loads of equal weight, like ore. Then the cross-tree saddle is effective and quickly loaded. But when heavy and uneven loads, especially machinery, has to be packed, the aparajo beats the saddle a hundred times over. In fact, there are many loads of mining machinery, such as sectional mortars, crushers, and fly-wheels, weighing from 250 to 450 lb., which cannot be packed successfully on a cross-tree saddle. The aparajo is somewhat similar to Mr. Davis' pad, made of heavy leather 28 in. wide, its length adjusted to the size of the animal, so that it comes two-thirds way down the animal's side. It is stuffed, from a small round hole, near the top on inside, to near the centre, where it crosses the back, with small fine dried grass, not long or coarse. Saddle blankets are first placed on the mule, the aparajo on top of them, a heavy leather pad over this, then cinched tight. Then load on either side or on top as you wish. If one load is 50 lb. and the other 150 lb., it is quickly balanced, so that they ride even, by raising the heavy load until it balances the light one.

In case it is a heavy or bulky load that must go on top, a small round stick, 3 or 4 in. diam., split as long as the aparajo is wide, with the two ends of each stick tied together with a small string, is placed on either side of the aparajo, one-third way down from the back. This will level up the load, and still keep it low, not top-heavy. Large Saratoga trunks, weighing 300 lb., are packed over mountain trails in this manner. Such a load, if on a platform, built up on top of the cross-tree saddle, would make the load top-heavy, and on a heavy grade throw the animal down the mountain.

I have known a battery cam-shaft made in 1866 and weighing 625 lb., 6 ft. long, to be successfully packed 60 miles, over three ranges of mountains. A wire cable, if over $\frac{5}{8}$-in. diam., should never be coiled and packed as a load on each animal, the short coil necessary breaks and strains the small wires of the cable. Unwind the cable on a level piece of ground, lay it out in a long loop, of such length that the total weight is of proper proportion to the number and character of your animals; this is easily regulated by the number of strands of cable on a side. Tie these strands securely together, with a small wire, place your mules in the centre of the loop, lash the strands as one on either side; the looped ends extending in front and rear of the first and last mules will be stiff enough to stay in place and swing clear. I have seen a $\frac{7}{8}$-in. tramway rope, 8400 ft. long, packed in three pieces, over three ranges of mountains, in this manner.

Track-iron and piping, 12 to 16-ft. lengths, with the ends tied together, are packed. Mine timbers and lumber over 10-ft. lengths, if over a rough trail, had better be dragged with one end on the ground. A $\frac{3}{4}$ or $\frac{7}{8}$-in. lash rope is too stiff and heavy; the Mexican's raw-hide twisted rope is better. In Mexico, probably three-fourths of all freight for the mines is packed; one never sees anything but the aparajo. In fact, where there is occasion to have much freight packed of all classes, only the aparajo is used. They are much easier, safer, and better for the animal; when sufficient blankets are used and proper care exercised the animals can be kept in better condition.

G. L. SHELDON.

Ely, Nevada, March 30.

Tonnage Estimation

The Editor:

Sir—In your issue of February 24, T. B. Greenfield is referred to an article of mine in the same issue for the solution of a problem which seems to have arisen as a result of the application of South African formulae in the tonnage estimation of a Mexican ore. My article contains no elucidation of the problem. The credit for the idea as to the use of the specific gravity bottle in the estimation of classifier tonnage belongs to H. Stadler, whose interesting paper on the subject appeared in the *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa, November 1911.

As a preliminary, may I draw attention to the desirability of a few pointers being published with a reprint of a paper applicable to local conditions only. Mr. Stadler deals with an ore of apparently absolutely uniform composition, and is, in consequence, able to use the determined density of the whole on calculations dealing with any classified portion. Mr. Greenfield's ore, on the other hand, consists of quartz and a large amount of clay and oxide of iron. In endeavoring to find the tonnage of sand passing through a tube-mill, as delivered at the classifier cone underflow, a difficulty is experienced on account of the varying results obtained in the estimation of the density of the ore, due to the presence of the clay. Perhaps it is superfluous to add that calculations of cone underflow tonnage should be based on the density of the ore comprising that underflow, in which the proportion of clay would surely be very small. With an ore of varying density it is difficult to see the advantage of the specific gravity method in the compilation of tonnage figures which are not used in connection with assay returns.

Mr. Greenfield refers to the "varying oxidation of the iron and de-hydration of the alumina" in the ore-density estimation. As the iron has already been reported to be in the form of oxide, it is difficult to see how material change can occur under ordinary conditions. As regards the clay, I presume it may be taken to be an ordinary hydrated silicate of aluminum whose natural water content might be anything from 5 to 15%. The water would occur hygroscopically and in combination, but the temperature necessary to drive off the combined water is so much higher than that required to remove the hygroscopic moisture that there should be no difficulty in keeping the two estimates separate.

In calculating classifier tonnage the need for extreme accuracy is questionable. In most cases, however, tonnage has no significance apart from assay value; and in dealing

with ores carrying a large amount of clay it is advisable to dry the sample for a density estimation at the same temperature as the ore is dried preparatory to being assayed. Too often the density sample is dried with the utmost care at the temperature of boiling water, and the assay sample heated to redness on a hot-plate. A lower density means a higher tonnage; a smaller bulk a higher assay result. Hence an addition to the 'unaccountable' discrepancy occurring at the end of the month.

A. W. Allen.

London, March 12.

The Mine-Owners' Liability for Accidents

The Editor:

Sir—It was a profound change in the status of the law in regard to those who must eat their bread in the sweat of their faces that was made by the enactment by the legislature of 1911, of the Roseberry liability and compensation law. Not since the shackles of slavery were stricken from our black brother of the South has anything occurred that was comparable to it, and it is not flattering to our American vanity to call to mind the fact that, as with slavery, so with the emancipation of industrial labor from the old order, Europe led America in the reform by one full generation of men. What Lincoln was as an emancipator of the black man, Bismarck was as the emancipator of the hurt man, and the world is coming to recognize this as the greatest act of Bismarck's great career.

As far as California is concerned, the old order went out when the Roseberry liability and compensation law went into effect, September 1, 1911, and the new order came in. What the old order was will be the subject of this letter. What the new order is will be the subject for the next. Prior to September 1, 1911, it was the law in California, except as slightly modified by a statute enacted in 1907, that whoever took employment at wages himself assumed all the physical hazards of the occupation, and his employer, and the industry out of which that employer hoped to grow rich, assumed none of them. This was known as the common-law doctrine of 'assumption of risk', and had its origin in a judicial decision rendered in England in 1837, by Lord Abinger, in the case of Priestly *v.* Fowler, growing out of an injury that was suffered through the breaking down of a butcher's cart.

The law in the case was judge-made. No legislature or parliament ever enacted such a law, although nearly all legislatures and all parliaments have been called upon from time to time to mitigate the severities of the law then made by this sleek, well conditioned, periwigged judge while toasting his shins comfortably in front of a blazing hearth in the seclusion of his own chambers. Thus ensconced, this judge gave himself up to the delights of pure reason and so decreed that whoever took employment in a hazardous occupation would naturally demand, and receive, wages proportionately increased according to the hazard, or else he would refuse to work, and that this increase in wages would insure the worker against the consequences of injury. The reasoning of the noble lord was all right, but the facts were all wrong. Except where labor is so thoroughly organized as to be able to compel, through collective bargaining, favorable arrangements as to wages and hours and conditions of labor, the laborer has always had to take the work he could get at such wages as his employer was willing to pay, and some of the most dangerous occupations have been about the most poorly paid. Wise in the law, Lord Abinger was densely, even stupidly, ignorant of the commonest facts of everyday life, and as a result of that ignorance he inflicted upon toiling humanity one of the most grievous burdens that it has been the lot of the children of men to bear. Any workingman could have told him better, but it never occurred to him to ask one of them. The relation between employer and employee in those days was that of master and servant, with all the difference in social station that those terms imply, and it had not been twenty years since it was as unlawful for as many as five workingmen to assemble together to consider their industrial welfare as it would have been to plot to blow up a building or hold up a traveler.

The fellow-servant doctrine grew out of that assumption of risk and constituted merely another risk assumed by the luckless employee—that of being hurt through the carelessness of another employee. It was reasoned out in the seclusion of the judicial chambers that if an employee knew that a fellow-employee was careless, he would go to the employer and say to him: "That man is careless; he will be the means of some of us getting hurt some day; therefore if you do not discharge him I will quit your service," and of course the careless workman would be discharged forthwith or the prudent workman would proceed to hunt another job. Again the reasoning was all right, but the facts were all wrong and wholly inconsistent with the common experience of mankind. That is a fault with the law of judicial decision. It does not square with the facts and everyday experiences of life, but goes off into the aerial realm of pure reasoning. As any intelligent workman could have informed the noble lord, accidents through the carelessness of fellow-workmen do not often flow from workmen of known and notorious want of care, but rather from momentary lapses of the mind, wholly unlooked for. Inadvertently one gives the wrong signal, pulls the wrong rope, strikes a glancing blow instead of a direct, and the accident has happened. And yet the hurt workman, hurt through such inadvertence, was barred all recovery from his master, in spite of the fact that the master ever had been responsible to those not in his employ for injuries inflicted by all who were in his employ. If a teamster had run down and injured a workman working for another man, his master would be responsible for his act, but if he ran down and injured one of his own workmen the injured workman could recover nothing from him.

Finally, this august lord of the British bench, superconscious of the great dignity of his office, held that where an injury was caused partly by the carelessness of the employer and partly by the carelessness of the injured employee, the injured workman should have no right of action, no matter how slight the contributory negligence of the person hurt or how gross the degree of carelessness of the employer, and for the reason that so august a personage as a judge could not be expected, where both parties were negligent, to undertake to apportion the degrees of negligence between the parties.

This, then, constituted the old order in relation to the status before the law of those who are industrially hurt, as that law stood in California up to and including August 31, 1911, and upon which California then and there turned its back. These rules came across the seas to us and were imposed upon American labor at the instance of the railroads. The first application of these doctrines was in the case of Murray *v.* the South Carolina Railroad, decided in 1841, and was a three-to-two decision of the supreme bench of that state. It was next applied in the case of Farwell *v.* the Boston & Worcester Railroad, where an engineer was injured through the carelessness of a switchman, the court holding that "justice" and "policy" required that the engineer, and not the railroad company, should assume the consequences of the negligence of a switchman (over whom the engineer had no control), and that "policy" required that assumption inasmuch as it would contribute to the safety of all concerned. A critical examination of the phrenological development on that judicial head should prove of interest to the science of psychology.

Anyhow, one judge followed another in applying these rules, as one sheep may follow another over the wall out of a safe pasture onto a railroad right-of-way, where an express train may presently come along and reduce the whole band into chops, and not until we understand the psychology of the mind of the sheep shall we fully comprehend the mind of the judge who follows precedents unheedingly, no matter where they may take him and those whose rights he thereby wrongs.

A. J. Pillsbury.

San Francisco, March 25.

Special Correspondence

LOS ANGELES

REPORT OF ORGANIZATION COMMITTEE OF THE MINING ENGINEERS SOCIETY OF SOUTHERN CALIFORNIA.

The committee on organization of the Mining Engineers Society of Southern California, recently formed, as before noted in the *Mining and Scientific Press*, reports that in its opinion the best results will be obtained by placing the technical interests of the society under the control of professional men, selected on their personal and professional record, and inviting the coöperation, as associates, with slightly modified membership privileges, of non-professional men, commercially interested in mining, in oil, in metallurgy, or in mining machinery and supplies, and of suitable persons occupied with business foreign to mining engineering and its allied branches. It points out that there are two classes available for membership: (a) members of the Mining and Metallurgical Society of America, and of the American Institute of Mining Engineers; (b) engineers in good standing who are not members of either body. All of the M. M. S. A. members in Los Angeles and most of the A. I. M. E. members would be eligible. Many not affiliated with either of the older organizations will be led to seek membership through interest in the M. E. S. S. C., while others would become members of the last, but would not care to join either of the older bodies. While it is believed that most of the members will be drawn from Los Angeles and tributary districts, no geographic limitation need be placed on membership. The committee reiterates that one of the chief needs is for a technical library and reading room.

An initiation fee of $10 and dues of $2 per month for members who have places of business in Los Angeles, or within 100 miles, are recommended by the committee. An initiation fee of $5 and annual dues of $10 are recommended for members outside of the boundaries named.

In regard to affiliation with the A. I. M. E., discussion concerning which was reported in the issue of this magazine for February 10, the committee states.

"The following reply, in a letter from the secretary of the Institute, dated February 20, has been confirmed by a committe report to the Council of that body under date of March 23:

"'The Council approves in general of the organization of a local, or geographical section of the American Institute of Mining Engineers, but under the constitution and by-laws, the organization must be effected in the first instance in harmony with the present rules of the A. I. M. E.

"'The Council believes, however, that the wishes of the Los Angeles members of the Institute can be met by giving the proposed organization the greatest possible measure of Home Rule under the rules of the Institute.

"'The Institute cannot approve of any independent assessment for dues, but sees no objection to voluntary contributions to be supplied at the discretion of the local organization to the local needs.

"'It occurs to us that possibly the organization of a library, on an independent basis, would meet the question of additional dues from the local members.'

"From this reply it is evidently necessary to form an independent society to support the library and reading rooms, for the reason that a library cannot live without an income, while the rules governing sections of the Institute forbid raising money by assessment and permit only voluntary contributions. Further, in such a section, all members and associates of the Institute would have equal membership privileges and persons not members of that organization would not be recognized."

In order to give all possible support to the A. I. M. E. and to assist in any needed reform, the committee advises members of that body resident in and about Los Angeles to form a section, and suggests that a section of the M. M. S. A. would be desirable. Owing to the difficulty in keeping up interest in meetings held for the reading of papers, it is suggested that such meetings are unsatisfactory without facilities for publication, and that publication is best left to a national organization or to leading scientific journals.

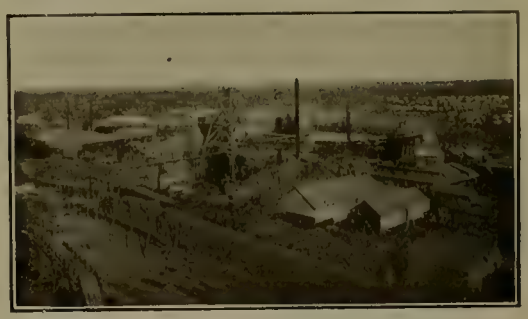
Further plans deal with the possibility of forming a general technical library through coöperation with the civil, mechanical, chemical, and electrical engineers, and with the Chamber of Mines and Oil.

One prospective member of the new organization has promised $500 in cash toward the proposed library, and others have agreed to assist. An initial membership of at least 50 is desired to provide an income of $100 per month for maintaining the rooms and library. All mining engineers entitled to receive a copy of the committee's report who may have been omitted from the mailing list, are invited to notify the committee, which includes F. J. H. Merrill, chairman, E. Call Brown, T. B. Comstock, C. Colcock Jones, E. A. Montgomery, and W. F. Staunton.

KALGOORLIE, WESTERN AUSTRALIA

CYCLONE DAMAGE.—JANUARY DEVELOPMENT.—COLLIE COALFIELD.—PRODUCTION FOR MONTH.

Eight years ago a very destructive cyclone occurred in this district, and almost every year since we have had one in a mild way, but on February 5 a 15-minute blow visited us again and did a lot of damage generally. The worst feature of the affair was that the Power company's mains, which carry power to many of the mines, were blown down, while its cooling tower for the condensing plant was smashed. The Associated, Horse-Shoe, and Ivanhoe have their own complete generating plants. The Lake View &



GOLDEN HORSE-SHOE MINE.

Star and Oroya Links have part stand-bys, while the Kalgurli, Great Boulder, Perseverance, and South Kalgurli depend greatly on the Power company. The Associated Northern and Hainault use only a few small motors, which do not affect work much. The Horse-Shoe has power to spare and is supplying the Boulder; but the Kalgurli expected to be in operation a week after the cyclone.

The month of January has been quiet. Developments may be chronicled as follows: The Horse-Shoe, at 2800 ft. from the Boulder main shaft on No. 4 lode, drove 5 ft., where the lode was 15 ft. wide, the ore averaging $30 per ton. The progress reports from the Boulder, Ivanhoe, Lake View, and Kalgurli are of a satisfactory nature, yet the lower levels in most of them are poor. The Perseverance is re-centring and skidding its main shaft, which has given trouble of late, and is installing two-ton skips, which are made at the mine. The plant will run at about 450 tons daily capacity in the meantime, ore being hauled through No. 6 shaft. The Associated has stopped work at its No. 20 level, the ore being of low grade. The Chaffers is practically closed down, the reserves being given as 104,900 tons, worth $6.90 per ton. The problem is whether to remodel and enlarge the dry-crushing plant to a capacity of 6000 tons per week, so as to give a profit of 60c. per ton, or leave it alone. The Bullfinch main shaft is down to 333 ft. The latest development in a winze at a depth of 50 ft.

below the 100-ft. level shows a lode 31 ft. wide averaging $25.50 per ton. The boilers, hoist, and head-gear are in position. The Sons of Gwalia is diamond-drilling on the seventh and fifteenth levels. The Lady Miller at Norseman is being equipped with a new plant. The North Kalgurli report shows that during the past financial year tributers crushed 10,209 tons valued at $160,000. This was from ore between the fifth and sixth levels. The gross profit to the company was $19,300. Since 1907 $82,000 has been paid in royalties by tributers. The option on the Gimlet mine at Ora Banda was dropped by the Gwalia South company, the ore being too low grade and hard. The Gimlet S. Extended has stripped its shaft in preparation for skips and a 350-ton daily capacity. During the past six months a party had a tribute on the Oroya Links and finished the term last month, four men netting $22,000 each.

The tributers at the Golden Pole, Davyhurst, up north, made a profit of $2000 each in 11 months. During 1911 the Dundas goldfield returned 28,665 oz. bullion from 38,037 tons treated, also 320 oz. from alluvial workings. The inspectors for the districts named report that in 1911, in the Menzies district, mining has not been satisfactory; while centres between there and Kalgoorlie, some eighty miles, a depression existed. Other districts near showed fair results from a good deal of prospecting. Mount Ida had little development done, although the country would repay prospecting. Other places are quiet on account of no water-supply. A few gas engine and Huntington mill plants are working in these parts. The Kanouna district was quiet, although of late active exploratory work has been undertaken in old mines.

The Collie coalfield produced only 249,784 tons during the year, or 11,800 less than in 1910, on account of strikes. There are 6 mines at work, which produce from 2913 to 89,227 tons annually. There were no accidents among the 477 men at work, while the output was 523 tons per man. The two Holman pneumatic stamps on the Mountain Queen, at the Southern Cross, are doing good work, each crushing about 70 tons per day. The new 20-stamp mill, with tube-mill and vacuum plant, on the Yuanmi is at work, and the output should soon be announced. The Richards classifier at the Hainault is good, and takes the pulp from 40 stamps, delivering a clean classified product.

The new mill at the Bullfinch will consist of a crusher, 20 stamps, tube-mill, agitators, and three Ridgway No. 3 style machines, all motor driven. It is to be ready in August. The ore is expected to average $10.50 per ton. The use of the new Ridgway machines increases, and at present the Boulder has two, the St. George one, on a kaolin ore, the Ora Banda three, and the Bullfinch three, while it is known that one or two of the Kalgoorlie mines view the machines favorably. Mechanically it is good and the washing leaves low soluble gold. The increase in value of wash solution is exceedingly low, when compared with other vacuum systems. On roasted ore, one machine can treat 350 tons per day, and on a soft oxidized ore, or kaolin matter, about 120 tons. The old-style Ridgways are apt to be superseded.

For examination of engine-drives in Western Australia, the Minister for Mines has formed a traveling board of examiners who will hold the quarterly, half-yearly, and yearly district examinations. Ambulance classes have been started for the mines and are being well attended. Already the mines have a number of good first-aid men, and, of course, the properties are fully equipped with accessories to be quickly available in case of serious accidents occurring.

In the December number of the Chamber of Mines *Journal*, W. R. Degenhardt discusses gas engines at the Sons of Gwalia. This mine is 1250 ft. above sea-level. The tests were on a 167-b.hp. coupled engine of Crosby make, with cylinders 17 by 24 in. by 190 r.p.m., driving by belt an A. E. G. generator of 112 kw., 550 volt, 3 phase, 40 cycles driven 800 r.p.m. The useful work totaled 24.5%. Fuel per horse-power, 0.96 lb. charcoal. Cost per brake-horse-power, 1 cent.

The January gold output was valued at $2,255,000, the principal returns being as under:

Name.	Tonnage.	Yield.	Profit.	Divid'd.
Associated	10,193	$72,500	$6,100	.....
Burbanks Main Lode	1,641	18,000	.....	.....
Golden Horse-Shoe	23,264	164,000	10,000	.....
Golden Ridge	2,817	27,000	8,500	.....
Gt. Boulder Perseverance	19,681	113,000	15,500	.....
Gt. Boulder Proprietary	17,535	245,000	132,500	.....
Great Fingall	5,685	60,000	12,000	.....
Hainault	5,639	34,000	50	.....
Ivanhoe	20,102	204,500	90,000	50,000
Kalgurli	10,630	108,000	45,000	24,000
Lake View & Star	18,060	105,000	17,800	.....
Oroya Black Range	4,700	47,000	16,500	.....
Oroya Links	11,000	64,400	9,700	.....
Sons of Gwalia South	2,456	15,400	3,700	.....
South Kalgurli	9,600	60,100	9,700	.....

FAIRBANKS, ALASKA

District Developed Without Outside Capital.—Many Promising Claims.—Mine Notes.

That this district bids fair to be self developing is shown by the large number of shipments to the local mill. Most of these are from prospects that have no financial backing as yet, and which must depend on the ore taken out to carry the burden of development. Although this is not true in every case, the large proportion of self-supporting prospects is remarkable.

A shipment of 2 tons from the Otto Nars property on Fairbanks creek, returned $60 per ton in free gold, no attempt being made to save concentrate or to test the tailing. This is the first shipment from the claim. Following the satisfactory mill test on ore from the Hudson brothers' property on Ester creek, a larger shipment, of almost 50 tons, is being sacked. The vein is over 5 ft. wide. It is probable that a small mill will be built this season. At present, the local mill in charge of Lou Freestone is crushing 13 tons of ore from the Overgaard lease at the head of Willow creek. The rock should return $50 per ton, by conservative estimate. This property is now owned by the principal stockholders of the Newsboy company, which recently bought it from Herschberger & Buell.

Development is being carried forward on the Newsboy property with all possible speed. The 215-ft. level development is on contract while the regular crew is sinking the shaft to the 315-ft. level. Considerable trading in Newsboy stock has been going on lately. Several blocks of promotion stock have been taken at 35c. The par value is $1 and the capitalization is $320,000. There is a 5-stamp mill on the property. The undoubted integrity of the controlling stockholders is an argument in favor of the investment. Were this camp closer to financial centres, a flurry in this stock would undoubtedly occur.

A two-ton shipment from the Utigaard-Nehrland lease has just been crushed by the local mill. Returns show content of $30 per ton. Shipping will probably be discontinued till a customs mill can be erected at the mouth of Chatham or Wolf creeks. Fourteen tons of ore from the L. J. McCarty property at the head of Wolf creek, was put through recently and $60 per ton in free gold was recovered. The shaft on the Fredrich property on Vault creek, is down 275 ft. The installation of the small 3-stamp mill on the Reliance M. Co.'s ground at the head of Dome creek, is nearly complete and Mr. Spaulding, the manager, expects to begin crushing soon. There is plenty of water in the mine to supply the mill. Only the highest grade ore will be milled, the lower grade being put on the dump for future treatment with a larger mill.

It is reported that W. B. Vanderlip will start soon on a trip to Ruby and the Koyukuk to examine some properties. Development on the large Treasure creek antimony vein will be continued while he is absent. Braumbaugh & Hamilton are working at present on a 5-stamp mill for McGillvray & Fisher, who are operating a lease on the News-

boy Extension. A hoist will also be installed as soon as the 100 ft. shaft shows a good sized vein. Keller & Oedekoven, lessees on the Jupiter-Mars property, on Chatham creek, are now driving along a vein that shows a width of close to 20 ft. While the ore is not valuable enough to permit shipping, a mill on the ground should show a profit. The Jupiter-Mars property consists of a group of 11 claims between Chatham and Wolf creeks, on a line between the Rhoads-Hall and Rexall claims. Tests, run from smaller veins on these claims, have shown ore valued at $30 per ton. Several men are working at present on the Rexall claim, on which Mr. Cooper holds a lease. Two 10-ton shipments were made last month, one returning $170 per ton and the other $65 per ton. Jesson brothers are still driving along the vein on their property at the head of Chatham creek. A new vein has been found on Fairbanks creek on the left limit claims of Cook brothers. Since the shaft on the Hess & Thompson property has been completely retimbered, the owners have been engaged in development. It is doubtful if any large shipments will be made, it being the intention to install a small mill this summer. Birch & Anderson, of Granite creek, have a three-ton shipment awaiting treatment at the local mill. Sumner S. Smith, mine inspector for Alaska, recently paid his first visit to Fairbanks. It is Mr. Smith's intention to pay a longer visit during the open season this summer. E. R. Peoples will soon try out a Straub rapid-stamp mill, made in Oakland, California. The process uses electrolytic amalgamation.

With the number of excellent prospects being opened up, and several mills crushing on proved orebodies, this season should show a marked increase in activity among the quartz miners. Competent judges of the placer outlook predict an output for the Fairbanks district as large or larger than that of last year.

NEW YORK

MARKET CONDITIONS MUCH BETTER.—COPPER SITUATION.—CALUMET & ARIZONA PROFITS.—MASON VALLEY PLANS.—PORPHYRIES AVOIDING OVERPRODUCTION.

It has been many weary months of waiting for Wall Street; months of depression and stagnation that seemed never ending. The tide apparently has turned, and it requires all of the comparisons that are familiar in describing a hearty welcome—the flowers in May—the sight of land—the hand held out to the drowning man—to do justice to the reception that traders are giving to the coming and increasing business. The present turn to activity and million-share days is an instance of the domination of psychology over fundamental conditions. As some one said of the game of golf, the condition of the market is a 'state of mind.' To find any logical reason for market advances and brisk trading by way of comparison with what has gone before would be exceedingly difficult. Just now the swing is upward, the sky is all rosy, and it is unjustifiably pessimistic to call attention to the fact that not one of the obstacles in the way of a return to business activity and an era of constructive enterprise has been removed.

In a way the copper situation has been the leading factor in the recent betterment, and the cutting down of accumulated stocks to a point where there is no more than a safe working balance on hand is the one argument that is never overlooked among the various causes mentioned as responsible for the recent market upturn. Realizing that uncertainties are always more alluring than certainties, the leading operators in the copper share market and those who are behind what is evidently a concerted move to distribute stocks are talking much of increased dividends possible in the coppers, and pointing to the added incomes that will be received from 15c. copper.

Amalgamated, which is leading the advance in the copper list, is much discussed in regard to dividend possibilities. The Anaconda-Amalgamated organzation is so involved that the ordinary trader tires and quits before achieving any real analysis of the relative positions of the two concerns, and as a result that attitude of the public is to treat Amalgamated, which is the market favorite, simply as a gambling counter. It is stated, however, upon apparently good authority that the two companies can show combined cash assets of about $40,000,000 and that there will soon be something of a melon to cut by the Anaconda, which will in turn be distributed to Amalgamated shareholders. There is some talk of a coming move to retire the stock of the Amalgamated Copper Co., by a distribution in exchange of Anaconda, on the basis of two shares of the latter for one share of the former. Should this be done it will be the end of one very vivid chapter in American affairs; a chapter embracing mining, high finance, state and national politics. Fiction hardly holds a more thrilling story than that of Amalgamated, and it will never be written in all of its devious intertwinings, nor will there ever be compiled a complete chronicle of the men it made and unmade in Montana, in Boston, and in New York. The day for such happenings has passed, but the future will hardly hold any more interesting important series of events, in any more picturesque setting or with actors of greater power than those who battled for supremacy in Butte.

OHIO COPPER CO. MAIN MILL BUILDING.

Rehabilitation of the Calumet & Arizona seems to be complete. It is producing 50,000,000 lb. of copper per year and at a cost of 7.34c. per pound. There is but one large producer that succeeds in reaching a lower figure, the Nevada Consolidated. On 15c. copper this means that the company is making a profit of 50% on its output; with earnings equivalent to about $6.50 on the company's outstanding stock. One of the most important strikes ever made by the company was made recently when an orebody was opened on the thirteenth level, in a cross-cut from the Briggs shaft. The ore is sulphide and runs from 22 to 41% copper.

The Mason Valley smelter at Yerington is reported to be doing a largely increased custom business. The Mason Valley property belongs to the family of which Inspiration Consolidated is the head, and if production justifies increasing smelter capacity, the present plant will probably be the nucleus for a much larger smelter. It was reported recently that the Thompson-Gunn interests, which control the Mason Valley, were considering the purchase of the Ohio Copper and that Henry Krumb was making an examination of the Ohio in this behalf. It is now stated officially that such is not the case.

It is not so long ago that the greatness of the porphyries was supposed to lie in the enormous production of which they were capable. Now, however, it is apparently considered not good taste to allude to overproduction as a possibility, and the argument is advanced as to Utah Copper and Nevada Consolidated, that, on the present market, these properties are steadily accumulating a surplus, and from a managerial standpoint there is no necessity of increasing production. From the standpoint of the shareholder, whose interest should certainly be much ahead of all other considerations, there can be no excuse for holding back production. The shareholder has an investment, against which interest charges accumulate steadily, his dividends represent return of both interest and principal and the sooner his

investment is liquidated the smaller is the proportion of the total amount received which is required to be charged off as interest. The price of the metal being satisfactory, the stockholder has every right to insist not only that hay shall be made while the sun shines, but that the more hay the better.

The United States S. R. & M. Co. is able to show exceedingly satisfactory profits for January and February of the current year, notwithstanding the disturbed conditions in Mexico. The milling plants handling the ores from the Real del Monte and the Pachuca mines have been brought up from 600 tons daily capacity to about 1100 tons. This fact, coupled with the improved price of silver, has added materially to the company's earnings.

The interest in the Nevada precious metal stock continues to run high. West End is the favorite among the Tonopah issues and many thousand shares are being traded in daily. Atlanta and Goldfield Belmont are leaders among the Goldfield issues. While trading has been confined largely to professional operators, there is undoubtedly a growing public coming in.

W. A. Paine, of the Boston house of Paine, Webber & Co., is said to have become heavily interested in Tuolumne, one of the rich little properties of Butte, and is also said to be considering a deal for a large interest or the control of the Pilot Butte, which is a neighbor of the Tuolumne and controlled by the same interests. There has been at times some talk of a consolidation of the two properties mentioned and the Butte-Ballaklava, the three properties to make an independent producer large enough to have some voice in mining circles at Butte.

The Miami Copper Co. has declared its initial dividend of 50c. per share, thus being the first of the new porphyry group to make a distribution of earnings. Ahmeek, the big new producer of the Lake Michigan copper district, has increased its dividend and is now on a basis of $4 per share quarterly. The initial dividend paid one year ago was $2 per share, while the disbursement of three months ago was $3 per share. Ahmeek is traded in on the Boston Curb, not being listed on the Boston Exchange, as are most of the Lake coppers, and is selling at nearly $300 per share. North Butte has made a like proportionate increase, the recent declaration being 40c. per share as against 30c. three months ago. Greene-Cananea is said to be on a basis where it can earn more than $1.25 per share and that the present dividend rate of 50c. will in all likelihood be doubled in the near future. Utah Consolidated, which has been through some considerable difficulty during the past eighteen months, has just declared a dividend of 50c. per share. This property has become more of a lead producer than a copper property and in the development work during the year the lead orebodies were the most important opened. Over and above all—and by far the most important from a market standpoint—is the Anaconda-Amalgamated. Anaconda and Amalgamated are each paying $2 per share yearly. Anaconda is said to be earning more than twice its dividend, and Amalgamated is said to be disbursing less than one-fourth of its receipts. It is said that the former is possessed of a cash reserve of $27,000,000. All of which is by way of invitation rather.

An issue which is about to be offered to the public in a larger way heretofore is the Guggenheim Exploration Co., which now has its press agents calling attention to the assets piled up in the company's treasury, in the shape of holdings in Utah Copper bought some years ago at low prices, and which is nearly all clear profit now. It is stated that just before the recent rise in Smelters, the Exploration company bought a large block of stock at an average of $70. The Guggenheim Exploration shares are to be listed on the New York Stock Exchange, but the par value is to be reduced to $25 by issuing new stock in exchange for the old on a basis of four shares for one now held; the object being to make the issue less unwieldy. At present figures, a hundred shares of stock comes to $22,000, a price that does not look very attractive to speculators as it ties up too much capital. By way of further market news it may be said that Utah Copper has been under quite heavy pressure; some large holder is stated to have been liquidating holdings around $60, selling in 5000 share lots. Underground work in the Boston ground of the Utah Copper has ceased, as the miners have struck for an increase of pay to $3.50 for miners and $2.75 for trammers.

NIGERIA

TIN COMPANIES ATTRACTING ATTENTION IN LONDON.—HISTORY OF DEVELOPMENT.—THE NIGER COMPANY.

The rapid extension of tin mining in Northern Nigeria has provided almost the only outstanding feature of interest in the London mining market recently. February, in fact, was marked by a boom in the shares of tin companies formed to exploit the Northern Nigerian field. This interest has been a long time developing, and even now it may not be stated with any certainty that Nigerian tin mining has a great future. Yet companies are being floated now almost daily and some surprising and informative reports are being issued. The tin is found on the Bauchi field, and probably fifteen million dollars of capital is now invested in that region. The country a few years ago was a savage wilderness. Lying a long way in the interior and reached originally only by a long journey up the Niger river, and then by bush tracks for some 100 or so miles farther, the question of transport stood well in the way of effective development.

Tales of the stanniferous wealth of the country came down for a good many years before anyone paid attention to them. Eventually a little gold mining company, formed to exploit ground afterward proved to be worthless near the West African coast, wound up its affairs and resolved, in answer to these reports, to embark its remaining capital in an attempt to get tin from the interior. This was about two years ago and the results were so good that the attention of many other mining men was soon directed to Northern Nigeria. Prospectors and claim hunters began to make their way into the interior. The British Colonial Government in charge of the territory was determined not to allow anything in the way of improper working or the spoliation of the British investing public so far as lay in its power. For every claim taken up the lessee had to show so much definite cash capital for the working of it. This prevented the straw promoters from playing some of their usual games, and the development of the country, while being slow, has been more solid in consequence. The first definite sign of serious attention from wealthy mine owners came when important Rand houses began to inquire after claims on the Bauchi plateau. Throughout last year the attention given to Nigeria gradually extended, although very few companies so far have become producers. At the end of February there were one dozen companies producing from 6 to 50 tons of tin concentrate per month, the total January output being 202 English tons. Now the formation of companies is proceeding rapidly.

Expectations have been aroused from time to time that an extensive tin-bearing lode in the new field would be discovered. As far back as 1908, at the annual meeting of the Niger company, which was the concern originally having chartered rights over the whole of the two great districts now known as Southern and Northern Nigeria.

The Niger company originally held complete commercial and administrative rights over the whole of Nigeria, just as the Chartered company did over Rhodesia. As the country was developed, however, it parted with its administrative and political rights, retaining only its commercial ones. The company, of course, owns considerable areas in the tin districts of Northern Nigeria, and has been selling portions of the mining rights. For example, in the accounts for 1910, submitted in July last, there figured "special receipts from sales of mining concessions, together with the profits of tin working, $629,055." If, therefore, the industry is to develop, as some authorities believe, the Niger company will benefit materially. It will be able to obtain higher prices for its mining rights, which may represent a good deal in the course of time.

General Mining News

ALASKA

Juneau

(Special Correspondence.) — The Alaska Ebner Gold Mines Co. has been placed in the hands of receivers. This concern was formerly known as the California Nevada Copper Co. The moving spirit was F. L. Underwood, who was at one time and another connected with the Ely Nevada Mines Co., the British Columbia Copper Co., and other promotions. The California Nevada company acquired an interest in the Ebner mine at Juneau, which was described as a second Alaska Treadwell. A campaign was carried on for more than two years in an endeavor to raise capital through the sale of bonds, but the company was never able to fully finance itself, and the receivership resulted.

Juneau, April 3.

The Alaska Mexican G. M. Co.'s report for February shows that the 120-stamp mill crushed 18,606 tons of ore, the concentrate production being 431 tons. The gold and concentrate production was given as $54,527, 'realizable value.' Operating expense was $32,332 and construction expense $4059, leaving a net profit, estimated, for the month, of $18,136.

The Alaska United G. M. Co. reports that the Ready Bullion 120-stamp mill in February crushed 17,220 tons of ore, from which 472 tons of concentrate was obtained. The total production was valued at $44,832, 'realizable value.' Operating expense amounted to $22,592 and construction expense to $2219, leaving an estimated net profit of $20,021. The 700-Foot claim 120-stamp mill crushed 18,564 tons of ore, from which 377 tons of concentrate was obtained. The 'realizable value' of the total production of gold and concentrate was placed at $45,428. Operating expense was $25,844 and construction expense $3191, leaving an estimated net profit of $16,392.

Ketchikan

The Londevan adit has intersected the orebody about 200 ft. from the portal. The ore is silver-lead and contains some gold and silver.

Seward Peninsula

The 1912 All-Alaska sweepstakes was won by A. A. ('Scotty') Allan, driving Mrs. C. E. Darling's team of malamute dogs, in 87 hours, 32 minutes. The race was one of the hardest in the history of the sweepstakes. O. Blatchford, driving the Oliver dogs, was lost for three hours in Death Valley, blinded by a storm. Allan was hard pressed, excepting for the last 50 miles. Alexander Holmson, driving John Johnson's Siberian wolfhounds, holder of the record time, 71 hours, 14 minutes, 20 seconds, got second place. Allan and the Darling team won the 1908, 1911, and 1912 races and made second in 1909 and 1910 events. The purse this year was $5000. Charles Johnson, driving Fox Ramsey's dogs, arrived third, half an hour behind Holmson, who was half an hour behind the winner. The last team, the Oliver dogs, was in poor condition and hopelessly outdistanced. Mrs. Darling, of Berkeley, California, has announced that her team has been withdrawn from further contests. The dogs will be exhibited at the Panama-Pacific Exposition in 1915.

The Tanana

Pat O'Connor and associates have found rich ore in the Wild Goose association claim at the head of American creek, in the Hot Springs district. The three-stamp mill on Garden Island, says the *Fairbanks Times* of March 18, has crushed 75 tons of ore since it was started, after a long period of idleness, on December 13. L. A. Freestone is in charge of the mill.

C. P. Guis recently had the 60-hp. boiler formerly used by Peterson & Kellum erected on the Twin creek discovery claim. As the gravel did not yield a profit by hand-work, he is to use machinery in development this summer. A report from Cleary City states that the Homestake property, Wolf creek, has found a new vein 575 ft. from the portal of the adit.

ARIZONA

Cochise County

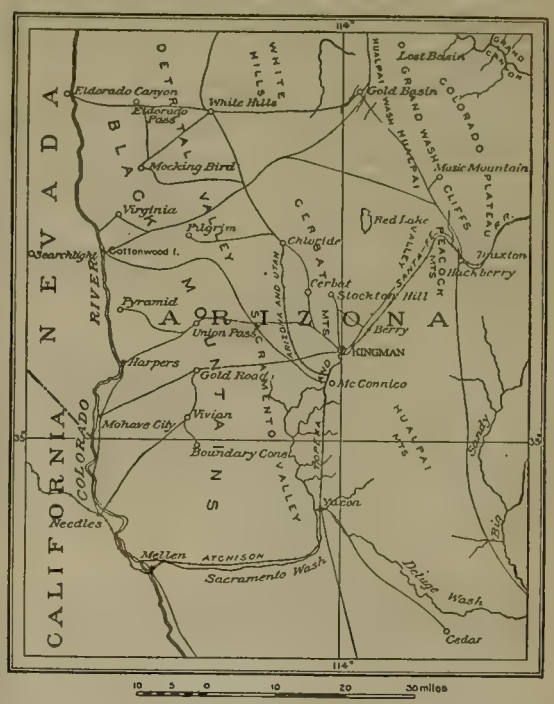
(Special Correspondence.) Phelps Dodge negotiations with the Shattuck Arizona are still pending, but it is said that the Shattuck interests are demanding quite a little more per share than the Copper Queen people are willing to pay. In the meantime the Shattuck is shut down and the recently drawn plans for a smelter are held in abeyance.

Bisbee, April 7.

The Leadville M. Co. has discovered good shipping ore in a raise from the 200-ft. level of its Maid of Sunshine property. Daniel Brown and brothers, owners of the Ontario claim, have a carload of high-grade ore ready for shipment.

Gila County

(Special Correspondence.)—Churn-drill hole No. 2 of the Southwestern Miami Development Co. is 1070 ft. deep and still in the chalcocite ore it cut at 945 ft. Hole No. 3



PART OF WESTERN ARIZONA.

is 520 ft. deep in the schist formation. Progress has been slow on account of caving. The two new drilling machines have arrived and two new holes will soon be started. Churn-drill hole No. 2 on the Barney group is 420 ft. deep. A road is being built to the place where hole No. 3 will be drilled at the apex of the Live Oak, Southwestern Miami, and Barney properties, the expense to be shared equally by the three companies. At the Inspiration the experimental mill has been started again and J. M. Callow is conducting another set of tests. The trestle connecting the portal of the main adit with the site of the new steel warehouse is nearly completed. E. M. White, formerly manager for the Warrior Copper Co., has been appointed manager for the Manitou Copper Co. operating the Five Points mine 15 miles west of Globe. The present work consists of sinking the Cracker Jim shaft, which is now 130 ft. deep.

Globe, April 4.

Miami Copper has declared a quarterly dividend of 50c. per share, placing the stock on a $2 basis. It is scarcely more than a year since Miami started the first unit of its concentrator. In eight of the twelve months since its mill was placed in operation, copper has averaged about 12¼c. per pound.

MOHAVE COUNTY

Lyon Kay has discovered a vein containing copper, gold, and silver between the Keystone and George Washington mines, at Mineral Park, says the *Mohave County Miner*. For 18 in. the ore is reported to have assayed $7 per ton gold and silver and 41% copper. The Frisco M. & P. Co. as the result of a ten days' run at the mill has sent to the mint a bar of bullion valued at $6500. F. H. Summeril and Frank Duden report the discovery of good tungsten ore on their property, east of Yucca. The Arizona Alpha M. Co. has had 500 tons of ore from the Alpha mine concentrated at Needles. The results have not been announced, but it is rumored that the concentration was at the rate of three and one-half tons to one, and that the concentrate is valued at about $80 per ton. It is believed that plans are made for building a mill. O. F. Brinton is superintendent of the property. The Oro Plata recently sent 30 tons of concentrate to the smelter.

SANTA CRUZ COUNTY

It is reported that the Shannon Copper Co. has purchased the R. R. R. mine near Patagonia, and will develop the property on a large scale. Rich ore was discovered there recently.

YAVAPAI COUNTY

High-grade ore was found recently in the Bannie Mines Co. property, states a Prescott report. Litigation which has involved the property for many years has been settled for some time, and it is rumored that sufficient money has been raised to insure the resumption of development. E. A. Rogers is president of the company. It is reported that a new mill is to be erected on the Independence group of claims, owned by J. A. Forbes and associates.

CALIFORNIA

Articles of incorporation for the Prospectors' Alliance of America, organized recently at a meeting at Bishop, have been filed at Sacramento. Among the incorporators is T. L. Oddie, governor of Nevada. There is no capital stock. The incorporators are: J. A. Butler, Sacramento; Tasker L. Oddie, Carson City, Nevada; Eugene Grutt, Hawthorn, Nevada; Lester C. Hall, George W. Leedy, A. H. Swallow, and C. E. Kunze, all of Bishop, California.

AMADOR COUNTY

(Special Correspondence.)—Thirty stamps of the Central Eureka mill are dropping on ore from the 2600 and 2800-ft. levels. On the 2700-ft. level an eight-foot orebody has been intersected by the south drift. Arrangments are under way to open this vein on the 2800-ft. workings. J. E. Davis is manager of the property. The shaft at the Plymouth Con., otherwise the Empire-Pacific, has been unwatered to the 500-ft. level. The old timbers are said to be in good condition, and it is expected the shaft will be easily placed in shape for development work. The Hardenburg shaft is near the 800-ft. point and will be continued probably to a depth of 1500 ft. Work is about to start on a head-frame at the South Jackson. It is expected to have a new plant of machinery in position and 40 men employed within 30 days. San Francisco capitalists are principally interested in the company, of which Jeffrey Schweltzer is president and manager. A rich gravel strike is reported from the Grillo property, in the Volcano district.

Jackson, April 8.

KERN COUNTY

(Telegraphic Correspondence.)—The California oil companies during March paid an aggregate of $745,842 in dividends. To this amount should be added $80,000 paid in dividends by the Mexican Petroleum, Ltd., making a total of $825,842.

L. P. St. Clair, president of the Independent Oil Producers' agency, reported yesterday at the annual meeting of that organization here that contracts for more than 52,000,000 bbl. of oil are on hand. The requirements for these contracts will be about 60%, or more than 31,000,000 bbl. The storage price to the agency for the year was 35.7c. per bbl., and the net price 31.97c. The oil handled during the year amounted to 24,132,709. Deliveries, principally to the Union Oil Co., amounted to 14,004,102 bbl. The total net sales amounted to $4,940,887.

Bakersfield, April 11.

The Red Dog mill cyanide plant is again in operation, after a shut-down of about two years. Frank Howard has obtained a bond on the Manuel Rodgers property, in the Argus range district. The price given in the bond is $30,000. The Yellow Aster M. Co. has a $26,000 gold bar as the result of a clean-up from mill No. 1.

NEVADA COUNTY

The report of the North Star Mines Co. for the year ended December 31 shows a production in that period of $1,025,088, on which the net profit was $468,681. For purchase of property and development of the Cincinnati Hill mine the company spent $58,065, leaving a balance of $410,616. Income from invested funds and other sources brought the total net receipts to $452,890. The company paid in dividends during the year $425,000. It has an option on the Champion group at Nevada City.

PLUMAS COUNTY

Exceptionally rich ore has been discovered in the Gruss mine at Genessee at a depth of 175 ft. W. H. Draney and associates of Greenville are planning to develop several claims south of that city. A rich vein containing copper and gold has been cut in the Engle mine, near Taylorville, in the Greenville district.

SANTA CLARA COUNTY

B. L. Barney and J. W. McCord, representing about 25 former stockholders in the Lost Hills M. Co., have brought suit at San Jose against J. D. Martin and William Lindemann to recover $104,700. The plaintiffs state that Martin and Lindemann told them of a man who was willing to pay $5 per share for the stock, and the stockholders indorsed their 34,900 shares, all that had been issued to that time, to the defendants. The stock, it is asserted, was sold on March 28 to George E. Cameron for $8 per share, of which $5 per share was turned over to the members of the pool. The latter are suing to recover the remaining $3 per share.

SIERRA COUNTY

(Special Correspondence.)—Stockholders of the Rio Antigua M. Co. have purchased the stock of the South Fork M. Co., owning the South Fork mine, near Forest. The Rio Antigua people have operated the placer deposits under bond and lease for about eight years, their work being principally confined to search for the south extension of the Bald Mountain channel. Occasional streaks of rich gravel have been uncovered and five quartz veins intersected. Under the new arrangement the attention of the company will be largely concentrated on the development of the quartz resources. These are thought to be extensions of the Tightner-Rainbow-Red Star vein-systems. It is reported that electrical machinery will be obtained. Los Angeles investors are backing the company, for which Fred W. Kuhfeld is manager. San Francisco people have taken a bond on the Hayes Con. group, near Sierra City, of which Thomas C. Heide is now superintendent. The 10-stamp mill is running steadily and it is rumored the management plans to enlarge it this summer. It is reported operation will be resumed at the Phoenix mine, Sierra City district, of which A. Wise is manager.

Downieville, April 6.

COLORADO

GILPIN COUNTY

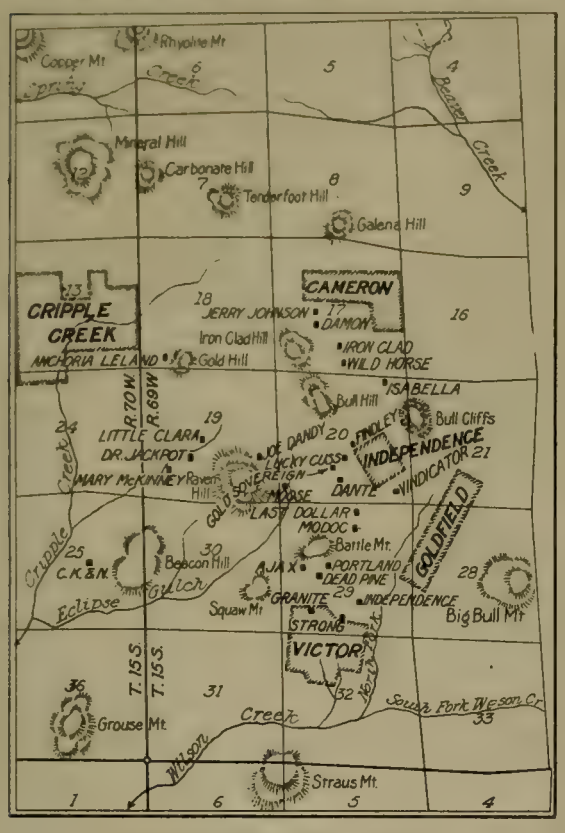
Fred Berger and Robert Sayre of Denver have taken over the Phoenix-Burroughs, Conlee-Burroughs, Kansas-Burroughs, Pease-Kansas, University-Kansas, Monroe, and other nearby claims. It is reported that they will start development on a large scale. The properties are in the Nevadaville district.

TELLER COUNTY

The Crystal Peak Gem Co., of Cripple Creek, has filed

on seven placer claims in the Crystal hills, about seven miles north of Florissant. There are eight locations, each claim being for 160 acres, on the basis of 20 acres per locator. The Vindicator Con. G. M. Co. in March produced 130 cars of ore, of which the company itself shipped 82 cars, the largest output for the company in the past two years. The Vindicator company, it is reported, will pay a dividend of 4c. per share on April 25, to stockholders of record April 15. The El Paso mine in March shipped 100 cars of ore. The Lady Campbell G. M. Co. has sunk its Emma Abbott shaft to 130 ft. and will start a drift under the main orebody.

The Blue Flag G. M. Co. will use the cyanide process in its mill at Cripple Creek. John Masson, formerly of



MAP OF CRIPPLE CREEK DISTRICT.

Broken Hill, New South Wales, will be in charge. Owen Roberts, who is operating the El Paso Gold King, has secured from the Midget-Bonanza G. M. & M. Co. a lease on the Gold hill property of the company.

The Cripple Creek district in March produced 76,054 tons of ore, valued at $1,209,530, the largest production of the present year. The monthly report of the mills and smelters is as follows.

Plant and location.	Tonnage.	Gross bullion value.
Golden Cycle, Colorado City	32,000	$640,000
Portland, Colorado City	10,000	215,000
Smelters, Denver and Pueblo	4,150	266,000
Portland, Cripple Creek district	14,500	43,065
Colburn-Ajax, Cripple Creek district	3,100	9,920
Wild Horse, Cripple Creek district	1,400	4,242
Jo Dandy-Cavanagh, Cripple Creek district	1,200	3,300
Stratton's Ind., Cripple Creek district	8,704	26,504
Blue Flag (est.), Cripple Creek dist.	1,000	6,000
	76,054	$1,209,531

In a letter to stockholders the Pharmacist G. M. Co. directors explain that the company, formerly known as the Pharmacist Con. G. M. Co., was reincorporated with the present name under the laws of Wyoming to avoid payment of the flat, license, and occupation tax levied by the state on all Colorado corporations, based on their capitalization. As it was necessary to make the change before March 1, and time was limited, the action was taken without consultation with the stockholders. The new company has the same officers as the old, and stock in the latter will be exchanged without delay for stock in the new corporation. The Exchange Registry & Guarantee Co. of Colorado Springs is the transfer agent named by the directors.

IDAHO

Shoshone County

Dennis Ryan, manager of the Hunter mine in the Coeur d'Alene district, has announced in Spokane that additional equipment will be provided within 90 days to double the present output. One hundred and twenty-five men are at work in the mine and mill. The mill capacity of 300 tons per day is to be increased to 400 tons in May, and it is the intention to add a 400-ton unit this summer. Other plans are to prospect and open a body of high-grade silver-lead ore between the No. 4 and No. 6 adits.

Black Horse mine, near Murray, recently shipped a car of zinc concentrate that ran 51%, the highest grade of zinc yet forwarded from the Coeur d'Alene district. The Bunker Hill & Sullivan M. & C. Co. declared its regular monthly dividend of $65,400 on April 4. This is the one hundred and seventy-fifth regular monthly disbursement and makes the total payment to stockholders during the present year $251,600 and a total of $13,421,250 to date. James F. Howarth has taken an option for 30 days at $225,000 on the Idora Hill mine, near Wallace. The first payment of $56,250 is due April 21. The final installment of $112,500 is payable March 21, 1913. Mr. Howarth is said to represent Eastern investors. Directors of the Gold Leaf Con. Mines, controlling the Wisconsin, Gold Leaf, Copper Belt, and Washington properties, near Wallace, arranged at a meeting in Spokane to clear the claims of encumbrance and liquidate all debts. Officers were elected as follows: president, Fred N. Davis; vice-president, W. J. Parks; secretary-treasurer, Vince A. Day. Louis Bolduc of Kellogg, is manager.

MONTANA

Lincoln County

(Special Correspondence.)—Operations have started at the Libby Placer M. Co.'s plant on Libby creek, and the big hydraulic outfit is to be run with a double shift throughout the season. Mr. Hooten, the seperintendent, arrived in town a few days ago from Butte and at once secured a force. P. J. Brophy, president of the company, is expected from Butte within a few days. The company owns nearly 1000 acres of placer ground on Libby creek, about twenty miles from here.

Libby, April 8.

NEVADA

Esmeralda County

Guy and John Hibbs, of Montana, have bought the Reward No. 1, 2, 3, 4, and 5 claims, known as the old McNamara group, from W. H. Keenan and others. It is reported they will build a 50-ton mill, which is to be ready by July 15. The sale was effected through B. E. Thomas, of Goldfield.

Nye County

(Special Correspondence.) — The Mushett-Wittenberg lease on the Manhattan Con. confirms the report of finding a rich vein on the 130-ft. level. The lessees state the shaft will be sunk 125 ft. deeper. The ore will be treated at the Associated mill. The Steffner lease is moving the hoisting plant from the old to the new shaft. With the completion of this work it is planned to sink the 200-ft. shaft to a depth of 720 ft. A large tonnage of milling-grade quartz is blocked out in the Poak-Steen-Cicala lease workings. This lease is sending 100 tons of ore per day to the leased Lemon mill, where 45 tons per day are treated. The balance will be milled as soon as facilities permit.

Arrangements are under way for the sinking of the shaft from the 400 to the 500-ft. level. Two other leases are operating on the Big Four estate.

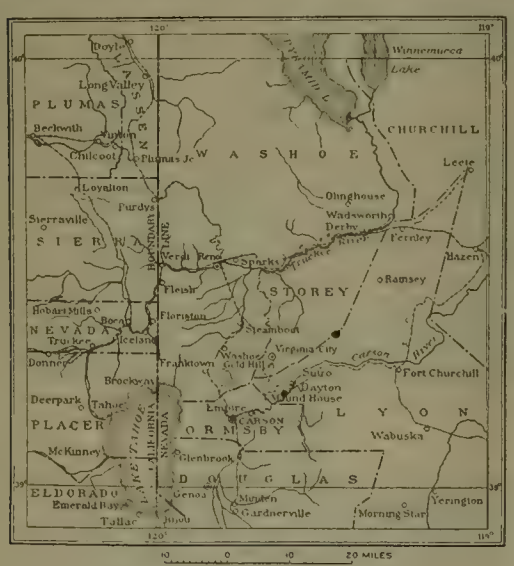
Manhattan, April 5.

The Associated Milling Co.'s 50-ton mill in the Manhattan district has been started and is crushing ore from the Steffner lease on the Manhattan Con. property. The Big Four M. Co. has purchased the Poak-Steen-Cicala lease on the Big Four property. The shaft will be sunk to the 500-ft. level.

Mines in the Tonopah district last week produced 8481 tons of ore, valued at $212,025. The Tonopah Belmont was in the lead with 1950 tons. The Tonopah Extension mill during March crushed 4618 tons of ore, producing bullion valued at $55,300. The ore averaged about $14 per ton.

STOREY COUNTY

During the week ended April 6 the Ophir S. M. Co. produced 257 tons of ore averaging close to $25 per ton, and shipped 400 tons second-class ore to the Kinkead mill. A carload of concentrate also was shipped to the Selby smelter. During the regular development in the Con. Virginia mine 53 tons of ore averaging $10.87 was saved. The Mexican mill crushed 557 tons of ore which assayed an average of



PART OF WESTERN NEVADA.

$23.77. Repairing the 1600-ft. level of the mine jointly with the Sierra Nevada and Union Con. proceeded. From the 2300-ft. level 36 tons of $59 ore, and from the 2400-ft. level 103 tons of $29 ore were taken. The Union Con. and other properties were the scene of the usual repair and development.

WASHOE COUNTY

The Nevada Deep Mines Co. has ordered a 10-stamp mill with a capacity of 75 tons per day, for its property in the Como district, near Reno. The mine is developed to the 300-ft. level. The plant also will include tube-mills and cyanide equipment.

NEW MEXICO

SOCORRO COUNTY

(Special Correspondence.)—The Deadwood Mines plant will resume operation today. During the shut-down of the past six weeks a large tonnage of custom ore has accumulated. The new gasoline hoist of the Deep Down property has been installed and the mine crew increased. Both property and equipment are now in readiness to make regular daily deliveries of ore to the Deadwood mill. The mine is operated under lease.

The Ernestine M. Co.'s new Blake crusher has been shipped and will be placed in commission immediately on arrival. In March the mill treated 3200 tons of ore; last week, 760 tons. Precipitate for the last ten days of March is being smelted. By the Socorro Mines 1200 tons of ore was milled during the week. The Treasure M. & R. Co. shipped 480 tons of ore in the week ended March 31. During March a total of 133 ft. of development was done on the Pacific mine of the Oaks Co., producing 75 tons of ore. In the course of recent development work on the Trilby group a large tonnage of ore was accumulated and is now being sent to the Deadwood mill. Should the results be satisfactory, it is likely a lease will be let.

Mogollon, April 5.

TEXAS

EL PASO COUNTY

The old Federal Copper Co. smelter, which has been idle for the past ten years, is being torn down. W. C. Greene bought the plant to treat his Chihuahua ores, but when he had to close some of his properties in 1907 he sold the smelter. When built 15 years ago the smelter was well outside of the city. Now its site will be used for residence purposes.

UTAH

JUAB COUNTY

The Chief Con. M. Co. in the first quarter of 1911 earned about $124,300, according to recent reports. The January profit was $13,300, that for February $51,000, and the March profit is estimated at $60,000.

Dividend paying properties in the Tintic district for 1910 and 1911 have been tabulated as follows by the *Salt Lake Tribune*.

Company.	1910.	1911.
Centennial-Eureka	$600,000	$600,000
Colorado	300,000	180,000
Gemini	.....	10,000
Grand Central	60,000	25,000
Iron Blossom	200,000	320,000
Lower Mam. Extension	2,000	.....
Ophonogo	.....	10,000
Soiux Consolidated	89,448	89,448
Uncle Sam Consolidated	45,000	75,000
Victoria Consolidated	10,000	.....
Totals	$1,306,448	$1,309,448

Some of the companies named have not yet paid dividends this year, but new producers are coming forward.

SALT LAKE COUNTY

The Utah Copper Co.'s Boston mine was shut down last Wednesday after 350 miners and trammers had walked out. The men asked an increase of 50c. per day, to $3.50, for miners, and 25c., to $2.75, for trammers.

SUMMIT COUNTY

The Daly West M. Co. has declared the regular quarterly dividend of 30c. per share, payable April 20, to stockholders of record April 10. The dividend will mean the disbursement of $54,000, and will bring the dividend payments of the year to $121,500.

CANADA

BRITISH COLUMBIA

Advices from Spokane state that it is officially announced that construction work on the 2000-ton smelter for the Granby Consolidated company at Granby Bay, Portland Canal district, will begin in May. The company plans to expend an equal amount in the development and equipment of the Hidden Creek mine. The smelter site has been graded, and the company will start work soon on the construction of a tramway to convey the ore from the mine to the smelter at tidewater.

Plans for financing the Hidden Creek property of the Granby are held up indefinitely. The Granby management is said to be very well satisfied with the prospects at the Hidden Creek mine. On the present copper market Granby can show a fair margin of profit, and it is possible that the new properties will be financed out of accumulated earn-

ings, which would avoid the necessity of making a new stock issue.

Twenty five thousand dollars, at the rate of 1½c. per share, payable April 10, is the amount of the first dividend declared by the Standard M. Co., operating the Standard mine in the Slocan district. The property, which is owned by Spokane and New York investors, has been under development fourteen months. John A. Finch, of Spokane, who holds the controlling interest, has with him Patrick Clark, George Aylord, W. E. Cullen, and Michael Shea.

ONTARIO

(Special Correspondence.) The Pearl Lake Co. has now sunk the shaft to the 400-ft. level and after sinking 20 ft. farther will cross-cut to intersect the two veins. The same process is to be repeated at the 600, 800, 1000, and 1200-ft. levels. About 3500 ft. of diamond-drilling has been done on these orebodies. About 27,000 ft. of diamond-drilling has been done on the Dome property since August 1911.

The McIntyre mill has been running again on electric power supplied from Sandy Falls. The ore is fed into bins at the top of the mill and then passes through the stamp batteries, where 10 stamps, weight 1250 lb., are dropping 8 in. at the rate of 100 drops per minute. After passing over the amalgamation plates the ore is concentrated by passing over two Deister concentrating tables, and from there to three No. 3 Deister slime tables, the concentrate being stored for further treatment later on.

The Bradley company of New York has just given an order for 25 rock-drills to the McKiernan-Terry Drill Co. of New York. The order was awarded after three weeks competitive test participated in by several of the big firms. The Vipond shaft is being sunk to the 300-ft. level, and about 500 ft. of driving is being done per month. The cross-cut on the Three Nations at the 100-ft. level has now cut the vein, which looks promising.

Ontario, April 2.

The Casey Cobalt company has obtained a 5-stamp experimental mill and a 3-drill compressor. Tests will be made for five months to determine the best method of treatment for the Casey ore. At the Townsite mill at the Northern Customs concentrator, 20 stamps are being added to the present equipment, bringing the battery up to 50 stamps.

The silver production of the Cobalt district in 1911 established a new record, according to the annual report of Arthur A. Cole, mining engineer to the T. & N. O. Commission, to the Ontario legislature. Last year's production was valued at $16,500,000, as against $15,477,987 for the preceding year, which was the previous record. The tonnage was less than that of either 1910 or 1909, being 25,710, as against 34,710 in 1910, and 30,058 in 1909.

YUKON

Owners of copper properties at the head of the White river have been passing through Dawson on their way to start the season's operation. H. E. Morgan, owner of some promising claims, is among them. Men are said to be scarce at Whitehorse, with wages at $5 per day and board.

CHILE

At the Braden property two units of the concentrator are in operation and a third is about to go into commission. A leaching plant is being constructed. At the same time, independently of company operations, the Mineral Separation, Ltd., of London is erecting a 250-ton plant at its own expense and expects to handle a large part of the Braden ores. This company is operating successfully in Australia and New Zealand. In the end, with very cheap power and the working out of various methods of treatment, Braden expects to produce its copper at something less than 7c. per pound, which will give it a prominent place among the low-cost coppers.

MEXICO

OAXACA

Reports in the *Mexican Herald* state that the damage done by the revolution in this state in the closing of properties, the options allowed to lapse, and general apprehension, has been great, and that the movement of capital in development and returns is about a third as large as during the days preceding the anti Diaz revolution. The Los Ocotes properties of the Tezuatlan Copper Co. have been shut down. The Natividad mines of the Sierra Juarez have caught fire and for the past month attempts to smother the flames in the workings have been ineffectual. H. A. Monday has sold his half interest in the Dos Cabezas group to Hillsboro, Indiana, investors, who are operating. James Griffin is superintendent of the property. The A. S. & R. Co. has closed its ore buying agency at Tayiche, as the larger mines are shipping direct, and the smaller mines do not justify maintaining the office. A. R. Wren, formerly in charge at Tayiche, has moved to the Monterey office. J. E. Gee and J. A. Wilkerson have taken charge of the Indiana-Oaxaca M. Co.'s properties, vice Mr. Cartens, who is now manager for the Compania Minera de Tejomulco, a Mexican company, in the same district. Ground has been broken for the new Cubilete mill. The Andes-Bullion properties, Tayiche district, have been shut down. The Santa Caterina mill is again operating, after having been closed for two years. Due to revolution or accident, only three treatment plants are operating in the state.

Among the Copper Mines

SHANNON'S production is showing an increase over that of 1911, the output for the first two months of 1912 having been 2,849,000 lb., as against 2,411,000 in the previous year. Though its cost of production has been reduced, it is still, according to latest reports, around 11½c. per pound.

The INSPIRATION'S new mill's first unit should be in operation within 18 months, according to an annoucement by W. B. Thompson. Construction will be started within sixty days. At least 45,000,000 tons of ore averaging more than 2% copper has been proved, in addition to 15,000,000 tons partly developed.

The MIAMI COPPER CO. is mining and concentrating an average of 3000 tons of ore per day, and it is estimated that production of fine copper is close to 3,000,000 lb. per month. Development is at the rate of nearly 6000 ft. per month. All mining is being done above the 420-ft. level, but the 570-ft. level is being opened up. Pits are being dug for foundations for a tailing tower. It will be equipped with four bucket-elevators having 24-in. belts and designed to elevate the tailing 60 ft., so that the gulch into which it is now being run may be filled to the limit. This elevation will also be sufficient to run the tailing by gravity into the next gulch to the east.

NOTWITHSTANDING the national strike of the colliers and subsequent great diminution in the consumption of copper throughout England and Scotland, says James Lewis & Son's mid-monthly report on copper, the value of 'Standard' has advanced from £64 5s. for cash on March 1 to £64 15s. March 18, the sales amounting to about 21,000 tons. In face of such adverse circumstances this advance shows the exceptionally strong inherent position of this metal. A settlement of the strike would probably be followed by active buying and a further improvement in values. Large sales of electrolytic copper have been made by American producers to British consumers up to 14⅝c. per pound, and £68 per ton c.i.f. is now asked for Europe. The American Producers' returns show an increased production for the first two months of this year, as compared with the same period last year, of 4396 tons, the British consumption being 11,596 tons and the exports 20,087 tons greater. The stocks are reduced 11,837 tons in the two months, making the reduction in the American and European stocks 18,063 tons and 78,784 tons in the past twelve months. European consumption shows an increase of 14,893 tons as compared with the same period last year—58,482 tons against 43,589 tons.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

W. H. Radford has left for Alaska.

J. F. Newsom has gone to Montana.

E. S. Berry is at the Braden mine, in Chile.

R. S. Rainsford was in San Francisco Tuesday.

R. W. Perry has returned to Medellin, Colombia.

Wilbur E. Sanders is at Soulsbyville, California.

J. B. Woodworth has returned to Toronto from Arizona.

W. E. Thorne is now at 408 Salisbury House, London, E. C.

F. L. Sizer is at Ray, Arizona, and will go to Tonopah, Nevada.

Enrique Valle is in charge of the Santa Catarina mines, at Taviche.

R. E. Cranston has gone to Bodie on a two weeks professional trip.

R. B. McGinnis has returned from New Mexico and has gone to Oregon.

C. L. Hargrave has returned to Berkeley, California, from Cobalt, Ontario.

J. C. Nicholls is now with the Dome Mines Co., Ltd., South Porcupine, Ontario.

P. G. Spilsbury, general manager for the Aguacate mines, has returned to Costa Rica.

A. L. Queneau will sail from New York on April 27 for Jemappe sur Meuse, Belgium.

C. H. Shamel is now at Seattle and expects soon to visit San Francisco and Los Angeles.

F. W. Oldfield is on his way to London and should be addressed care *The Mining Magazine*.

Stanley C. Sears has returned from Mexico and is at Room 104, State House, Boston, Massachusetts.

A. W. Burgren has returned from Mexico and is now at at Pacific and Poverty Point mines at Placerville, California.

Robert Linton, general manager for the Sierra Consolidated Mines Co. of Ocampo, Chihuahua, is now at Los Angeles.

James Nash, who discovered the Gympie goldfield, Australia, in 1867, has been granted a pension by the Queensland Government.

Obituary

Thomas Edwards, who died at Melbourne early in February, was born at Blackwater, in Cornwall, July 10, 1838. His father, who was a 'mine captain,' died soon after, and, at the age of 17, Mr. Edwards went to Australia with his uncle, who was one of the pioneer gold-seekers. The pair went to Ballarat, then at its zenith, and engaged in mining for a number of years. In 1864 while Mr. Edwards was employed by the Clunes United Co., at Clunes, he saw the desirability of improving milling methods and, securing the right of re-treatment of the tailing, erected a plant for roasting and amalgamation. In 1871 he removed to Western Australia and, with others, formed the United Pyrites Co. for roasting and amalgamating concentrate, and here first introduced the Plattner process into Australia. Later he became connected with the Mount Morgan mine, and in 1890 he erected a large ore-treatment plant at Sebastopol, Ballarat. The work here led to the invention of the Edwards furnace, which was so successful that its use has become general. He was an enthusiastic investigator and keenly interested in mining education. A shareholder in many of the principal mines of Victoria and a member of the board of several, he was also a member of learned and technical societies. He leaves three daughters, his son having died a few years previously.

Market Reports

LOCAL METAL PRICES

San Francisco April 11.

Antimony	11—11½c	Quicksilver (flask)	$42.50
Electrolytic Copper	16—16½c	Tin	47—48½c
Pig Lead	4.45—5.40c	Spelter	7¼—7½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

Average daily prices in cents per pound, based on wholesale transactions, standard brands.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Apr. 4	15.75	4.20	6.50	58⅜
" 5	15.75	4.20	6.50	58⅜
" 6	15.75	4.20	6.50	58⅜
" 7	Sunday.	No market.		
" 8	15.75	4.20	6.60	58⅜
" 9	15.75	4.20	6.60	58⅜
" 10	15.75	4.20	6.60	58⅜

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, Apr. 11.		Closing Prices Apr. 11.
Adventure	7¼	Mohawk	$ 65
Allouez	45	North Butte	33¾
Calumet & Arizona	73½	Old Dominion	58¼
Calumet & Hecla	488	Osceola	117
Centennial	22	Quincy	86
Copper Range	65¼	Shannon	14¼
Daly West	6¾	Superior & Boston	2½
Franklin	14½	Tamarack	28½
Granby	54½	Trinity	8¾
Greene Cananea, ctf.	9	Utah Con	14
Isle-Royale	27½	Victoria	4¼
La Salle	5¾	Winona	7
Mass Copper	8	Wolverine	112

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, April 11.

Atlanta	$ .31	Mayflower	$ .03
Belcher	1.05	Mexican	3.47
Belmont	10.00	Midway	.37
B. & B.	.20	Montana-Tonopah	3.42
Booth	.10	Nevada Hills	2.45
Chollar	.12	Ophir	1.32
Combination Fraction	.18	Pittsburg Silver Peak	1.45
Con. Virgina	.74	Round Mountain	.47
Florence	.85	Savage	.29
Goldfield Con.	4.30	Tonopah Extension	2.12
Gould & Curry	.08	Tonopah of Nevada	7.62
Jim Butler	.74	Union	1.12
Jumbo Extension	.43	Vernal	.17
MacNamara	.24	West End	2.25

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, April 11.

Associated Oil	$44.50	Peerless	$ 4.50
Brookshire	.65	Pinal	4.25
Caribou (New Stock)	1.20	Premier	.50
Claremont	.55	P. S. Petroleum	.17
Coalinga National	.15	Republic	.41
Con. Midway	.02	Silver Tip	.90
Empire	1.15	Sterling	1.47
Enos	.03	S. W. & B.	.20
Maricopa 36	.64	Turner	.80
Midway Premier	.40	Union	98.25
Monte Cristo	1.32	United Oil	.32
Palmer	.58	W. K. Oil	2.35

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. Apr. 11.		Closing Prices. Apr. 11.
Amalgamated Copper	$ 82	Miami Copper	$ 26¼
A. S. & R. Co.	86	Mines Co. of America	3⅜
Braden Copper	5¼	Nevada Con	16⅜
B. C. Copper Co.	5½	Nipissing	8
Camp Bird Ltd.	7½	Ohio Copper	1⅛
Chino	29⅜	Oroville Dredging	11/16
El Oro	4	Ray Con	20⅜
Esperanza	7½	Santa Gertrudis	7½
First National	3⅜	Tenn. Copper	41⅜
Giroux	6	Tomboy	4⅜
Goldfield Con.	4⅜	Tonopah Belmont	10⅜
Greene-Cananea	9½	Tonopah Ex.	2⅛
Hollinger	12⅜	Tonopah Mining	7½
Inspiration	20⅜	Trinity	8¼
Kerr Lake	2⅞	Tuolumne Copper	3⅜
La Rose	3⅜	Utah Copper	64
Mason Valley	12⅜	West End	2⅜
McKinley-Darragh	1⅜	Yukon Gold	3⅜

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling and smelting.

DOUBLE RIVETED lap joints in $\frac{3}{8}$ in. plates gives efficiencies of from 61.4 to 71.5%, according to tests.

EFFECT of vacuum upon the steam consumption of a turbine is strikingly shown by the reports of a recent test on a 1000 kw. machine in which the consumption increased 40% with a decrease in vacuum from 29 to 21 inches.

ZINC VIOLETS are scientifically known as *viola calaminaria*, and in Europe grow in particular abundance in soils containing the zinc ore, calamine, whence the derivation of the name. The same species is found at the Horn Silver mine in Utah.

ELECTROMAGNETIC separators are used for removing metallic iron from cupola slag, rubbish, and sweepings. Some old dumps contain as much as 20% iron, and in foundries 10 to 12% of the iron is lost; the foundry waste amounts to 7 to 10% of this. The average cupola slag contains 4 to 6% of iron recoverable by magnetic methods.

BRICK vary in strength, according to the method of manufacture. A soft brick will crush under 450 to 600 lb. per square inch, but a first-rate machine-pressed brick will stand 3000 to 6000 lb. per square inch, or 200 to 400 tons per square foot. The weight of brick varies from 100 lb. per cubic foot of inferior brick to 150 lb. per cubic foot for the best pressed brick.

CHLORIDES may be detected in the presence of bromides and iodines by the use of a boiling solution of $(NH_4)_2C_2O_4$, since AgCl is slightly soluble, AgBr less soluble, and AgI insoluble. By boiling the washed precipitate of silver salts for a few minutes with half-normal oxalate solution, filtering, and adding KBr to the filtrate the presence of chlorides can be detected by the occurrence of turbidity.

CEMENT, measured by the capital invested, is one of the world's three great attractive industries. In capital employed it apparently far outranks the gold-mining industry. Only coal and iron stand ahead of it. The price of portland cement in 1910 was as low as 73c. per barrel in some places, the average for the United States being 89.1c. per barrel. In 1890 the average price was over $2 per barrel, and as late as 1903 it was $1.24 per barrel.

EXHAUST STEAM can be used for evaporating by filling a pan 11 by 17 ft. and 18 in. deep with cast-iron condensing pipes of 250 sq. ft. of surface. By keeping the pan-room warm and letting in only enough air to carry away the vapor adds to efficiency, as the temperature in the pan will average only about 165°F. In evaporating liquids whose boiling point is much above that of water, exhaust steam can do little more than bring them to saturation, but on weak liquors it is useful.

HANDLING of the various materials is one of the most important engineering problems in every large construction job. The facility with which the concrete may be placed becomes as great an advantage as the strength and durability of the finished structure. The handling of the cement and aggregates, and the mixing and placing of the wet concrete are problems that may be readily solved by machinery, and the entire process from the raw-material bins to the forms may be made continuous and very rapid. The proper design and arrangement of the concrete-mixing plant must be determined with respect to several things. The source of the material, the treatment the material must receive (washing, sizing, or crushing), the capacity of the plant as it bears upon the rate of progress of the work, and the manner of placing the mixed concrete, influence the design of the plant and thereby the cost of carrying on the work.

IN air-compressors, even where the fuel supply cost per unit is low, if the most economical commercial results are to be obtained it is necessary to consider carefully not only the design of the compressor in detail, but also the factors entering into the cost of the necessary boiler capacity installed, the cost of the compressor foundations, building, and all other factors involved in the complete installation. The annual charges, based upon the total cost of the compressor installed, for the same capacity of output, added to the cost of fuel, operation and maintenance costs, will give the proper basis for comparison and decision in the purchase of the most economical air-compressor.

KEENE'S cement is usually made by burning lump gypsum to a red heat in a small vertical kiln closely resembling those in common use for lime burning. The dehydrated sulphate of lime is immersed in a solution of alum, dried, and again burned at a high temperature. After the second burning the product is finely ground and is then ready for the market. The gypsum used for Keene's cement should be of the purest. Especially should it be free from iron, since this tends to discolor the product. As small a quantity as 0.04% of iron oxide will sometimes give red streaks in the lumps of gypsum. Large quantities of Keene's cement are imported, but its manufacture in this country has increased much of late years. Kansas and Virginia furnish large supplies. The finished product should be pure white. It sets much slower than other plasters, and should develop a tensile strength in seven days of between 600 and 700 lb. per square inch.

COAL LANDS were disposed of at the minimum price of $10 and $20 per acre until July 1906. At that date and since, large areas reported to contain coal have been withdrawn from all forms of entry. These withdrawn areas have been or are being classified by the United States Geological Survey through field examinations into coal and non-coal lands, and restored to entry as fast as possible. Those classified as coal lands were formerly subject to such entry only, excepting mineral locations for other minerals, and at the valuation per acre placed upon them by the Geological Survey. They may now be filed upon for coal at the valuation set, or the surface only obtained by an agricultural entry, relinquishing the coal to the Government, which may dispose of it to other parties. The basis of the valuation made by the Geological Survey is contained in the 'Regulations regarding the classification and valuation of coal lands, as approved to June 6, 1910, by the Secretary of the Interior.'

BISMUTH is one of the few metals of which the United States cannot or does not produce enough to supply its needs. The scarcity of bismuth in this country and the accredited control of the market by a foreign syndicate have kept the American price high, but according to the United States Geological Survey interest is rapidly being developed in the recovery of bismuth as a by-product in electrolytic lead refining. No large deposits of bismuth are known in the United States, but some ores mined for their gold or silver have been found to be more valuable for their bismuth than for their original content. Thus in 1910 a Colorado mine reported to the Geological Survey the production of ore which carried up to 18% of bismuth, in addition to gold and silver. The ore was smelted for the precious metals it contained, but if it had been sold for its bismuth content alone it probably would have brought at least $185 per ton. Another Colorado mine produced during the same year ore containing 11 to 16% of bismuth, the total content of the metal amounting to several tons. Though mined for gold, this ore was more valuable for its bismuth. The imports of bismuth in 1910 were 198,174 lb., valued at $332,668.

Company Reports

DALY-JUDGE MINING COMPANY

The report of this company for the year ended January 1, 1912, in addition to showing a satisfactory cash surplus, states that surface indications prompt the belief that the Ontario-Daly vein, already proved for 2600 ft., in the Ontario, Daly, and Daly West properties, extends through that of the Daly-Judge for its entire length, about 11,000 ft., and into the Snake Creek M. & T. Co.'s ground beyond. Since the previous report of November 1, 1911, the company has exceeded without difficulty the dividend requirements. Other data given in the report have been printed in the issues for March 23 and 30.

STANDARD CONSOLIDATED MINING COMPANY

In the thirty-third annual report of this company, for the year ended February 26, Albert Fries, president of the company, states that unless some chances are taken in pumping out the lower levels of the mine, at a considerable expense, expectations of dividends should be modest, as during the 33 years of operation most of the better-grade ore above the water-level has been mined. A threatened loss was averted, and a small profit made for the year. J. R. Buchanan, superintendent of the property, which is situated at Bodie, Mono county, California, recommended the Lent shaft as the best place for the pumping plant. Dividend No. 120, paid during the year, amounted to $17,839, bringing the total sum disbursed in dividends by the company to $4,329,809. Previous to the consolidation the Standard M. Co. paid $900,000 in dividends, making the total dividends from the property $5,229,809. The production for the year was $235,477. The total production by the property has amounted to $16,135,993, of which $1,513,735 was before the consolidation. The ore mined during the year amounted to 9466 tons, of an average value of $14.74, as against an output the preceding year of 14,528 tons averaging $14.38. The small profit was due to unusual difficulties in operation, and it was impossible at any time to mine sufficient ore to keep the mill running at capacity.

TRINITY GOLD MINING & REDUCTION COMPANY

This company's second annual report shows that in the year ended November 30, 1911, it made a net profit of $66,265. This sum, which was about half of the expected profit, represents about six months' operation, states the report, and it is believed a much better showing can be made when the alterations and improvements to the plant have been completed and it is running at full capacity. During the year $25,068 was spent, on capital account, for improvements, and of this $15,138 was on the crushing plant, mill, and buildings. Other expenditures represented in this amount were on the water-power plant, electric light and power systems, fire protection, cyanide tanks, and refining works. In the mine account, an increase of $8863 was due to interest and other costs in carrying the borrowed money used in paying for the property. Equipment caused the expenditure of an additional $2499. There was a net increase in the ore development account of $6239, making a total increase in the fixed assets of the company of $42,669. The company during the year reduced its indebtedness by $10,930. At the end of the fiscal year the indebtedness exceeded the current assets by $81,924, as against $132,520 at the end of the preceding fiscal year. If the 45,500 shares of capital stock be added to this account, the excess of indebtedness over current assets is reduced to $36,424. The earnings for the year amounted to $207,831 and the expenses to $141,566.

PHELPS, DODGE & CO., INC.

This company was organized in 1908, as the successor of the firm of Phelps, Dodge & Co., with a capitalization of $50,000,000, in shares of $100 each. The company controls, through ownership of more than 99% of the various stock issues, the Copper Queen Consolidated Mining Co., Moctezuma Copper Co., Detroit Copper Mining Co., Burro Mountain Copper Co., and the Stag Cañon Fuel Co., and controls indirectly the Old Dominion Co., the Old Dominon Copper Mining & Smelting Co., United Globe Mines Commercial Mining Co., and the El Paso & Southwestern railway. The report of the corporation for the year 1911 shows that during the year it sold 131,327,002 lb. of its own copper and 48,974,963 in commissions at an average price of 12.63c. per pound. Dividends amounting to $5,400,000, or at the rate of 12% on the outstanding shares were paid. The combined reports of the constituent companies show that during 1911 ore amounting to 1,841,210 tons was extracted, of which 1,017,352 tons was melted, producing 179,234 tons of concentrate, and 930,331 tons was smelted. The production for the year was:

	Copper, lb.	Silver, oz.	Gold, oz.
From companies' ores	123,653,978	1,195,954	10,158
From custom ores	10,495,649	598,941	10,996
Total output	134,149,627	1,794,895	27,154

During the year the mercantile departments of the constituent companies were dissociated and organized into the Phelps Dodge Mercantile Co., which purchased from each company its store business and stock of merchandise. The total sales during the year amounted to $5,317,994, on which a profit of 7.51% was made. The combined balance sheet and income statement is as follows:

Assets

Cash		$2,692,821.32
Accounts receivable		1,404,636.93
Bonds owned		81,060.00
Stocks owned:		
Copper Queen Con. Mining Co.	$27,000,000	
Moctezuma Copper Co.	8,000,000	
Detroit Copper Mining Company of Arizona	6,000,000	
Stag Cañon Fuel Co.	6,500,000	
Burro Mountain Copper Co.	2,200,000	49,700,000.00
		$53,878,518.25

Income Statement, 1911

Liabilities

Due to subsidiary companies and others	$3,250,143.14
Capital stock, 450,000 shares issued	45,000,000.00
Reserve against stocks owned	1,500,000.00
Surplus	4,128,375.11
	$53,878,518.25

Receipts

Dividends received from subsidiary companies	$6,994,000.00
Commissions and miscellaneous earnings	289,508.52
	$7,283,508.52

Payments

Dividends paid	$5,400,000.00
Expenses, taxes, etc	149,206.44
Transferred to:	
Reserve against stocks owned	1,500,000.00
Surplus account	234,302.08
	$7,283,508.52

An interesting feature of the report is the results of the second year's workings of the Employees' Benefit Association, which had an average membership of 1500. Contributions from members during the year amounted to $40,303, the Copper Queen Mining Co. contributing $25,000. During the year 4.96% of the members received accident benefits and 1.37% sickness benefits, the total expenditure for this purpose being $50,702; the expense of administration was $1898.

On Thursday, April 4, the Bunker Hill & Sullivan M. & C. Co. paid dividend No. 175, of $49,050. This makes the total amount of dividends paid $13,388,550.

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EDITORIAL

ARIZONA rejoices in the possession of a Canon Diabolo, according to our New York contemporary. Possibly this peculiar form of geomorphic expression may be due to the gyratory motion of the hot air of the desert.

FRENCH railway and postal authorities have made a commendable innovation in providing that after June 1 the hours of the day, from midnight to midnight, shall be numbered 1 to 24, thus preventing confusion of morning and afternoon time. Incidentally, the remark of the convivial one, "23 for mine," will acquire a new significance.

DEPENDENCE of the share markets upon men rather than on money alone was shown by the sharp decline in prices in New York when the rumor gained currency that Mr. J. P. Morgan may have been on board the *Titanic*, though the knowledge that many millionaires, among them John Jacob Astor, were among the missing had previously left the market unmoved.

RECORD extraction is being made in the mill of the Dome Mines, Ltd. According to recent advices, the tailing from the cyanide plant contains $0.07 in gold, representing an extraction even higher than was anticipated. The mill was first started on March 21 and both the builders and the management are to be congratulated on having made so notable a record during the first month of operation.

RECEIVERS were appointed on April 6 for Allis-Chalmers Company, being Mr. D. W. Call, president of the company, and Mr. Otto H. Falk, president of the Merchants & Manufacturers Association of Milwaukee. This is probably intended to facilitate the early reorganization of the company, details of which have lately been published. The works will be operated by the receivers with no cessation of activity in any line.

OPERATION of the third unit of the Chino mill marks the completion of the plant as originally designed less than two years after the organization of the company. The first section was started in November last, and it is now planned to add two more units, bringing the capacity to 5000 tons per day. In a recent issue, Mr. J. M. Sully, manager for the company, described the mill, which, under the superintendence of Mr. W. T. McDonald, is doing excellent work. At the Ray Consolidated the March output was 2,400,000 pounds of copper, produced at a reported cost of under 9½ cents per pound. The output of ore for March was 108,700 tons, which, it is hoped, will be shortly increased to 4000 tons daily. A 70 per cent recovery of copper worth 16 cents per pound at a working cost of 9½ cents per pound represents approximately $50,000 worth of copper going to waste monthly at the Ray Consolidated. It is allowed to go to waste, of course, because it cannot be recovered at even a much greater cost than 9½ cents per pound, but the comparison is useful in evidencing that dressing of ores of this character is a field in which large rewards may be won by further improvement of methods.

ADDITIONAL competition in the coal trade at San Francisco is probable as a result of the purchase by the United States Smelting, Refining & Mining Company of Utah coal mines, and the organization of the Western Pacific Fuel Company as a subsidiary. The mines purchased have been delivering coal to yards in Oakland, and while the purchase is assumed to have been made mainly with a view to assuring an adequate fuel supply to the smelters controlled by the parent company, some effort to expand the retail trade in coal is to be expected. Total coal sales at San Francisco, however, are not sufficiently large to allow much scope for a new company, and until coal is sold at greatly reduced prices it cannot compete on the Bay for steam-generating purposes with oil, or with hydro-electric power.

PERSISTENCE of ore-shoots in depth forms the subject of an admirable study by Mr. F. Lynwood Garrison, which was presented at the recent meeting of the Canadian Mining Institute and is reproduced elsewhere in this issue. Mr. Garrison presents much valuable evidence, and, with the true spirit of the investigator, is content to reach an inconclusive conclusion, since until the evidence is all in it is impossible to form a final judgment. Mr. Garrison refers, in passing, to a matter which has given rise to more discussion than investigation, namely, the amount and influence of ground-water in the genesis of ores. It is evident that a wide range of opinion exists among geologists regarding this question, though it might be expected that it would be one of the first to be settled, since the ground-water lies in that part of the earth's crust which is directly under our observation. Direct evidence is incomparably of more value than deduction in the study of ore deposits, as a homely example will perhaps serve to show. The percolator coffee-pot, in which hot water is forced by steam up a central tube and distributed over the ground coffee, the resulting solution passing back into the central reservoir, is a common object. It would seem obvious that where so vigorous a circulation exists the solution must be homogeneous in composition, yet it is a matter of everyday observation that the top portion of the decoction, that which has most recently passed through the coffee, is less concentrated than the bottom portion. Similarly, in the study of natural forces a small amount of reliable field evidence is worth reams of deduction.

LEGISLATION by accretion is described by H. W. MacFarren in his series of articles recounting the history of the development of the American mining law which was begun last week and is continued in this issue. California was the natal place of the mining act, though perhaps it would be more accurate to say that, like Topsy, it was not born but 'just growed.' Defects in the mining law are easily perceived now, but looking at it from the other viewpoint, and considering that it had its inception in local regulations devised by law-abiding citizens to permit orderly action in a field where Congress had provided no law, remembering that it was founded in the light of a faulty knowledge of the nature and characteristics of ore deposits, it is in some degree remarkable that the law has not proved more unsatisfactory. Much of the trouble has resulted from the fundamental defect of American judicial procedure; a defect arising from a laudable desire to prevent any citizen from being deprived of his just rights, but which has tended rather to prevent a citizen from securing his just rights within a reasonable period and at a reasonable expense. This is the right of appeal for trivial causes, frequently for no cause, and which sometimes leads to the protraction of litigation for decades. A movement is now on foot tending toward limiting the right of appeal to those cases where evidence can be introduced to show that substantial justice has not been done, and if this result can be attained, much relief will result. Another defect of American law is legislation by accretion, due to the fact that the meaning of the law can only be determined by a series of judicial decisions. This leads to such a situation as that of the Sherman law, passed a quarter-century ago, of which the purport has only recently been made clear. Attempts to amend it are restrained by a knowledge that the significance of the amendments could only be defined after another quarter-century of judicial consideration. To criticize the law is easy, to mend it is a task of another order.

Advertising Value of Plain Truth

To the modern disciple of Epictetus no phase of life is more interesting than the general divergence of precept and practice. Among the most notable contributions to American philosophy are the Essays of Emerson, which inculcate the idea of balance and due proportion in all human emotions and activities. These are generally commended, yet modern life in its attitude toward them much resembles the man who said he was a Methodist but was not working at it. Nowhere is this more clearly emphasized, perhaps, than in the methods pursued by individuals and districts endeavoring to secure for themselves a measure of public attention—which may be designated as advertising. The word must be used semi-apologetically, since the condition to which we refer has so generally obtained that the word advertising has almost a derogatory sense except when restricted to the advertisement of wares and commodities. No better example could be desired than the practice of many communities of issuing from time to time booklets, pamphlets, and especially editions of local papers, in which the sawmill is portrayed as a magnificent industry, the store as an emporium of trade, and the prominent citizen as a distinguished capitalist or a statesman. Usually this is regarded as an evidence of the humorous American spirit of exaggeration. But the trouble with this is that it puts the whole scheme of things on the wrong footing. If statements are to be discounted 70 per cent for exaggeration, then the proprietor of a really large sawmill must describe it as a wonderful example of magnificent ingenuity and business insight, while the owner of truly important manufactory must draw upon the wealth of Oriental hyperbole to portray his business. Probably he will do nothing of the sort, but instead will take refuge in dignified silence. Thus arises a marked characteristic of the ordinary newspaper, which commonly devotes its space either to people and things so eminent that they cannot escape publicity, or else to the trivial and insignificant. The broad field between is left untouched. We are often, for example, in receipt of issues of daily or weekly journals, published in districts where there are mines of importance, only to find that all the news given bearing on the mining industry relates to some insignificant prospect, or that some drunken miner has beaten his wife. Why should the irregularities in the lives of the ignorant and vicious be regarded as of importance, except from the standpoint of securing better government? From time to time we are asked why we do not publish more authentic information regarding this or that mining district, and recently a financier and engineer of international reputation went so far as to say that he could secure four or five times as much capital for investment in the mines of a certain district if such information were available. To all such inquiries we can make but one reply; such information, news in the correct sense of the word, is not available; the companies do not give it out, and the local journals do not publish it. Yet these same communities and districts will publish bul-

lotus and folders for the avowed purpose of drawing attention to their resources. Nothing is so convincing as the plain truth; nothing is so much appreciated as real information. Exaggerations serve only to discredit those who are content with the established facts. The pervasive influence of print is too seldom realized. Exchanges go far and wide and the happenings in remote places do not remain hidden. A community can have no better advertisement than the sober recital of the plain facts of the achievements of its citizens and the enterprises under their control.

Loss of the Titanic

The futility of human endeavor when it runs counter to natural forces was shown with horrible distinctness on Sunday night when the White Star liner, *Titanic*, the largest ship ever constructed, on her maiden voyage from Southampton to New York, collided with an ice-floe 400 miles off Cape Race, on the banks of Newfoundland, and sank within four hours, with two-thirds of the ship's company still on board. Passengers and crew numbered 2350, of whom less than 850 are known to have been saved. The steamer *Carpathia* was within 70 miles of the *Titanic* at the time of the disaster, and picked up boats containing the survivors, but as nearly as can be learned from the dispatches, the vessels which arrived later, summoned by wireless messages, were unable to find any of the shipwrecked kept afloat by wreckage or life preservers, all having apparently been carried down by the tremendous suction of the great vessel as she plunged to the bottom. Of the survivors nearly all are women and children, only enough men to man the boats having left the vessel. Among those supposed to have been lost are H. Forbes Julian, the well-known metallurgist, at one time technical adviser to the Deutsche Gold und Silber Scheide Anstalt and a former special contributor of the *Mining and Scientific Press*, Washington A. Roebling, president of John A. Roebling's Sons Co., who constructed the Brooklyn bridge after his father's design, Benjamin Guggenheim, one of the seven brothers of the family which has been prominent in the development of the American smelting industry, and Edgar J. Meyer, vice-president of the Braden Copper Mines Company.

Much about the loss of the vessel is likely to remain permanently unknown. The occurrence of icebergs in this vicinity is not remarkable. Eleven other vessels have been lost from the same cause in the past fifty years and it is the custom of mariners during the season when ice is most abundant to follow a route which, though longer, lies farther to the south and is correspondingly less likely to be infested with the great masses of ice which are borne far south by the Arctic current to form a silent and deadly peril. The rapidity with which the vessel filled and sank is astonishing, and is generally taken to indicate that the enormous vessel, proceeding almost at top speed, struck the ice-mass a glancing blow and tore the entire bottom of the hull so badly that water-tight compartments were rendered useless, unable even to keep the hulk afloat until nearby vessels could come to her aid. The boat accomodation was only sufficient for little more than a third of the ship's company, since shipping regulations apply only to vessels of less than 10,000 tons burden. The wireless equipment was of such a type that it was effective only over a short range and was speedily rendered useless by the stopping of the engines by the inrushing water. External conditions favored the escape of the passengers; the sea was calm, help was but a few hours off, and except for the darkness and the benumbing cold of the water the conditions which led to this greatest of marine disasters were man-made. The preceding day the *America* had reported icebergs in the vicinity, yet the huge vessel, inadequately safeguarded, went rushing through the darkness to her doom because those on board wished to reach New York as quickly as possible. It is easy to say now that three times as many boats should have been provided and that the wireless equipment should have been of the highest efficiency, and independent of the main engines. The officers of the steamship company had provided more boats than were required by law, and did not provide more still because the added weight would have diminished speed. They gave their passengers what they believed they wanted, and as a result over a thousand persons, among them many of the most notable men and women of the country, are dead. The spirit of recklessness in attaining ends, deplorable as it is, can lead to only individual injury where small forces are concerned, but where titanic energy is hurled recklessly against the Jovian resistance of natural forces the resulting disaster is appalling. It is not a compliment to modern life and thought that it requires a catastrophe such as this to make us pause and consider whither we are tending in our headlong race for size and speed.

The Copper Market

There is much interest in the copper situation, though there is considerable skepticism as to future prices. If it were not for the enormous financial strength that is known to be behind the copper market, the attitude of the public would be much more skeptical than it is. Outsiders are by no means convinced that the consumption abroad or a revival of business at home is actually absorbing the huge copper surplus that was in existence a few months ago, but which has now disappeared, according to published figures; the question remaining being as to the actual disappearance or consumption of the metal. All current comment is congratulatory in tone and descriptive of the strength of the market, and there is no little talk of the effort being made to prevent a 'runaway copper market.' Our New York correspondent states that the high price is having the expected effect of reviving interest in copper mining, and cites numerous instances.

The larger companies are making hay while the sun shines. The New York office of the Utah Copper Company reports the shipment of about 20,000 tons per day from the mine to the mills, and putting of 18,000 tons daily through the concentrators. Shares are selling in the market at practically the record price. With the improved outlook producing results such as outlined, and with properties such as Braden, Chino, Inspiration, Miami, and Ray Consolidated just getting into stride, it is plainly to be seen that, without regard to the foundations upon which the copper market is built, the metal at 16 cents is sure to bring about an era of activity in mining, and if the copper market can be held long enough, the public will buy copper stock, which is the consummation so eagerly sought in New York. The report of the Copper Producers' Association showed the situation unchanged, and has been generally passed without comment. The foreign copper authorities are taking considerable interest in the increased production shown in Russia. There is much unexplored territory under Russian dominion, and it is quite within the range of possibility that that country may become a very important producer of copper. The production for 1912 is expected to total something over 67,000,000 pounds and will be an increase of about 10 per cent over that of the preceding year. We present elsewhere a summary of the James Lewis report on the European situation as regards copper.

Decrease of Value in Ore-Shoots With Depth

By F. Lynwood Garrison*

*Anyone who has kept in touch with the trend of development in metal producing and especially precious-metal producing districts, must have noted with interest, if not surprise, the repeated instances of discoveries of orebodies at relatively deep points in old mines, thus infusing new life into the district and affording encouragement to operators of other mines similarly situated to explore and extend their deeper levels. In directing attention to this important and interesting subject it must be recognized that one deals with a matter of which inherent difficulties may not be lightly regarded, and from which unwarranted deductions might be drawn for promotion purposes or to deceive. It is therefore but proper to state at the outset that profitable ore deposits do not usually persist to great depths; in fact, in a geologic sense, they are essentially superficial phenomena. It is true that mineralized fissures are known to extend to depths of 6000 ft. and probably much more, but it seems likely they will seldom be sufficiently rich to pay.

The class of ore deposits considered in this paper are those in fissures that traverse crystalline rocks, or sedimentary rocks, intimately connected with rocks of a magmatic origin. These associations are almost invariably cut by intrusive dikes or sills of igneous rocks belonging to a subsequent period. The mineralization of these fissures in the process of creating veins was later than the formation of the country rock; in other words, the ore deposits here considered are epigenetic. Such fissures, when single, are termed a vein, and when grouped or bunched in a zone or belt may be considerd a lode. Of course, a lode may be a single vein or no vein at all, but simply an accumulation of ore. It is recognized that the common use of the terms 'vein' and 'lode' is not altogether satisfactory, but it is not intended to suggest any rule for their application, further than as a matter of convenience within the limits of this paper. As a general fact, openings or fractures in the earth's crust decrease in size as depth is attained, and a fissure that may have a width of many feet in its upper part, if followed to sufficient depth, is likely to end in a series of small cracks whose width is measured in inches rather than in feet.[1] Fissures thus defined may not be necessarily ore bearing, or they may be too lean to pay in whole or in part. A fissure is not necessarily a vein, but a vein assumes the pre-existence of a crack or fissure. Here only such veins are considered as have had their mineral contents deposited by filling or replacement along fissures through which the metal-bearing waters and vapors have supposedly circulated.

Bedded deposits, such as the Lake Superior copper and the South African gold-bearing conglomerates, are in a class by themselves, one not considered in this discussion, although, as is well known, the workings on them are about the deepest in the world. Both carry native metals in the cementing or binding material of the conglomerates, and the orebodies are practically continuous and persistent, quite unlike the irregular, often erratic occurrences of ore-shoots in precious metal-bearing lodes. It would seem probable that the genesis of two such dissimilar types of ore deposits is as different as their physical characteristics. It is essential to bear in mind that many veins as we now find them, may be mere roots of what they once were, erosion having removed hundreds or even thousands of feet from their original upper portions. According to Lindgren,[2] in some of the Australian deposits, such as those at Bendigo, although carrying profitable ore as deep as 4600 ft., the gold quartz was probably deposited therein when they were at least 7000 ft. below the original surface. Similarly he believes the gold ores of the Mother Lode, California, to have been formed at depths not less than 6000 ft. from the surface. The gold deposits of the southern Appalachians are perhaps as good examples of vein roots as are to be found. The amount of material eroded from their croppings since the time of formation Lindgren believes to be greatly in excess of those figures given for Australia and California.[3] Considering that, although usually lean, these gold ores have been found and followed in the southern Appalachians to depths of over 1000 ft., their original outcrops must have had a vertical range exceeding 7000 or 8000 ft. According to Ransome, the original surface at Cripple Creek, Colorado, was probably from 2000 to 5000 ft. above the present one.[4] In the gold districts of Nova Scotia, Faribault[5] has estimated that the erosion of some of the sharpest and highest folds has had the effect of truncating them to a depth, so far as known, of over eight miles. The presumption here is that this vast amount of erosion has removed what was probably the best part of these gold lodes, since the mere stumps that remain have never yet proved of much value. Basing his views on the extreme narrowness of the fissures in the Cobalt mining district, Emmons concludes that the veins there were formed under the pressure of an enormous weight of superincumbent rock at a great depth below the then existing surface; hence before present conditions were reached, the greater part of the original veins had been eroded away, leaving today mere remnants of their original metal treasures. This assumption Emmons supports by a seemingly logical and convincing analysis of the geologic history of the region.[6] Whether or not this unpromising and unwelcome view is accepted, it appears to be a fact that the change from rich to poor in the Cobalt veins is abrupt, and that this alteration takes place at depths not exceeding 300 ft.; in other words, the productive zone is seemingly shallow. Since these observations were made by Emmons, a continuation of ore-shoots from the Huronian into the Keewatin is reported which rather dispels the pessimistic view held by many that these deposits would not persist below the Huronian, that is, below 300 or 400 ft. in vertical depth. In eastern North America it is certain that the type of veins found close to the surface—that is, those cutting volcanic rocks, recent flows, the upper surface of which at the time of vein formation can be determined with more or less accuracy—is exceedingly rare. On the other hand, older veins which may intersect the intrusive rocks like diorite and granite; rocks which have surely been consolidated at great depths, and which were probably once covered by heavy masses of just such flows as above indicated, are comparatively common.[7] It is doubtless assuming too much to conclude that a district which has been profoundly eroded like some of those mentioned, is unlikely to contain veins profitable and persistent in depth, it is impossible to know how deep the original fissures may have been; it is only possible to collect observations from a comparatively few widely scattered districts all over the world, where deep mining has been attempted. These records are ever open to suspicion, for it is never certain that a vein supposedly bottomed in lean ore or no ore at all, has not simply temporarily pinched out, to be followed lower down by another shoot as good as any

*From the *Journal* of the Canadian Mining Institute.

[1] S. F. Emmons' 'Cobalt, District, Ontario,' *Mining and Scientific Press*, March 18, 1911, p. 394.

[2] *Economic Geology*, Vol. I, p. 41.

[3] *Economic Geology*, Vol. I, p. 42.

[4] *Ibid*, Vol. V, p. 462.

[5] 'The Gold Measures of Nova Scotia, and Deep Mining,' by E. R. Faribault, *Journal* Canadian Min. Inst., Vol. 2 (1899), p. 121.

[6] *Ibid*, pp. 394-395.

[7] Lindgren, *Economic Geology*, Vol. I, p. 39.

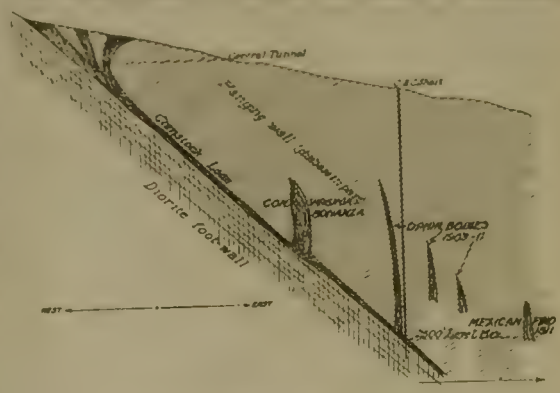
found higher up. Undoubtedly many, possibly most, veins in which such conditions have been encountered are hopeless as far as profitable working is concerned. But the difficulty is to be certain in such cases that a vein or lode is done for all time, and may not perchance again blossom into full bloom of productivity. The probabilities are, however, that in the majority of cases veins or lodes do decrease in richness below 1000 to 1500 ft. This cannot always be safely accepted as a rule, save it be one with many exceptions.

It is well known that the North American continent has been relatively stable since the close of the Cretaceous period, and that its land surfaces are older than those of Europe; I refer more particularly to those of the eastern half of North America. Suess has pointed out that the land surfaces of Africa are far older than either North America or Europe. Africa has as yet produced no great vein or lode deposits of the first rank; the gold 'banket' of the Transvaal not belonging to the class under discussion. The lodes of Rhodesia have been on the whole disappointing, while none of the modern gold mines of Egypt have ever paid a dividend and most of the concessions taken up in 1900 and 1901 have been abandoned." As before intimated, these suggestive observations may be foolish if carried too far, in view of the present very incomplete knowledge of Africa, for it is a vast continent, but slightly explored in the geologic sense, and may yet yield highly productive ore deposits of the class under consideration. The undoubted great yield of gold from Africa in ancient times was the result of slave labor, a brutal bondage probably unsurpassed in history. It is an interesting reflection in this connection that it was slave labor which made the gold deposits of the southern Appalachians profitably productive, and that, on the whole, attempts to operate them have been financial failures in modern times with free labor. The consequent thought from the trend of these observations is that in cases where great areas have been subjected for long geologic periods to erosion by virtue of their stability, the planing down of the surface has been so great that little is left today of the original deposits in the old rocks. While such generalizations must evidently be accepted with the greatest caution, there does seem to be some relation between the vertical extent of metal lodes and the geologic age of the area in which they occur. In other words, the more stable an area has been through its geologic history the greater the erosion to which it has been subjected, and the less productive have been its mineral lodes.

Instances of the discovery of new deep-seated ore-shoots are not uncommon in well established metal-producing districts where systematic exploration and development are being carried on. A number of such cases might be cited, including the famous Comstock and some of the old mines on the Mother Lode in California. At Guanajuato, Mexico, the lower reaches of the Valenciana lode on the Veta Madre are to be tapped at a vertical depth of 2000 ft. below the collar of the Nueva Luz shaft, and about 3300 ft. on the dip of the vein from the top of the old Valenciana shaft, by new workings, with a reasonable assurance of finding large bodies of payable ore. The Mexican Government, doubtless after obtaining professional advice, has had sufficient confidence in the success of this undertaking to grant a subsidy to the American company doing the work for each metre of depth attained in this new (Nueva Luz) shaft; the expectation being that the orebodies thus opened for exploitation and the incidental unwatering of the old Valenciana workings will bring new life to this once enormously productive district. I believe this is the only instance in which the Mexican Government has directly given such pecuniary aid to a mining enterprise, showing thereby confidence in the persistence with depth of this great mother lode.

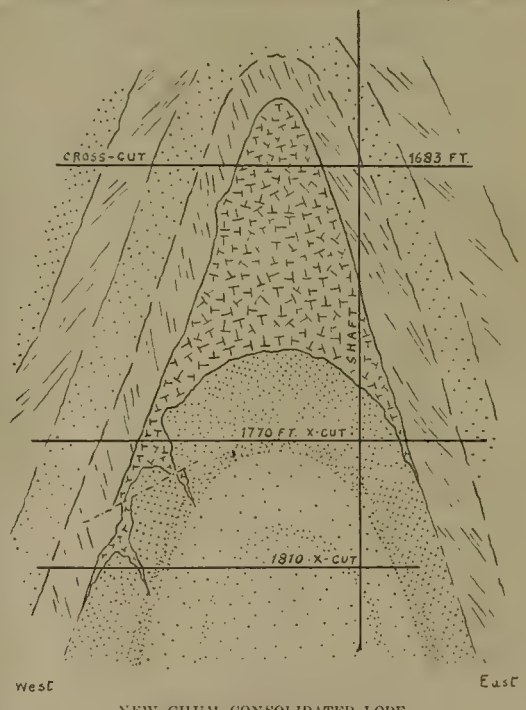
In Australia the Victoria Reef Quartz mine at Bendigo has attained a vertical depth of over 4600 ft., but as the orebody at this level is too lean to pay, it has been decided to sink to a depth of 5251 ft., the Government bearing half the cost. Between the 4251 and 4454-ft. levels considerable coarse gold was found, some pieces weighing a half-ounce after passing through the stamps. The average of the ore was about $17 per ton. The gold itself has not decreased in purity nor was it in unusually fine particles, as had been expected. This is situated centrally on the famous New Chum lode, from which many millions of dollars have been obtained."

H. Kilburn Scott, in the June 1911 issue of *The Mining*



CROSS-SECTION OF COMSTOCK LODE.

Magazine, calls attention to the Morro Velho mine in Brazil, belonging to the St. John Del Rey Mining Co., Ltd., as the deepest gold mine in the world. He states he recently had occasion to visit this mine, and found it almost 5000



NEW CHUM CONSOLIDATED LODE.

ft. in vertical depth; the ore has an approximate dip of 45°, so that the depth along the slope is about 7000 feet.

It is evident there exists among experienced mining people a belief that in profoundly mineralized regions it is reasonable to expect that the deep sections of great vein systems will continue to yield abundantly of their treasures whenever the costs of exploration and extraction are not prohibitive. According to H. C. Hoover, at Kalgoorlie, Western Australia, there are several properties upon which orebodies have been discovered in depth where none or but small ones

[8]Maclaren, 'Gold,' p. 414.

[9]Wilfred J. Rickard, *The Mining Magazine*, Oct. 1910, p. 281.

existed at the surface. In other instances in this district a marked increase of value has been noted with depth.[10] This paper of Hoover's was written eight years ago, and whether this last characteristic has been maintained I do not know; the latest reliable information obtainable is to the effect that several of the deeper mines in the Kalgoorlie district are producing abundantly at the 2600 to 2800-ft. levels. Hoover considers that the profound structural features of the district are such that this width and continuity of the fissures are well assured, but that the ore will occur continuously with the lodes "is a matter which admits of less finality."[11]

Lindgren likewise says these deposits have no definite boundaries, either horizontally or vertically, other than those determined by the decrease of assay value of the rock in any one direction.[12] It would be a mistake to draw any general conclusion from conditions at Kalgoorlie. They are not unique, though perhaps unusual. There seems to be little reason to assume that depth below the surface has *per se* any direct relation to the extent and richness of the lodes. Recent experience at Tonopah, Nevada, tends to show a decrease in value with depth with a compensating tendency to wide lateral extent of profitable ore in the veins, limited only by the characteristic block faulting of the district. However, it is not to be inferred from this that a vein, or lode, or series of veins is necessarily continuous laterally through the full extent of such a block. Evidently such is not the case, for the veins appear to cease laterally as they do in depth, even before being cut by a fault or intrusive dike. But the practical point in this instance is that the chances of finding ore are overwhelmingly greater in lateral exploration than in vertical. An interesting classical case may be cited in this connection. At Joachimstahl, Bohemia, the veins have been divided into two classes, first, those rich in the upper levels but which grow poorer with depth; and, second, those fissures that are of fairly constant and persistent value as deep as 2000 ft. A peculiarity of the latter class is that some of the fissures reach the surface, not as mineralized veins, but as narrow barren cracks.[13] A number of years ago W. P. Blake observed that when a lode cuts different formations its contents must be expected to change with the varying character of the rocks, either downward or horizontally. The change in Cornwall, England, from copper ore to tin ore in passing from 'killas' into granite is a good and classic example of this. When lodes traverse stratified rocks parallel with bedding, the conditions as respect the chemical constitution of the walls may be assumed to be alike for great distances, and therefore similar mineral contents may be looked for as far as these conditions extend. But when the lode traverses a group of beds transverse to the bedding, uniformity of mineralization either in quantity or quality need not be expected.[14]

The old German miners recognized the value of pyrite as an indication of the proximity of ore; they gave the name *fahlbands* to zones or belts of pyritized country rock, and observed that fissures intersecting such zones are usually locally enriched. For example, in the Kongens mine at Kongsberg, Norway, the ore-shoots are usually, but not invariably, confined to the *fahlbands*. A short distance from these zones the veins are apt to be barren. This famous old silver mine is now probably about 3000 ft. or more in vertical depth, and has been a great producer since the year 1623. Most of the silver is in the native condition. It has been assumed, and I think logically, that the metalliferous portions of this interesting lode are the consequence of the associated *fahlbands*. Intimate associations of pyrite and native silver have also been observed in several Mexican mines, and the inference has been drawn in such cases that the pyrite was in some way connected with the presence of native silver.[15] At Batopilas, according to Collins, the native silver occurs with calcite, but below the pyritic zone.[16] On the Mother Lode in California it has been observed that pyrite does not appear to have been the direct precipitating agent for gold, but to have facilitated its precipitation by acting as a depository or base for the precipitate. Instances have been noted where the gold appears to have been precipitated upon the pyrite in preference to associated quartz. The same influence that precipitates the gold seems to have also precipitated the pyrite. The quantity of pyrite in solution, being in excess of the gold, is naturally precipitated out first.[17]

A remarkable instance of the apparent influence of pyrite upon gold deposition has been noted by Scott at the Morro Velho mine in Minas Geraes, Brazil. He states that this great lode consists of lenticular shoots of quartz enclosed in schists. They follow the cleavage or bedding of the enclosing rock; the quartz is often associated with arsenical pyrite, pyrrhotite, and carbonates of lime, magnesium, and iron. When these sulphides are lacking, gold in appreciable quantity is entirely absent. The most productive matrix is a compact mixture of quartz and pyrite enclosing varying quantities of country rock. The Morro Velho lode shows little appreciable difference in size or gold value throughout its great depth. The enclosing rock, though generally speckled with pyrite at the contact, contains only a small amount of gold. The pure quartz in the lode is seldom auriferous, and the pure pyrite (unless it be arsenical) is hardly ever rich.[18] According to Derby, the Morro Velho lode was characterized by the presence of free carbon, either disseminated throughout the ore or segregated in zones of movement.[19]

Among the minor causes of enrichment of ore deposits near the surface is the mingling of solutions from cross fissures. Van Hise attributes the principal cause of ore-shoots to them and it is indisputable that at such intersections orebodies are common. But it does not appear that bonanzas or local enrichments in deep lodes are necessarily dependent upon such influences; in fact, deep-seated ore-shoots are generally characterized by comparative dryness. As a rule the deeper the less water there is; in other words, it would seem in most instances that after a certain level has been passed the amount of water encountered varies in inverse ratio with the depth, the deepest workings being the driest.

In connection with the topic of this paper, it may be profitable to call attention to a subject recently discussed by H. V. Winchell regarding the differences in surface appearance and mineralization between southern ore deposits and those formerly covered by the continental ice sheet, or, roughly speaking, north of the 45th or even 40th parallel of latitude in Eastern America.[20] This geologist points out what probably most of us know, did we stop to consider, that even were the rocks of these regions unplaned and undegraded by the ice sheet, the natural oxidation and decomposition of their vein croppings would be much slower than in southern, especially tropical, latitudes, hence the consequent secondary enrichment of such lodes is necessarily less. The planing down by the great continental ice sheet of the Pleistocene or Glacial period must have removed much if not most of the oxidized portions of these outcrops, except in places which may have been sheltered from this titanic leveler by reason of local topography or perhaps minimized by some other cause. Hence what remains today is either the roots of deposits of secondary ore or else primary ore veins which are likely to extend downward to considerable depths. Winchell claims that boreal regions seldom contain extensive deposits of secondary ore, that is, upper portions of primary deposits

[10] *Trans.* Institution of Mining & Metallurgy, Vol. XIII, p. 12.
[11] *Idem.*
[12] *Ibid*, Vol. I, p. 533.
[13] Beck, 'Nature of Ore Deposits' (Weed's translation), p. 285.
[14] 'Persistence of Ores in Lodes in Depth,' W. P. Blake, *Eng. and Min. Jour.*, Vol. LV (1893), p. 3.
[15] *Trans.*, Institution of Mining & Metallurgy, Vol. III, p. 425.
[16] *Ibid*, p. 441.
[17] Prichard, *Trans.* A. I. M. E., Vol. XXXIV, p. 459.
[18] H. Kilburn Scott, *Trans.* A. I. M. E., Vol. XXXIII, pp. 413 and 429.
[19] *Trans.* A. I. M. E., Vol. XXXIII, p. 287.
[20] *The Mining Magazine*, Dec. 1910, p. 436.

enriched by secondary deposition. That such roots are likely to be as productive as secondary enriched lodes in unglaciated regions is not to be expected. Speaking in very general terms, their primary character would tend to render them low grade, but with the compensating advantage of probable persistence with depth. I take it that the practical point which Winchell here desires to emphasize is that in glaciated regions and those far north or south where, by reason of the cold, but little alteration could take place, the lode outcroppings are quite different from what may be expected in more temperate, especially tropical, countries. In warm regions outcrops may even be deceptive, since by excessive oxidation and decomposition a larger and richer deposit might be indicated than subsequent development exposes. In glaciated areas the planed-down rocks are likely to expose the lode at the surface in much the same condition as it exists a hundred or more feet in depth, that is, all superficial alterations have been sliced off, leaving the unaffected stump cropping to the light of day. Even though such veins be but the roots or stubs of once greater lodes, and are thereby likely to be of infinitely less value than when in their pristine condition, there is a compensating advantage in that the true character of the veins in such glaciated areas may be determined with comparative ease by simple surface trenching. In more southern unglaciated areas considerable depth must usually be attained before the original character of a lode can be studied with accuracy.

The most serious difficulties to overcome in deep mining are threefold—hoisting, high temperatures, and rock pressure. The mechanical problem of hoisting from depths of 5000 ft. is probably the least of these, and has been pretty well worked out in South Africa and at the copper mines on Lake Superior. When such shafts depart from the vertical in part of their course, the best practice seems to be to hoist in stages; in fact, it is not unlikely such a system may be found in many cases the most economical even where the shafts are wholly vertical, especially now that electrical appliances have reached such a high degree of efficiency.

The normal increase of rock temperature with depth is a more serious matter, although so far it has been capable of control, for while there is a steady rise of something like 1°F. for each 208 ft. (beginning with an average of 60°F. at surface) of depth in the South African gold mines,[21] and 1°F. for each 103 ft. in the Lake Superior copper mines,[22] good ventilation overcomes much of the discomfort from this source. In cases where the surrounding rocks are chiefly or wholly of eruptive origin, the rock temperatures are likely to be even higher. In the Comstock, for example, at the 2000 and 2100-ft. levels it ranges between 111° and 119½°F.[23] In the Savage mine, on the same lode, at a depth of 2200 ft. a spring of water having a temperature of 154°F. has been tapped.[24] In the Victoria Reef Quartz shaft at Bendigo the rock temperature is about 110°F., the water issuing therefrom 114°F.[25] At the bottom of the Nueva Luz shaft, 2000 ft. deep, at Guanajuato, Mexico, rock temperatures of 106°F. are now found.

It must not be assumed that the deeper the crust of the earth is penetrated the uniformly greater the heat, for some increase in rock temperature may be due to local phenomena, such as oxidation of the sulphides of the kaolinization of the feldspars. Thus, in the Comstock, the rise of temperature is not progressive below the 2000-ft. level. In fact there seem to be belts or zones of high temperature which rises to a maximum of about 2000 ft., followed in depth by a slight decrease. It should not, however, be concluded from this that there is not in general a normal rise of rock temperature on penetrating into the earth, for there undoubtedly is such in all kinds of rocks; in other words, the earth becomes progressively hotter toward its centre. There have been many calculations as to what this increment of increase may be, but it is safe to say, as a rule, they are far from accurate; for, as we have seen, local conditions often import disturbing influences.

The increase of rock pressure in deep workings is probably the most serious difficulty of all, one likely to make the methods of supporting the roof increasingly costly with depth. It seems likely that steel and concrete and especially waste rock filling may be used in such instances to marked advantage, where in higher levels timber would suffice. One thing is certain, that in most cases whatever methods are adopted the expense is likely to increase out of all proportion to the profits. Moreover, the outlook for a decrease of cost in this respect is not hopeful, unless it be in the direction of flushing with tailing and fine dump material. These methods, or at least schemes of a somewhat similar character, have been carefully studied and used in the anthracite coal district of Pennsylvania and in the gold mines of the Transvaal.

In summing up the discussion attempted in this paper, I am impressed by the inconclusiveness of my conclusions. In fact, the nature of the subject precludes definiteness, except in a few broad principles. Probably it may be generally conceded that fissure veins will not contain profitable ore to indefinite depths. It must be recognized that a deep orebody which may not pay to work today, might be profitable in the next decade by reason of improved mechanical and electrical equipment as well as greater economy and efficiency in milling practice. General experience throughout the world tends to the conclusion that metal-bearing veins of all kinds, with some exceptions, show a marked decrease of value as depth is attained below the 1500 or 2000-ft. levels. Among the exceptions might be cited the Perseverance mine at Kalgoorlie, Australia, where the bottom levels are richer than the intermediate horizons between 1300 and 1750 ft.[26] Again, at Mysore, India, at several points in the bottom levels the gold content is high; thus, for instance, at the 2790-ft. level in Tennant's section, an average was obtained of about $37 per ton, for over 4 ft., and at the 4010-ft. level in Bullen's section (Ooregum) the vein is 15 in. and averages 1½ oz. gold per ton.[27] Maclaren says of this great Mysore ore-shoot that it has an average width of about 4 ft., and has maintained this general width and value for a depth on its pitch nearly 4000 ft., and it is certainly the most notable shoot known in the history of gold mining.[28] At the Waihi mine, New Zealand, the veins are characterized by the continuity of profitable ore both in horizontal and vertical extension.[29] It is certainly a notable fact that so far as I am aware few of the deep metal-producing lodes other than iron occur in districts which have been subjected to glaciation. The copper deposits of the Lake Superior region are an exception. It is going too far, however, to assume that because of this the lodes have been eroded away and deep mining may never be expected to be possible in such areas; our knowledge is too slight to accept any such general conclusion. The fear that this condition may be a fact is perhaps justifiable from experience throughout the world, and in some degree is supported by deductive conclusions based on geologic observations. This question is a peculiarly timely one, moreover a very vital subject to Canada in view of the rapid development on the rich lodes of Cobalt and Porcupine.

MONAZITE-BEARING SANDS have been found in streams to the west of Naraguta, in Nigeria. In one case the tin concentrate contained nearly 30% monazite and zircon. The Mineral Survey in 1908 found a good deal of monazite among the granite hills at Kirigama and Kajuru. Analysis of some tin concentrate obtained at Jalingu showed 6% ceria and thoria compounds present.

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[21] *Trans.* Institution Mining & Metallurgy, Vol. XV, p. 415.
[22] Chamberlain & Salisbury, 'Geology,' Vol. I, p. 543.
[23] Lord, 'Comstock Mining and Mines' (Monograph IV, U. S. Geol. Survey, 1883), p. 387.
[24] *Trans.* A. I. M. E., Vol. VII, p. 71.
[25] *The Mining Magazine*, Oct. 1910, p. 282.
[26] *The Mining Magazine*, Feb. 1911, p. 80.
[27] *Ibid*, p. 81.
[28] 'Gold,' p. 255.
[29] Bell, *Economic Geology*, Vol. I, p. 747.

Measuring Low-Pressure Air

By G. S. Weymouth

*The uses of compressed air in connection with treatment plants are many, and it is necessary in view of power economy to be able to estimate the quantities employed in different processes in order to make comparisons with other methods of doing similar work. Meters can be obtained for measuring fairly large quantities of air at considerable pressures or velocities, also delicate and expensive instruments for dealing with small quantities and low pressures, but what is required is a cheap, simple, and strong apparatus suitable for actual working conditions. In some cases, where the only obstruction to the free passage of air is a fluid of definite density, from calculations based on pressures and densities of fluids, sufficiently reliable results can be obtained. But often the obstructions are numerous and of unknown quantities, and to meet such a case (in connection with slime-pulp aeration experiments), I evolved the method described below and shown in the above sketch (Fig. 1), namely, that of substituting temporarily an equal flow of air under conditions which allow an easy measurement, in place of the ordinary supply. This method has been in use here for several months, and would, with slight modifications, measure any quantity of air flowing, provided that the supply pressure is constant during the test, and the flow regular for the few seconds necessary to obtain the reading of the first gauge *B*, which flow is then measured at leisure. The only disadvantage is that the flow of air must be diverted to obtain the quantity measurements, but half a minute is usually sufficient for this purpose. In one case, where it was desirable to keep a constant supply of air in a vat, a duplicate pipe was run from the point *J* to *K*, with a stop-cock so placed that this pipe supplied the vat only while the regular supply was being measured. The arrangement, which is simply the addition of a few fittings of the same size as the ordinary supply pipe to it, is as follows: *A* is a valve regulating the air to the required working pressure; *B* is a mercury gauge a few feet from *A*; *C* and *D* are stop-cocks, *E* the apparatus under test; *F* a small tin receiver, connected by rubber hose to *D*; *G* a round orifice in a tin plate for air outlet, and *H* a water-gauge with a range of about 12 in. to allow for occasional rushes of air while manipulating the cock *D*.

A low-pressure supply being required at *E* (about 5 lb. per square foot) and the cock *C* being opened and *D* closed, the regulating valve *A* is opened until the gauge *B* indicates the required pressure. (It is important not to touch the valve *A* again during the test.) This point on *B* is marked, and to measure the quantity flowing at this instant, the cock *D* is opened and *C* closed; *D* is then gradually closed until the gauge *B* reads the same as before, when the total substituted resistance to the free flow of air is equal to that of the apparatus being tested, the pipe *A* to *I* in both cases acting as an intermediate receiver with constant in and out flow as proved by the gauges. The height of the water-gauge is now taken, and the area of the outlet orifice noted; the cock *C* is opened and *D* closed, the gauge *B* reading the same as before. This is a check on the constancy of flow during the testing period. The velocity through the orifice *G* is that due to a head of air equivalent to the pressure on the water-gauge and is

$$\dagger\sqrt{2\,g\,h} = \text{feet per second}$$

h being the height of the motive column (head) in feet. (For air, the formula holds good only for small differences of pressure on the two sides of the orifice *G*.) Reducing to inches of water and simplifying, this becomes

$$\dagger\sqrt{\text{in. water}} \times 66.1 = \text{feet per second.}$$

The coefficient of flow for such an orifice being 0.64, owing to the contraction of the flow near the edges, the actual mean velocity over the full size of the opening becomes

$$\sqrt{\text{inches water}} \times 42.3 \text{ feet} = \text{feet per second.}$$

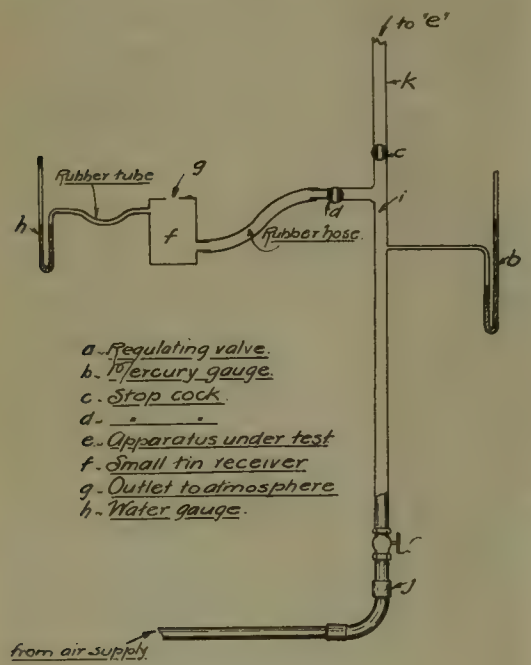


Fig. 1.

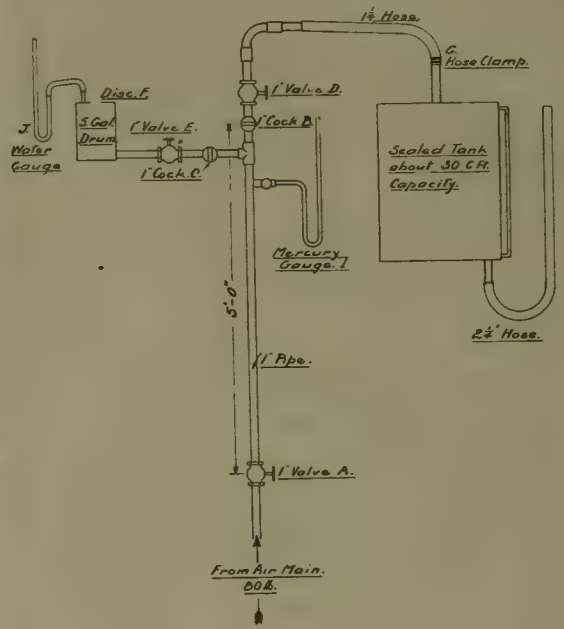


Fig. 2.

*From the *Journal* of the Chamber of Mines, Kalgoorlie.

†The weight of 1 cu. ft. of air at 62°F. = 0.0671 lb.
" " 1 " water at 62°F. = 62.5 lb.
∴ the ratio of water column to air column is

$$1 : \frac{0.0761}{62.5} = 1 \text{ to } 821$$

$$\sqrt{2\,g\,h \text{ ft.}} \quad \sqrt{\frac{821}{2\,g.\,12}} \times h \text{ in.}$$

$$= \sqrt{h \text{ in.}} \times 66.1$$

In the experiments referred to, the effective velocities for an orifice of 1 sq. in. area, at pressures of up to 4 in. water-gauge, were tabulated, with the corresponding discharges in cubic feet per minute (free air.) All subsequent readings for different sizes of orifice were simply referred to this table. Removable screwed caps were used on the receiver with orifices of 0.125, 0.25, and 0.5 sq. in. area, these being simple fractions of 1 sq. in. These different sizes were used to keep the water-gauge readings within reasonable limits and covered all measurements up to 7 cu. ft. per minute, with $^3/_8$-in. pipe and fittings. Pipe sizes do not come into the calculations provided that they are large enough to carry the quantity of air, and the receiver *F* need only be of sufficient size to reduce the kinetic action of the air to a negligible quantity, and give a true reading on the water-gauge. In the above case it was a can of about 2 pints capacity, and for air-lifts, consuming about 50 cu. ft. per minute, an ordinary kerosene

cock *C* closed, and valve regulated to give the same reading as on *I*. The resistance of valve *D* is thus made equal to that of *E* the orifice. The tank was then nearly filled with water and its level noticed; cock *C* opened and *B* closed and hose connected to tank at *G*. Cock *B* opened and *C* closed simultaneously and free end of hose lowered; reading on *I* noted; when tank nearly empty, *C* opened and *B* closed simultaneously. The time air was passing to tank taken by stop-watch; air in tank reduced to atmospheric pressure (by bringing free end of hose *H* to level of water in tank) and volume of air noted; gauge *I* (if necessary due to any back pressure from tank) brought to same level (as when passing to tank) by valve *E* and reading *J* taken.

The table shows the results of these measurements, using discs with orifice equal to 0.214, 0.441, and 0.797 sq. in.; pressure on mercury gauge equal to 9 lb. per square inch; and volumes of free air from 9 to 16 cu. ft. per minute:

Area Orifice F sq. in.	Height of Mercury Gauge I	Water Gauge J	Calculated Volume flowing through orifice using 0.61 as coefficient of discharge as in Mr. Weymouth's article Free Air		Volume passed into tank Cubic feet.	Time Seconds	Volumes in tank Cubic feet free air	
			Cubic feet per sec	Cubic feet per min.			Per sec	Per min.
0·214	12 in.	$8^2/_{16}$	0·184	11·0	17·49	96·5	0·181	10·9
0·214	19 in.	$9^9/_{16}$	0·194	11·6	23·01	108·0	0·212	12·7
0·214	16 in.	$7^1/_{16}$	0·167	10·0	16·11	94·5	0·171	10·3
0·214	16 in.	$5^7/_8$	0·152	9·1	13·82	88·5	0·156	9·4
0·214	16 in.	$5^3/_4$	0·151	9·1	13·82	88·0	0·157	9·4
0·441	9 in.	$2^1/_4$	0·194	11·6	19·33	96·0	0·201	12·1
0·441	12 in.	$3^1/_8$	0·237	14·2	20·48	86·0	0·238	14·3
0·441	13 in.	$1^{15}/_{16}$	0·186	11·2	22·55	116·0	0·194	11·6
0·441	16 in.	$4^3/_8$	0·271	16·3	22·86	87·0	0·263	15·8
0·441	16 in.	$4^1/_4$	0·267	16·0	19·40	74·0	0·262	15·7
0·797	12 in.	$^{15}/_{16}$	0·228	13·7	20·48	86·0	0·238	14·3
Average			0·203	12·2			0·207	12·4

tin, with interchangeable orifice plates with openings of 0.5, 1, 2, and 4 sq. in. area, was used, pipe fittings in this case being 1 in. In all cases, the compression in the receiver is so slight that all calculations are as for free air. With the apparatus described above, no difficulty was found in measuring quantities anywhere between 0.5 and 60 cu. ft. per minute. By substituting a high-pressure gauge at *B*, readings can be taken at any pressure, and in any case a little experience soon gives the most suitable size of orifice to use.

C. C. Freeman, metallurgist of the Lake View & Star mine, has submitted the following results of experiments in connection with this method of measuring air quantities. The apparatus shown in the accompanying sketch (Fig. 2) is almost identical with that used by Mr. Weymouth, with the exception of the sealed tank in place of the apparatus to be tested. Owing to the size of the tank used, quantities over 20 cu. ft. of free air per minute could not be tested, but results obtained for smaller flows gave excellent results, and for low-pressure air for agitation and similar purposes in the neighborhood of 5 lb. per square inch this method would be very useful. It consists of measuring the flow of air through a suitable orifice under low pressures, the orifice being varied so as to keep the pressure in the drum low enough to eliminate factors due to variations of volume due to pressure. Tests were carried out as follows:

Valve *A* opened to admit the requisite quantity of air, cock *C* opened and valve *E* regulated to give any required pressure on mercury gauge *I*. A suitable orifice attached to drum at *F* to give a reading on the water-gauge *J* of from 2 to 9 in. Hose at *G* disconnected, cock *B* opened,

these check very closely with the volumes measured in the tank.

The coating of cement mortar applied by the pneumatic cement-gun which was sent to the Isthmus a little less than a year ago for use in spraying the surface of certain rock faces in Culebra cut which disintegrated on exposure to air, was found not to prevent this disintegration. The concrete mixture sprayed on the smooth surfaces adhered uniformly, but was not sufficiently air-tight to retard appreciably the progress of disintegration. The gun was used recently on the re-located line of the Panama railroad, in coating the surfaces of hand-laid revetment wall, made of hard Bas Obispo rock. In this case the concrete penetrated the interstices between the rocks as far as several feet and thus obtained a firm hold. Using a mixture of 1 part of cement to 3 of sand for the inner coating and 1 part of cement to 2 of sand for the final surfaces, it was practicable to lay a smooth strong coat from 2 to 3 in. thick over an area of about 25 ft. square per day. The spraying was continuous. By the time the work had been carried from one end of the area under treatment to the other, the first part was ready for another coat. In all, about 10,000 sq. ft. of revetment was treated.

California is the only state which makes a commercial production of borax annually. The output for 1910, according to the U. S. Geological Survey, was 42,357 short tons, valued at $1,201,842. Less than 4 tons was imported. About one-half of the borax consumed is used in the enameling industry for making kitchen and sanitary ware. Each year some new use is found for the mineral.

Birth of the American Mining Act—II

By H. W. MacFarren

(Continued from page 526)

Early Taxes

In 1864 a tax of $\frac{1}{2}\%$ had been levied upon all bullion produced from public land, to be collected by a stamp tax at the United States assay offices. The following year it was increased to $\frac{5}{8}\%$. The mining bill as introduced by Mr. Sherman contained a clause providing that owners or occupants of a mine patented under this law should pay into the Treasury of the United States, each year until the national debt was extinguished, 3% of the *net* product of the mine in lieu of the stamp tax on bullion from land that still remained unpatented. This was a clause with which Senators Stewart and Conness and the balance of the Western delegation were not in accord. They had allowed it to be included under their protest to conciliate the Secretary of the Treasury and Mr. Sherman and those of Congress who believed that the Western mines should be directly taxed to assist in paying the Federal debt. Following Mr. Stewart's speech, Mr. Sherman moved to amend by making the tax of 3% perpetual. This amendment failed. He next proposed that the tax be raised from 3 to 5%. Mr. Stewart replied that he hoped the amendment would not be accepted. That it was much for them to consent to be discriminated against to the extent of 3%. That the mining industry should be fostered rather than taxed, and the poor man thus further encouraged to try his luck in finding mines so that the metallic currency could be increased. This, he contended, would increase the value of property and make the national debt that much easier to meet. He ended his argument by saying: "It seems to me the whole of this tax is wrong, but we have to submit to something, I suppose, and I trust at any rate it will not be put higher than three per cent." Thereupon followed a debate in which it was apparent that the senators generally considered that the mining industry deserved fostering through bounties rather than to be taxed. Thomas A. Hendricks, senator from Indiana, proposed that the section imposing a tax be stricken out. Mr. Sherman showed his broad character by volunteering to vote for the bill with or without the tax clause.

Mr. Williams, senator from Oregon, now moved to amend by striking out of the bill everything relating to the sale of mineral land. This would have left the bill stating only that mineral lands were open to occupation and development and water rights were open to acquisition under local or district rules and regulations. This would not have changed the nominal condition of mining and water rights one iota; it would simply have been a statutory acknowledgment of what the nation had impliedly given by its silence. It would simply have perfected the possessory right. Mr. Williams made objection upon nearly every point relating to the sale of mineral land, stating that the cost of survey and disposal would be prohibitive and that no rational system could be developed. He appeared to act partly under instructions from some of his constituency, partly from failure to grasp the bill, and partly from a realization of the difficulties of the question, for he said:

> I am opposing every system of selling the mineral lands. I say that no system can be devised, and I defy any man to devise any system of selling the mineral lands of the United States at this time that will be found to be wise and just in its practical operation. My judgment is, that when Congress undertakes to legislate generally for the mines of this country it will do those mines an irreparable injury. Congress, when it once commences, will be compelled to tinker with legislation from time to time, until the whole system of mining regulations which has grown up from time and experience, and which is now well adapted to the wants and interests of the miners, will be thrown into inextricable confusion and made the means of endless controversy and litigation.

Senators Stewart and Conness worked with Mr. Williams step by step to show him the error of his way of thinking. James A. McDougall, the other senator from California, agreed with Mr. Williams, stating, after paying his respects to the learning of Mr. Stewart: "This might be called 'a bill to promote litigation, create controversy, and occasion difficulties.' No system yet has been matured for disposing of the mineral lands in fee, except as they are occupied in present possession under the customs of the country. Here is a bill providing a policy full of machinery very ingenious, but which, like some of those machines that are intended to secure perpetual motion, will run but a short time. We are not prepared here at the present time to provide a plan for the disposition of the mineral lands of the country." Mr. Hendricks of Indiana also sided with Mr. Williams. Under these conditions and with this diversity of views, the bill finally passed the Senate on June 28, 1866.

Fight in the House

On July 3 William Higby, representative from California and chairman of the House Committee on Mines and Mining, moved in the House to take up the Senate bill No. 257 on mining and refer it to the Committee on Mines and Mining. Mr. Julian of Indiana, the author of the principal bill to sell the minerals lands, was also chairman of the Committee on Public Lands as well as one of the older members of the House. He immediately seized upon the bill and had it referred to the Committee on Public Lands, where he exerted his influence to practically kill the bill through pigeonholing it. He proposed that the bill should not get out of the hands of the committee until his own bill had been discussed and, as he hoped, passed by both branches of Congress. Try as they could, every attempt of the Western members and senators to get the bill out of the hands of the House Committee on Public Lands and before the House met with failure, even though a majority of the committee were favorable to the measure. They were up against a solid stone wall of rule and precedent which they could not breach. Then occurred a piece of clever generalship upon the part of Messrs. Stewart and Conness. Mr. Higby had introduced House of Representatives bill No. 365 in the House and had it reported back from the Committee on Mines and Mining, together with some discussion in the House. The purpose of this bill was by a statutory act to confirm the owners of ditches and canals and the holders of water rights in their possessions under local or district rules and customs. Its purpose was so identical and its interests so inseparable from the subject of mines, that Messrs. Stewart and Conness had included it in the mining bill, though in a different and simplified form. As the way was clear for the House to consider and act on its water-right bill, Mr. Stewart reported the bill to the Senate from the Senate Committee on Public Lands with the recommendation that the entire dual mining and water right bill passed June 28 be substituted by amendment. On July 20 the Senate agreed to the amendment and the mining act took its place as H. R. bill No. 365, 'A bill granting the right of way to ditch and canal owners over the public lands, and for other purposes.' In this form it reached the House on July 21 as having been passed by the Senate with amendments in which the concurrence of the House was requested. At the same time the House Committee on Mines and Mining reported favorably on a bill precisely similar which had been introduced by Mr. Higby on July 16. A majority of the House Committee on Public Lands stood ready to report favorably on the original Senate bill as soon as they would be allowed to do so. The Committee on Territories

had approved the bill. The Commissioner of the General Land Office had given his written recommendation. Messrs. Stewart and Conness had personally labored among the Representatives and had been promised support. Every possible effort had been made to win the final struggle.

The bill came before the House the day after it had been passed by the Senate. When Mr. Julian found that he had been outmaneuvered, he was furious. First he tried to have the bill referred to his Committee on Public Lands, next he tried in every way to block the consideration of the bill, then he attempted to amend the bill by substituting his own to sell the mineral lands. Driven back in each attempt, he finally vented his rage, charging crooked tactics because the fathers of the mining act in the Senate had come to the members of the House of Representatives and asked for help. He said: "It is altogether consistent with the interests of these mining districts that their representatives should zealously labor for this bill, and that honorable gentlemen, not members of this House, should come upon this floor and perambulate these isles as they did on Saturday and are doing today, and tell us to vote for this bill, and command us, in the tone of slave-drivers, to 'Get up, get up, help us, this is a local measure, help us carry it.' Admirably natural and characteristic. But occupying the standpoint that I do outside these mineral districts, and of the contagion of local opinion and feeling and having no other desire than the establishment of a broad and enduring national policy——." At this point he was called to order by a member from Vermont and severely rebuked by the Speaker of the House, who said that senators had a right to come upon the floor of the House to confer with members in regard to legislation and that criticisms and unseemly language against members of the Senatorial body for so doing would not be permitted. Among other things, Mr. Julian said in his argument: "This bill before us hands over the miners everywhere to interminable litigation, discord, and strife. Instead of leading them out of the bondage into which the inaction of the Government had led them, it leaves them to wrestle with their destiny as best they may. That is what the nation will do in remanding this question to the miners as provided for in this bill. And this 'local custom of miners', enacted by 'a corporal's guard' of adventurers, who are here today and gone tomorrow, is to be the basis of a national policy, and the harbinger of peace and order in the mining regions. Instead of extripating this pernicious system, or rather lack of all system, we now propose to set it up as a rule, and coolly ask the nation to conform its policy to it."

Donald C. McRuer, member from California, said:

I wish to say that the proposition to sell the mineral lands did not come from the Pacific coast or from the mineral region. Two years ago we were progressing, as we have progressed for the past seventeen years successfully, to develop the wealth of the country, and possessory titles were considered sound. They were bought and sold with entire confidence and faith in the legislation of this country, the same as titles to real estate were bought and sold. But, sir, since that time there has been introduced into Congress schemes to sell the mineral lands without any regard to the possessory titles. I hold in my hand a bill that was introduced into the Thirty-Eighth Congress, reported from the Committee of Public Lands, which proposes—what? Why, sir, to put up every possessory right within that whole region, and sell it at auction. And the whole logic of that speech and the report made in regard to that measure was, that the people of the mineral regions were a set of vagabonds, and the women were, to a large extent unchaste, and therefore we shall drive out that worthless class of people, sell the mineral lands, and thus attract a meritorious class of people to these regions as settlers. It is in consequence of the apparent encouragement which such a scheme has received here that we now feel that our whole titles are insecure. It has disturbed the faith, it has disturbed the credit, and consequently those who are interested in that region, those who have the interests of that country at heart, have set themselves to work to frame a bill recognizing the possessory rights of all these people.

D. R. Ashley, representative from Nevada, said:

In 1850 it was proposed to legislate upon this subject. A discussion took place in the Senate, but ultimately nothing was done, on the ground that Congress was not sufficiently informed, and it would therefore leave the people of the mining region to get along as best they could. Accordingly they were let alone, and for seventeen years they have been going on under their own local rules. Rights of property have grown up. Men have spent seventeen years of their lives there, and invested their property. Their future hopes are all centred in that country. They have considered themselves safe heretofore, and I tell you if we could be sure that the Congress of the United States would never interfere with our occupation of these lands, would never survey and cut them up into square parcels and sell them at auction, we would not come here asking you to dispose of these lands in the manner proposed by this bill, because the local title would be considered safe. We want security. You own your own property here. We ask that the Government of the United States shall give us the same titles to ours. Why should we be lessees and tenants always? Is that the system that the American Government wishes to establish—that all the rest of you may own your own homes, but we who delve in the earth for the precious metals shall be tenants and serfs always?

The bill passed the House on July 23, by agreeing to the amendment of the Senate, there being 73 yeas, 37 nays, and 71 not voting. On July 26, 1866, it became a law through the approval and signature of the President, Andrew Johnson.

The First Mining Act

The act of July 26, 1866, entitled 'An act granting the right of way for ditch and canal owners over the public lands, and for other purposes', opens with the section: "That the mineral lands of the Public Domain, both surveyed and unsurveyed, are hereby declared to be free and open to exploration and occupation by all citizens of the United States, and those who have declared their intention to become citizens, subject to such regulations as may be prescribed by law and subject also to the local customs or rules of miners in the several mining districts, so far as the same may not be in conflict with the laws of the United States." It provided that those who had expended $1000 in labor and improvements upon a lode or quartz claim could obtain a patent therefore at the price of $5 per acre. That the same was to be obtained through survey by the surveyor-general, and through application to the local land office. It provided that no location should exceed 200 ft. along the vein for each locator, with an additional location for the discoverer of the vein. No person was to make more than one location on the same lode, and not more than 3000 ft. of a lode could be taken in one claim by an association of persons—at this time it was customary for a number of locators to combine their locations into a single general claim. The apex or extralateral right to follow the vein indefinitely on its dip was fully given. It provided that all questions of adverse ownership arising when patent was being asked for, should be settled in the local courts and not in the land office. The section referring to water rights read: "That whenever, by priority of possession, rights to the use of water for mining, agricultural, manufacturing, or other purposes, have vested and accrued, and the same are recognized and acknowledged by the local customs, laws, and decisions of courts the possessors and owners of such vested rights shall be maintained and protected in the same; and the rights of way for the construction of ditches and canals for the purposes aforesaid is hereby acknowledged and confirmed."

The opening section of the act and that on water rights are the two vital features of the act as passed and as subsequently amended. About the first, all our mining law has been built as a matter of detail. The second, without any further national statutory act or legislation, has defined the method of securing water and ditch rights in the West, and is the fundamental authority upon which the states in the Far West control the disposition of water upon the public lands. Both are contained in the present law with a few substitutions of words which have not affected the meaning or interpretation in the slightest.

It is clear that the framers and amenders of the act had as full a knowledge and as wise an insight into each detail as was then possible. Nothing can be clearer from an examination of the debates in Congress, and a consideration of mineral-land history prior to, and subsequently than

that no man, possibly excepting one with a prophetic vision, could have done better, the apex question notwithstanding, as I shall show. For this wisdom, their hard labor, and the Napoleonic shrewdness by which the passage of this act was consummated, the miners of the West owe to Messrs. Stewart and Conness and their co-workers a great debt, one that we seem to have forgotten in these days of disagreement with any thing connected with public-land law. The opening section, and that on water rights was what the miners wanted to a man. They wanted to continue the system of free mining under their own local rules and customs. They were satisfied with them, they believed in them, in the words of Senator Stewart, "The miner's law is a part of the miner's nature. He made it. It is his bantling, and he loves it, trusts it, and obeys it." And in the words of Mr. Ashley, "I tell you if we could be sure that the Congress of the United States would never interfere with our occupation of these lands, would never survey and cut them up into square parcels and sell them at auction, we would not come here asking you to dispose of these lands in the manner proposed by this bill, because the local title would be considered safe." The miners were willing to pay tribute, willing to support the machinery of the Government, they were already paying a tax, but they wanted to secure titles—first, as to possessory rights, and then, as to the fee title through patent. They did not want to be tenants or trespassers, with their fortunes and their years of toil at the mercy of every will-of-wisp of public sentiment, and every irresponsible legislation. They did not want to be the footstool of every demagogue and politician, playing to a temporary popularity by proposing to sell the rich (?) mineral lands of the West to pay the national debt and replenish the federal exchequer—a pleasant and attractive proposition to the great majority in the East who were little concerned wih the hardships it would saddle on the small minority in the West.

Lodes Alone Considered

Though the Western miners were a unit in declaring that Congress should authorize free mining under the local customs and rules, they split in an attempt to go further. The minority could not see how any system of giving the fee title could be put into successful practice. We can now understand why Mr. Stewart and his allies did not attempt to extend the section authorizing the sale of quartz veins or lodes to placer deposits. The lode type of deposit was peculiarly adapted for trying out the new law, which, if found successful, could be extended to other types of deposits and other methods of mining. To have included all types of deposits in the first bill in a comprehensive way, would have made it so involved that Eastern statesmen would have been against it through sheer inability to grasp it—instance the inability of the layman to comprehend the mining law today. For the same reasons a large part of the miners would have thrown their weight against it. Without doubt the passage of an all comprehensive mining act relating to obtaining the fee title would have been delayed for years. The reasons that caused Mr. Stewart to urge the enactment of a means of selling lodes or lode claims to the miners, instead of stopping with confirming the possessory rights were doubtlessly many. He was familiar with the tremendously expensive litigation then going on in the Comstock. The Sutro Tunnel act was about to be passed. The Central Pacific and Union Pacific railroads were rapidly approaching completion. The recent disbandment of the armies of the Civil War was turning westward thousands of men imbued with the restlessness and eagerness for adventure born of camp life. The homestead act was just commencing to populate the West. All these were increasing the importance of quartz mining and giving a new impetus to the development of the West. Agricultural and mineral claimants were rapidly encroaching upon each other, so that the fee title to mining claims and the separation of the agricultural from the mineral land was becoming necessary. The sponsors of the act made it plain that the sale of provisions were to extend only to lode claims; that the bill so far as concerned all other mining claims was only to perfect their possessory right that they might continue working as heretofore, but with the certain knowledge that they would never be evicted as trespassers.

The idea contained in the act that only those who had expended $1000 in labor and improvements (reduced to $500 by the act of 1872) should obtain patent was probably first obtained from the miner's regulations of the Genoa district in Nevada. Hittell in 'Bancroft's Handbook of Mining for the Pacific States', 1861, gives Section 15 of these as follows: "Whenever $1000 shall have been expended on the claims of a company in this district, the ground so claimed by the company shall be deemed as belonging in fee to the locators thereof, and their assigns; and the same shall not be subject to location or re-location by other parties ever after, except by an acknowledged abandonment by the company of the ground." Hittell makes the following comment regarding this: "In this code are singular clauses, not found in any other mining regulations on the coast. The first peculiar and important feature of this code is that by the expenditure of $1000 in working a claim, the claimant gets a title beyond all forfeiture. Having spent that amount, he is secure forever in his possessions, against all other miners; but, of course, the code cannot give title as against the federal government, which is the fee-simple owner of the land and minerals. In every other code of mining regulations known to me, the title of mining claims is forfeited whenever the claim is abandoned; and neglect to work for a few days in the season when the claim can be worked, is considered abandonment."

Lode Not Land Sold

One distinguishing feature of this act as exhibited in the wording of the statute, and in the debates in Congress was that it was to give a title to a lode or rather so many feet along a lode, with so much surface ground adjacent as might be necessary—the same to be fixed by local rules—and not give title to an area of land together with all lodes outcropping upon it. The lode or vein was the main thing, and the whole thing with the miner at that time, and the act gave expression to this. The claim was to cover only one lode and no patent was to issue for more than one lode. The rule that no location could claim more than 200 ft. of a lode was in accord with local rules at that time which limited each individual locator to from 100 to 300 ft. along a lode.

Along with the idea that the lode and not surface ground was the main thing, came the apex idea included in the act. Mr. Stewart refers to the apex idea in his speech, and in argument said: "He evidently has not read it [the bill], and has fallen into the popular prejudice of supposing that land is to be sold in rectangular form between perpendicular lines. It has been explained that this cannot be done. A vein pitches into a hill, and a perpendicular line would cut it up into pieces. He speaks of that. This bill provides for selling the vein and following it into the earth, with its natural dips and angles." Mr. Conness also said under argument on this subject: "I desire to say to him, in this connection, that vein mines do not enter the earth by perpendicular lines; but on the contrary, have what are called dips or slants running by oblique lines into the earth; that they follow each other regularly in that respect; and that the custom now, and the habit everywhere, and the law, first determined by necessity, by the fact, next by population obeying that necessity, next by the local courts affirming that necessity by their decisions, is that the miner is authorized to follow every vein according to its dips and angles and variations. This whole bill is based upon the principle of confirming what has grown out of necessity, the wisest system, perhaps, that could possibly be devised, which is the work of the people themselves. Would the senator want to enter the earth by perpendicular lines so that a man who owned a claim today, after he had descended 50 ft. of it, should leave it to the ownership of another man tomorrow."

(To be Continued)

Gold deposits of exceptional richness are rumored to have been recently discovered at the Luibavinsky mine, on the river Onon in Siberia, about 200 miles from Chita.

The Institute Debt

By R. W. Raymond

*I have scrupulously avoided any connection with the recent contest concerning the management of the Institute. I have never personally favored a change in the name of the Institute, although, if such a change were deemed advisable by a majority of the members, I would not have regarded it as a question worth a fight.

I may also say freely that I have always opposed, except as a last resort, the increase of annual dues; and that I heartily approve the action, taken at the recent annual business meeting, by which this subject has been referred to a committee which is instructed to investigate the economy of the management of the Institute and to report whether such an increase is necessary. In my judgment, it would not be necessary, if the Western American members of the Institute would do their share in lifting the burden of the land-debt incurred by the Institute in its proportional acceptance of Mr. Carnegie's generous gift of $1,050,000 to pay for the magnificent and perfect building, now occupied by the three national societies of Mining, Mechanical, and Electrical Engineers. This benefaction required the three societies to pay for the land on which the building was to be erected; and this obligation, amounting to about $180,000 for each society, was so adjusted as to be payable in 20 years, with current interest at 4% on the unpaid balance. Into this somewhat perilous obligation the Institute was forced (in spite of my doubts and hesitations as its financial manager, though not against my hopes and aspirations for its assured national and international future) by appeal and pressure of all kinds, culminating in a vote of thanks of the whole membership, of which more than 99 per cent favored the acceptance of the Carnegie gift.

But no sooner had this gift been accepted, and the corresponding obligation assumed, than the very men who had, by their votes, forced this action, began to talk about the Institute as a concern maintained for the benefit of New York members. Now the facilities of our rooms in New York are enjoyed, as they are intended to be, rather by non-resident than by resident members. The land debt of the Institute has been reduced by voluntary subscription from $180,000 to less than $80,000, and I cannot recall a single subscription to this fund coming from any place west of the Rocky Mountains. In fact, 90% of these subscriptions have come from persons in the Eastern states. If the members of the Pacific states would do anything like their share, we could extinguish our land debt, and go on, without increased dues, to expand the operations, especially of our library, so as to make the Institute more valuable to all its members, and chiefly to those who do not reside in or near New York. It is my hope that the investigation committee recently appointed will declare these facts so that they will be understood.

*We are permitted through the courtesy of Dr. Raymond to make public this expression of opinion, originally sent in a private letter. Coming as it does from the long-time leader and manager of the affairs of the Institute, it is of especial importance to all members.—Editor.

An Improved Cone

By Douglas Waterman

Cone classifiers are in general use in cyanide plants to separate sand from slime. The ideal efficiency is attained when the overflow is free from sand. The volume and specific gravity of the pulp determine the size of the cone. It is desirable, in order to save head room, to have the cone as small as possible. Fig. 1 shows the usual form of cone, with a central cylindrical intake and peripheral overflow. Two factors operate to prevent the quiet settlement of the sand. One is the diminished sectional area where the pulp enters the cone, and the other the rapid rise of imprisoned air bubbles.

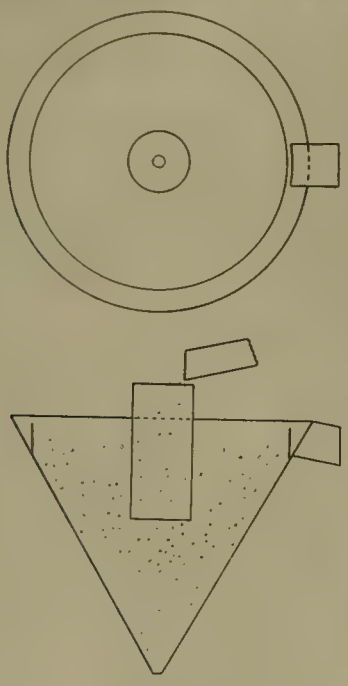


Fig. 1.

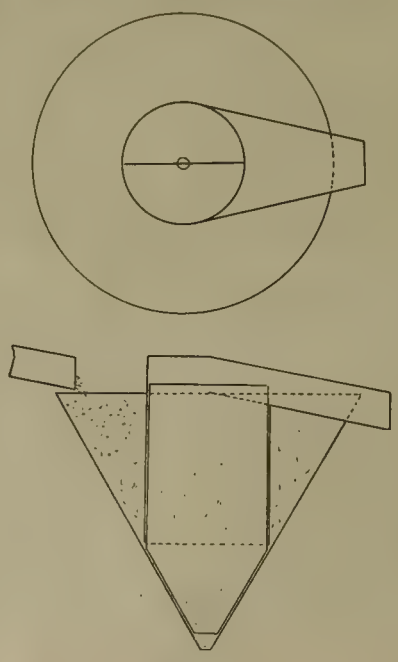


Fig. 2.

A simple device, which permits of a great reduction in the size of the cone, was introduced by W. G. Mosher at the Butters San Sebastian mine in Salvador, and has been generally adopted in the Butters plants. At San Sebastian this device has more than doubled the capacity of the cone. This improved cone is shown in Fig. 2. The pulp flows directly into the cone, rises through the central cylinder, and overflows by means of a spout attached thereto. The stream enters the cone at the point of greatest area, where the force of the current is readily dissipated. The rising current in the cylinder is of low velocity and entirely free from air bubbles. The cylinder is divided by a partition extending to near the point of the cone. This prevents the vortex which would otherwise be formed by the discharge of the spigot. The annular space between the side of the cone and the cylinder is ½ to ⅝ inch.

Chalking of White Lead and Its Prevention

By Henry A. Gardner

Chalking and Repainting.—The chalking of white lead is one of the evils attending the use of this valuable white paint pigment which the master painter is most anxious to correct. Every fair observer will probably admit that moderate chalking is not objectionable, as it leaves a surface for repainting which will quickly receive and amalgamate with the new paint applied; this result being difficult with an old painted surface which is excessively hard or brittle. Excessive chalking, however, which is often followed by deep 'alligatoring' and gradual disintegration, should be avoided if possible, for no matter how good a paint may be placed over a deeply-checked surface, the result is always unsatisfactory and unsightly. I have recently read with interest a pamphlet which attempts to explain the cause of chalking that is exhibited by nearly all pure white lead paints after exposure to the elements.

Oil Conservation or Oil Substitution.—It is stated in the pamphlet referred to that the chalking of white lead is due to a lack of linseed oil, and that chalking would not take place to any extent if white lead paints were mixed with greater quantities of linseed oil. From an economical standpoint, it would appear to me that if painters were to follow the above suggestion and use greater quantities of linseed oil than is at present the prevailing practice, the effect would be toward relief from the present high prices which must be paid for pure oil, and might not only encourage the use of linseed oil substitutes which have not been thoroughly tested, but actually lead to the use of such substitutes.

Short Oil and Long Oil Reductions.—It has further been stated that not only the painting coat of white lead but the top coat as well should receive very long oil reductions in order to form a film which would protect the pigment from the elements, which are the initial cause of chalking when lead is applied with the usual short oil reduction. The application of short oil varnishes which contain quantities of gum with very little oil is recommended, assuming that the same enduring results which are obtained on exposure of long oil varnishes would be obtained if lead paints were reduced with quantities of oil. Commenting on the above procedure, it would appear to me that the use of larger quantities of oil than are at present in common use would result in a paint deficient in hiding power and strength. Furthermore, the comparison is faulty in that varnishes consist of gums dissolved in oil; an entirely different material from an oil in which pigments are simply suspended. Both of these materials must be studied along separate lines, as they are physically and chemically different.

Amount of Oil Determined by Pigment.—It is well known that linseed oil, or, in fact, any oil, when spread into a paint forms a coating which upon exposure does not possess any great strength or moisture-excluding power. When linseed oil, however, has been ground with pigments, the strength of the films is increased materially, and the greatest strength is developed in those cases in which a critical percentage varies with the nature of the pigment, a small quantity of some pigments being sufficient, while of others a large quantity is found necessary to produce films of maximum strength. An average paint consists of 10 lb. of pigment suspended in 1 gal. of oil, but I have in mind at present a paint made from 35 lb. of pigment suspended in 1 gal. of oil. This pigment, namely American vermilion (basic chromate of lead), is probably the lowest oil-carrying pigment ever produced or applied under actual practical conditions, and today, after nearly four years' exposure along the Atlantic coast, where it has been subjected to the most severe atmospheric conditions, it is in almost perfect condition, showing absolutely no chalking. Being a lead pigment and being applied with a shorter oil reduction than white lead has been applied with, the result would seem to dispose of the theory advanced that white lead should be applied with longer oil reductions. If the amount of oil and not the amount of pigment should determine the service of the paint, would not a pigment such as asbestine, which requires enormous quantities of oil, form a paint more durable than white lead or any of the other white base pigments? It is known, however, that this is not wholly the case, and, moreover, the question must be looked at in a practical manner, for the hiding power of a paint is one of the most important properties.

Hydrate and Carbonate.—The percentage of lead carbonate in corroded white lead determines its hiding power, while the percentage of hydrate determines the oil-carrying capacity. When the amount of carbonate runs to 80%, the lead has a high gravity and requires only 3½ gal. of oil to a hundred pounds of paste lead to produce an easy-spreading paint that will have good hiding properties. When the amount of carbonate in corroded white lead drops to 60% and the hydrate reaches 40%, difficulty in grinding is observed, even if additional oil is added. Such a product is likely to harden and become gummy in the package, and upon thinning 100 lb. of paste for application, 6 gal. of oil is required and the product has only slight hiding power. Corroded white lead that contains about 70% lead carbonate and 30% lead hydrate is probably the best grade that can be obtained; its oil absorption is medium and its working properties and hiding power excellent.

Amalgamation.—The claim has been advanced that the application of long oil leads in repainting work is desirable, on account of the penetration into the old paint that can be secured from the newly-applied paint, both amalgamating to form one solid film. If this phenomenon really took place under such conditions, a cross-section of the film produced would probably appear under the microscope as one solid mass of pigment and oil. As a matter of fact, this is not the case.

The Effect of Tints on Durability.—It is very generally admitted that tinted paints are far more durable than white paints. In the article under discussion, the claim is made that the increased durability of tinted paints is due entirely to an increase of oil brought to the white paint by the coloring pigments, all of which have rather high oil-carrying properties. As a matter of fact, however, the amount of oil carried into a white paint by one or two per cent of tinting color is too small for consideration and is insufficient to give the results claimed above. White leads made by various processes take up varying amounts of oil, 100 lb. of some paste leads requiring only 3½ gal. of oil, while in other cases leads made by different processes require as high as 6 gal. of oil to produce paints of the same consistence. Upon exposure of such leads, there seems to be no material difference in the way they wear. This result would further indicate the fallacy of claiming that the extra durability obtained from tinted paints is due to the slight increase of oil brought to them as a contribution from the coloring matter used. The greater durability of tinted paints must be attributed, therefore, to the nature of the added tinting pigments and to the differing physical and chemical properties which they bring to the white base.

Carbonate and Oxide Pigments.—The carbonate pigments, such as lead carbonate, calcium carbonate, and barium carbonate, will all chalk when painted out and exposed to the elements. This chalking seems to be a distinct feature of the carbonate pigments. While it is true that certain other pigments which are not carbonates chalk quite heavily, it is furthermore true that the exception proves the rule. Pigments which are not carbonates, but which have other radicals, and which will probably be more readily recognized if called by their trade names, such as red lead, zinc white, litharge, etc., do not possess chalking tendencies, and they form paints which remain hard and glossy under long exposure. When either carbonate pigments or oxide pigments are reduced with short or long oil reductions, the same conditions hold true. It would become at once apparent, therefore, that if the chalking tendencies of the carbonate pigments are to be overcome and corrected, or the excessive

hardness of the oxide pigments is to be reduced, a mixture of the two in the correct proportions should solve the problem. As a matter of fact, mixtures of this type do not become excessively hard, nor do they chalk to any great extent, and, although this principle was long ago discovered and has been used for years by progressive painters, it must be stated over and over again in order to convince those who are not thoroughly familiar with the results of paint tests.

Conclusions. After considering the present practice of some of the leading members of the association, and summing up the results obtained from practical tests made throughout the country, I have formed the conclusion that the paint best suited to withstand service is a tinted paint made of a proper mixture of pigments, carefully ground together and applied by a painter, for even the best paint made must be applied by skilful hands, guided by intelligence, if the best results are to be obtained.

The Nature of Sherardizing

By A. R. Johnson and W. R. Woolrich

*It is now about a decade since Sherard Cowper-Coles made the discovery, quite by accident, that if a piece of metal, like iron, for example, is buried in zinc-dust, and the mass heated out of contact with air, there is deposited on the iron a beautiful coat of zinc. The process was given the trade name 'sherardizing.' While the commercial application of the process appears to have been slow at first, it nevertheless grew steadily in favor for certain kinds of goods, and, after getting a firm hold in England, appears to be spreading rapidly in the United States.

The close attention which this process is attracting may be due largely to the simplicity of the process and to the mystery surrounding the actual nature of the deposition, but, as we believe, is due more largely to the very great value of the coating as a protective agent for iron and steel goods. Any process that brings engineers and chemists one step nearer the solution of this so important problem in the realm of the conservation of building materials must surely attract the most serious attention. With this fact in mind, we present some results gleaned from a rather broad industrial research on zinc cementizing, which we hope are of sufficient scientific value to be of general interest. In working the process of sherardizing, whether for commercial or scientific ends, we must know the amount of zinc deposit as a function of the following factors: temperature, time, concentration of zinc-dust in inert powder, and size of zinc particles. No doubt, much of such information has been obtained, but it does not appear to have been published as definite data.

As in most physical and chemical processes, so in the case of sherardizing metals, the temperature factor is of extreme importance, and therefore many carefully arranged experiments were carried out to determine the rate of deposition of zinc not only upon iron, but also upon nickel, brass, copper, and zinc. Evidence is clear that not all metals, even those much less electropositive than zinc, sherardize with the same degree of readiness. Copper, as might be surmised, receives a coat of zinc much more readily than the other metals. The authors have produced coats on copper ranging from a mere film of yellow brass to a pure white of remarkable smoothness. Pure nickel sherardizes more readily than iron. A rod of pure zinc, polished until perfectly smooth, did not start to sherardize to any considerable extent until a few degrees below its melting point. Yellow brass receives a coat readily, but not so readily as does copper, and the curve has a somewhat different trend. But of the greatest interest is the fact that all the curves approach the same rate of deposition with rise of temperature, and the limiting value lies at about the melting point of zinc. From this point on, the deposition of zinc becomes exceedingly rapid. The range of temperature between the point where the first appreciable deposit occurs to the melting point of zinc may be looked upon as the true sherardizing range of temperature for a particular metal. This range is greater for copper than for iron.

One of the most surprising facts found in our study of sherardizing is the pronounced effect the fineness of the zinc particles has on the rate of deposition and smoothness of the zinc coat. The finer the zinc particles the smoother and apparently more penetrating the zinc coat. But the finest of zinc dust will not deposit as fast at a given temperature as a relatively coarse zinc dust of 150 to 100 mesh. Results were obtained which showed nearly twice as rapid deposition of zinc at 370°C., in three hours, from 150 to 100-mesh zinc, as from the finest zinc dust. The coat is quite rough for the coarser dust, however. For commercial work, a proper medium between smooth penetrating coats, slowly deposited, on the one hand, and rough thick coats, quickly deposited, on the other, might be struck. Coarse zinc-dust is much less satisfactory in other respects when used alone than fine zinc-dust, for it yields but little hydrogen when heated, and the voids are so large as to allow air to penetrate the mass to considerable depths and oxidize both the sample receiving a coat and the particles of zinc, often to such an extent as to destroy the sherardizing. Besides, there is a great tendency for the coarser material to fuse together. It is, therefore, necessary to use some impalpably fine inert powder with such so-called 'finely-divided zinc' to at least partly fill the voids.

Our explanation or theory of the sherardizing process is as follows: In the light of the phase-rule the iron, zinc, and vapor may be regarded as forming a closed system, all parts of which are practically at the same temperature. Zinc, compared with iron and most other metals, has a relatively high vapor tension. Zinc alloys fairly readily with many of the common metals like iron, nickel, and copper. When the process is ready to be started, the iron, for instance, is surrounded and in intimate contact with many particles of zinc. Under the influence of heat these particles, carrying their slight atmospheres of zinc vapor, form a superficial alloy with iron. This superficial alloy on the iron would very likely be a solid solution of zinc very rich in iron. Now we may look upon the iron with its insignificant vapor pressure as greatly lowering the very appreciable vapor pressure of the zinc which is forming a solid solution with it, and we should expect the zinc vapor to distil from the points of higher tension to the place of low vapor tension at the surface of the iron-zinc alloy. As the iron alloy grows richer and richer in zinc under the process of sublimation or distillation, its vapor tension will gradually approach the tension of the vapor of pure zinc particles, and hence the process gradually ceases.

The experimental facts already presented show that the nature of the metal to be sherardized, having reference to its alloying properties with zinc, has a great influence on the temperature at which sherardizing will start and its rapidity after starting. That we did not succeed after several trials in depositing zinc on a pure rod buried in zinc-dust is also in accord with our theory. Also, pieces of iron which had once received a coat of zinc of considerable thickness refused to sherardize at any such rate as fresh iron at temperatures below the melting point of zinc. However, if the coat of zinc already present is thin, the deposition will start again, though more or less tardily.

New lines for experimentation are suggested by this theory which should at the same time test its validity. Sherardizing should be greatly retarded if the finely-divided zinc used were a solid solution with some metal of low vapor tension, as iron, nickel, or copper. If the vapor tension of the metal to be deposited is lowered until about equal to that of the most saturated solution possible on the surface of the metal being sherardized, the process should not take place, or only to a slight extent. Furthermore, any substance which would impair or change the initial alloying tendencies of the metals should also greatly influence the process.

*Part of a paper presented at the meeting of the American Electrochemical Society, in Boston, Mass., April 18 to 20, 1912.

Lead Production in 1911

By C. E. Siebenthal

*This advance statement is designed to afford at the earliest practicable date authentic figures of the production of lead in the United States in 1911. The figures of production are based on confidential reports by each lead smelting and refining company in operation in the United States during the year. The figures of imports and exports are taken from the records of the Bureau of Statistics of the Department of Commerce and Labor, and those for 1911, not having been finally checked, are subject to minor revision. The cordial coöperation of each lead-smelting company is acknowledged with keen appreciation. In explanation of the tables below, it should be said that the refined-lead product cannot be apportioned according to source of ore, owing to the fact that lead refiners treat smelted products whose origin may, as in custom refining, be unknown to them, the identity of the ore, and thus its original source, being preserved only as far as the smelter. Accordingly, the table showing source of lead smelted or refined in the United States is based on smelter figures. It includes pig lead reported by all smelters using Mississippi Valley soft lead ores and lead produced at all other lead smelters in this country. A part of the product reported by smelters operated in conjunction with refineries is in terms of refined lead. A like part of the antimonial lead product is thus eliminated from the 'lead' produced and appears only in the figures of production of antimonial lead. No lead ore from the United States was treated elsewhere during the period covered by the table.

The statement of the production of refined primary lead embraces all desilverized lead produced at works in this country and the pig lead recovered from Mississippi Valley soft lead ores. The pig lead derived from Mississippi Valley ores and desilverized is shown separately. The antimonial lead reported by refineries is also given. The original source of the ore and bullion affording this refined product is shown in detail in the accompanying table showing primary lead smelted or refined in the United States. In the table showing consumption, 'lead' includes all kinds —lead in ore, base bullion, pigs, bars, and old. The figures of domestic production are based upon returns by the smelters; all other figures are from the records of the Bureau of Statistics. Decrease by liquidation covers losses in smelting and refining in bond and other corrections. Warehouse stocks of bonded lead of foreign origin are given, but it has been found impossible to obtain complete figures of domestic stocks. For this reason the result is given as 'lead available for consumption.' The 'apparent consumption' of previous reports would be this quantity increased or diminished by the increase or decrease of domestic stocks during the year. The table showing the world's production of lead has been recalculated to short tons from the statistics published by the Metallgesellschaft, except those for the production in the United States.

THE WORLD'S PRODUCTION OF LEAD 1906–1910.

APPORTIONED ACCORDING TO SOURCE OF ORE.

Country	1906	1907	1908	1909	1910
Australia	102,514	106,923	131,174	85,098	108,907
Austria-Hungary	18,078	16,975	16,094	15,432	19,290
Belgium	24,471	28,417	39,352	44,423	43,651
Canada	26,235	23,778	21,605	22,928	16,535
Spain	28,219	25,353	28,770	20,052	[a]23,148
Germany	160,117	157,156	180,887	185,076	174,053
Great Britain	26,455	30,203	32,758	31,085	33,620
Greece	13,338	15,212	17,647	16,865	18,519
Italy	23,479	25,213	28,660	24,361	17,639
Japan	3,858	3,858	3,197	3,748	3,858
Mexico	99,524	79,186	124,253	130,071	138,890
Russia	330	110	110	882	1,323
Spain	199,406	204,848	202,052	202,823	211,201
Sweden	882	882	331	220	331
Turkey in Asia	10,582	11,464	13,007	13,338	13,999
Other countries	220	220	551	4,519	14,220
United States (domestic)	350,153	365,166	310,762	354,188	372,227
Total	1,033,862	1,095,171	1,148,180	1,164,709	1,211,411
United States percentage of world's production	33.9	33.3	27.1	30.4	30.7

*Advance sheet from 'The Mineral Resources of the United States for 1911.'

PRIMARY LEAD SMELTED OR REFINED IN THE UNITED STATES.

APPORTIONED ACCORDING TO SOURCE OF ORE.

	1906	1907	1908	1909	1910	1911
Domestic ore:						
Alaska	8	.....	3	60	60	50
Arizona	2,884	2,340	1,464	1,465	858	3,150
Arkansas	.....	15	.....	14	.....	15
California	432	854	515	937	1,160	615
Colorado	50,497	48,876	28,728	29,326	35,685	30,621
Idaho	117,117	112,569	98,464	97,183	99,924	117,159
Illinois	572	408	363	274	262	198
Iowa	270	225	110	15	.....	.....
Kansas	1,932	1,798	2,293	2,764	1,308	2,522
Kentucky	44	75	.....	.....	50	.....
Missouri	111,075	122,856	122,431	142,650	161,459	182,297
Montana	2,485	2,035	2,320	1,376	1,780	2,499
Nevada	1,669	3,380	3,796	4,098	2,195	1,083
New Hampshire	.....	.....	.....	5	.....	.....
New Mexico	640	1,927	580	1,275	1,731	1,381
Oklahoma	.....	404	1,409	2,268	1,805	1,925
Oregon	.....	.....	7	6	.....	11
South Dakota	.....	.....	13	.....	7	33
Tennessee	11	16	.....	.....	.....	.....
Texas	25	10	42	42	33	57
Utah	56,260	61,699	42,455	64,534	57,081	55,198
Virginia	.....	82	13	.....	87	499
Washington	46	281	.....	115	311	601
Wisconsin	1,753	3,551	4,013	3,238	3,584	3,967
Philippine Islands	.....	.....	.....	.....	.....	5
Undistributed	380	357	26	303	238	50
Zinc residues	2,053	1,318	1,290	1,641	2,049	1,991
Total from domestic ore	350,153	365,166	310,762	354,188	372,227	406,148
Foreign ore:						
Africa	.....	323	.....	3,227	3,499	509
Canada	7,238	5,793	341	71	44	119
Central America	112	.....	12	25	7	27
England	.....	.....	.....	.....	26	10
Mexico	21,435	36,749	38,729	69,100	70,159	61,978
South America	.....	911	1,186	1,574	3,168	2,340
Other foreign	18	149	4	38	.....	.....
Foreign base bullion:						
Canada	.....	.....	.....	1,816	.....	.....
Mexico	39,743	32,924	57,489	27,006	31,648	29,143
Total from foreign ore and base bullion	68,546	76,849	97,761	102,857	108,553	94,134
Grand total, derived from all sources	418,699	442,015	408,523	457,045	480,780	500,282

[a] Primary lead is that smelted from ore.

PRODUCTION OF REFINED PRIMARY LEAD IN THE UNITED STATES.

	1907	1908	1909	1910	1911
Desilverized lead	284,432	265,351	296,890	301,136	295,357
Soft lead	99,948	101,013	118,302	141,318	155,947
Desilverized soft lead	29,809	29,869	32,420	27,926	35,672
Total production of refined primary lead	414,189	396,433	448,112	470,380	486,976
Production of antimonial lead	9,910	13,629	12,826	14,069	14,078

CONSUMPTION OF PRIMARY LEAD IN THE UNITED STATES.

	1907	1908	1909	1910	1911
Supply					
Stock in bonded warehouses Jan. 1	5,756	12,944	18,565	17,405	35,972
Imports					
For consumption	15,246	9,805	18,030	15,359	13,281
For warehouse	64,569	102,241	96,145	93,249	76,671
Production from domestic ores	365,166	310,762	354,188	372,227	406,148
Total supply	450,737	435,752	486,934	498,240	532,072
Withdrawn:					
Exports of foreign lead—					
From warehouse	51,447	76,857	86,077	69,786	101,227
In manufactures, with benefit of drawback	8,268	9,254	4,796	8,800	12,880
Decrease by liquidation	4,578	13,425	8,643	7,661	14,812
Stock in bonded warehouses Dec. 31	12,944	18,565	17,405	35,972	4,481
Total withdrawn	77,237	118,101	116,921	122,219	132,600
Available for consumption	373,500	317,651	370,013	376,021	399,472

PRODUCTION OF SECONDARY LEAD IN THE UNITED STATES.

	1907	1908	1909	1910	1911
Pig lead	9,990	7,990	17,822	29,384	[a]27,500
Lead in alloys	15,508	10,543	23,327	25,939	[a]25,000
Total recovered lead	25,498	18,533	41,149	55,323	[a]52,500

[a] Secondary lead is that obtained by refining skimmings, dross, old metals, etc.
[a] Subject to revision.

Ferro-tungsten can be produced in electric furnaces with a power consumption of 4000 kilowatt-hours per ton of metal. At Luton, the power is supplied from the corporation power-station at 500 volts direct current, and is converted into alternating current of low voltage by means of a motor-generator set provided with suitable regulating devices. Three large furnaces are operated alternately, thus utilizing the full power of the plant, and it is proposed to erect two more furnaces, each of about three times the capacity of the present ones. The ore is ground in a ball-mill, mixed with the reducing agent and flux in the desired proportions, and fed into the furnaces. After the smelting is completed, the resulting blocks of metal, weighing 6 to 8 hundredweight (hundredweight = 112 lb.), are lifted out by means of a crane and broken into large lumps, which are subsequently cleaned, broken into walnut size, and sorted ready for the market. Trials are also being made with other high-grade alloys, such as ferro-uranium and ferro-tantalum.

A revival during 1912 is predicted for the North Coolgardie field, Western Australia, which produced 60,270 oz. last year, and did not fall far short of the previous year's output of 60,887 oz. The chief mine of this field, the Menzies Consolidated, maintained its yield well during the year, and is looking as good as ever. Numerous small outcrops at Tampa and elsewhere have been taken up by small companies or syndicates, prospecting work has been fairly active, and the field begins this year with better prospects than last.

Discussion

Readers of the Mining and Scientific Press are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Government Bureaus and Potash

The Editor:

Sir: In the issue of March 30 of the *Mining and Scientific Press* I find an editorial on the subject of 'Government Bureaus and Potash.' I have no desire to enter into a controversy, but the wording of your article and the misstatements contained in it call for an emphatic reply.

At the outset I wish it understood that I assume full responsibility for the press bulletin on Borax Lake. The Bureau of Soils cooperated with the Geological Survey in the search for potash, and F. K. Cameron of that Bureau participated in the preparation of the press bulletin in question to the extent that it met his approval as prepared; the first page of the bulletin containing some facts which failed to please you was written by myself except so far as the wording of the telegram from the field was adopted.

I am glad that you admit that it is highly proper for the Bureaus in question to undertake to discover potash salts within the boundaries of the United States. Considering that special appropriations had been made by Congress for this purpose, it was not only proper but imperative for these Bureaus to undertake this task. The method of investigation and the publication of the results were left to the discretion of the Bureau chiefs, who have followed their best judgment. Congress wisely did not request them to follow the guidance of the press or of private parties who themselves were investigating the subject. While I regret that you think our method of publication "a disgrace," I fail to understand what method you would have recommended. Possibly you would have preferred to have the Geological Survey preserve silence until the matter had been fully covered in detail by the preparation and publication by the Survey of a well illustrated professional paper and the "private parties" could have had an opportunity to ascertain the extent and location of similar deposits, if such exist? As I see it, it is beyond question the duty of the Geological Survey to publish important data of this kind at the time when they are needed and not several years afterward. Truly you are hard to please: in one issue the Geological Survey is scolded for dilatoriness in its publications and in another for publishing the results too soon.

Your complaint is, it appears, that the press bulletin on Borax Lake contains sensational statements and not accurate information. You attack the bulletin as "disgraceful" in its estimate of the amount of potash in Searles lake, and with more experience in mine sampling than in the evaluation of brines you ridicule the assertion that a great tonnage of potash salts are here available. Permit me to say that I am still of the opinion that the estimate of four million tons of potash is conservative and that probably the supply is much greater. If in a uniform area of lake basin of eleven square miles six wells are sunk at widely distributed points and yield practically the same results in percentage of potash down to a depth of 60 feet, I consider that there was full justification for the assumption of uniformity throughout. In these salt marshes there is unquestionably a sufficiently free movement of brine through the mass to give a high degree of uniformity in content of potassium salts, which are among the most soluble of those in solution. You refer to such reasoning as "facile leaps"; I would call it good logic.

You question whether the data given are accurate. Your acquaintance with the Geological Survey might have led you to assume that they would not have been issued unless reliable. As a matter of fact, control analyses were made at the Survey laboratory in Portland. The statements as to the tonnage and availability of the supply of potash were issued as a *preliminary bulletin* and to furnish the people with information at the earliest possible moment. You will find in almost every sentence qualifying words indicating that the results are not final: the concluding sentence of the first page that, "at any rate it appears that this locality constitutes a very important source of potash in probably readily available commercial form," goes to make the press statement no more conclusive than we believed then and believe now the facts warrant.

You are evidently not aware of the exact facts in the discovery of potash at Borax lake. The deposits have been worked for borax and prospected extensively for soda by several different parties. All of this prospecting had been for the purpose of testing the brines and salines for sodium salts. No tests for potash were made. More recently some of the interested parties had three analyses made for potash on composite samples made up from old residue material on hand in the laboratory. Only one of these showed any appreciable amount of potash and it was questioned by the parties themselves whether the analysis was reliable. To the best of my belief this was the only scrap of exact information available to anyone interested in the Borax lake, until March 5 when the representatives of the Geological Survey and the Bureau of Soils jointly visited the locality and took careful samples of the brines from the six wells. While therefore the presence of potash was known before the visits of the Government men, Messrs. Gale and Free, the results of the analyses of the six samples was the first positive information available as to the exact amount and the uniformity of the contents of potash, even to the owners or proprietors of the Borax lake.

Your final accusation of "self advertisement" by Government bureaus is hardly supported by the fact that the Geological Survey is mentioned only twice in the offending bulletin in connection with the potash of Borax lake, but it leads me to inquire just how you would prefer to have a Federal bureau make authoritative announcement of information which it believes of public interest and benefit? I am not a little puzzled by your request for information as to the potash minerals in the brine. The potassium compounds are present in water solution, and if you will inquire from chemists you will find that with a mixture of salts in solution your query cannot be answered. In conclusion, I maintain that the Geological Survey was fully warranted in issuing the press bulletin of which you complain; that it has acted for the best interest of the people; that the facts are correct, and that future development will probably justify my position.

GEO. OTIS SMITH.

Washington, D. C., April 9.

[Our primary objection to the press bulletin criticized is the sensational form of the statement; secondarily, we question the accuracy of the estimates. No careful reader of the *Mining and Scientific Press* can have any doubt of our approval of promptness in publication on the part of the Survey. Indeed, among the excellent things that the present Director has accomplished, few rank higher in our estimation than the speeding up of the whole organization and particularly the decrease in lapse of time between field work and publication. While Presidential messages based on telegrams from field assistants may suggest an undignified scramble, we would not argue for dignity as against results. Neither have we any predilection for pretty reports or for elaborate, time-consuming illustrations. Prompt publication of reports that are simply and clearly written and which contain such illustrations as the circumstances demand, are what is desired by all the good wishers of the Geological Survey, among whom we claim a place. Our objection to sensationalism in a particular press bulletin can not fairly be interpreted as a criticism of the series or of promptness in publication. Surely there is no real confusion on this point.

In our judgment the particular bulletin to which objec-

tion was made was sensational and misleading in two particulars. In the first place, it announced as a "discovery" something that was previously well known to a considerable number of people, to most if not all of those concerned; in the second place, there was no suggestion of the fact that the lands concerned are not open to location but are already covered either by patent or location.

Searles lake or Borax lake has been known, as is stated in the original bulletin, for many years. It has been repeatedly investigated by engineers and chemists, and chemical works are now in existence on its borders. Borings have been made, at private expense, and much is known (as also much is unknown) about the content of the lake or *playa*, as it is better called. The samples taken by the Survey officials must have come from wells put down and owned by private parties. We are informed that the official had a blueprint showing the position of these wells, and probably also one showing the results of previous tests for salts other than those for potash. Scant recognition of all this previous work, which cost thousands of dollars, appears in the Survey bulletin. Furthermore, the Director is evidently not aware of the exact facts in the discovery of potash at Borax lake. It is true that potash was not taken into account at the time the original sampling was done, but its presence had been discovered some months ago. It is also true that many more than "three analyses" had been made, and it is not true that "only one of these showed any appreciable amount of potash and it was questioned by the parties themselves whether the analysis was reliable." As to these matters, the Survey officials were evidently not completely informed. So well established was the fact that potash was present, that negotiations have been conducted in New York for the sale of the property, and in fixing the price the probable value of the potash entered. Presumably the Survey officials knew, or could have known before visiting the property, that potash had been found there. Their observations are confirmatory, but they do not amount to a discovery—and the difference is large in advertising value.

In the second place, the bulletin was misleading in that there was no suggestion that the lands concerned are, in the eyes of the courts, if not on the records of the Land Office, private lands. Some of the land has been patented and the remainder is held by location; the very wells from which samples presumably were taken, were put down in performing annual labor on the claims. The California Trona Co., in particular, has large holdings, and its title was considered sufficiently good to warrant the Foreign Mines Development Co. in advancing considerable sums of money protected by a mortgage, which, it happens, was recently foreclosed. A locator has about as much chance to secure a share of this newly "discovered" potash as he has to file on part of the White House lot. Yet the bulletin was written in such terms that a stampede to the district resulted. We do not see that there is any public benefit in producing such a result, and much individual hardship is sure to follow.

Aside from the Sunday supplement style of the announcement, there is a question as to the accuracy of the figures furnished by the Survey. An estimate that ranges from 4,000,000 to 10,000,000 can not be very exact at best. Into its making entered (*a*) the accuracy and uniformity of the samples and analyses; (*b*) the salinity of the brine; (*c*) the percentage of brine in the salt body; (*d*) the area covered by the sampling. We have no question as to the accuracy of the analytical work, and it is stated that results indicate that the brine is nearly uniform throughout the flat—which statements of fact are accepted without question. Other sampling and analyses, however, give lower results both as to content of potassium and salinity of the brine. The latter is necessarily related to rainfall. The assumption that the salt body contains 25% by volume of brine, is necessarily arbitrary. It may be right or it may be wrong. There are no data available for checking or controverting it, but on its accuracy the whole estimate stands or falls. It is known that the solid salts, principally sodium chloride and sodium carbonate, vary greatly in purity and distribution throughout the lake, and also that the structure of the rock mass, if that term be applied to the body of crystalline salts, also varies through a wide range. Presumably its porosity does the same, and it is an open question how much brine there is in the lake; a question that, so far as we know, has never been tested thoroughly by pumping. There may be as much potash in the lake as is estimated by the Survey—there may, indeed, be much more—but we do not believe that the available data warrant any such estimate on the part of a technical bureau supported by the Government, an organization that should deserve and have a reputation for the highest accuracy. The estimates would be in place in "the prospectus of an irresponsible promoter", and despite the qualifying phrases upon which the Director insists, the public will be fortunate if they are not widely used in such literature.

There is still another question involved. The potassium, as the Director suggests, is in solution in the brine and while in that condition can not be considered to be in any particular combination. It is important, none the less, to know the form of combination in which it occurs before going into solution, and especially the form in which it can be recovered. While data on these points are not complete, they point to the occurrence of the potassium as a chloride. It happens that this is the less easily available form. For use in fertilizer, which must be the main market, the sulphate is preferred; particularly in the Western states where fertilizer is in demand mainly for sugar-producing crops or fruit. A process for converting the chloride to the sulphate has been devised, but it increases the cost of the finished product and is an important obstacle to development. There is plenty of aluminum in clay, but practically it is not commercially available. The potash as chloride is by no means as unavailable as the aluminum, but there is point, none the less, in the analogy, and this point has been commonly overlooked in discussion of the potash situation. The attempt to obtain potash from Pacific Coast kelp is proving disappointing for this among many other reasons. There are many conditions connected with trade organization which make it certain that the development of a profitable potash industry in the United States is for the present improbable. Announcements of discoveries so worded as to lead to stampedes to the desert and to promotion of potash companies are, therefore, harmful rather than helpful. Eventually we hope to see the United States independent in the matter of potash supply. There will be ample time before this occurs to permit the Survey to prepare a most elaborate report, even if there is not time before Congress adjourns. In brief, we consider the offending bulletin to have been better calculated to influence Congressional opinion favorably in the matter of appropriations than to help development of an American potash industry, and we regret to see the Survey resort to such means for justifying its work.—EDITOR.]

The Mine-Owners' Liability for Accidents

The Editor:

Sir—The new order of dealing with the problem of industrial accidents which had, as I have shown in my preceding letters, been evolving out of chaotic conditions for the better part of a century, was first given authoritative and general application in Germany in 1884 at the instance of Bismarck as a paternalistic counter-movement to the Socialistic proposals of the Social Democrats. The substance of Bismarck's economic creed was this: "Every able-bodied worker in Germany is an asset of the Fatherland and it behooves the Fatherland to take good care of him to the end that his toil may make the Fatherland rich."

Germany has done this better than any other nation, and for that reason Germany has become industrially the most efficient nation on the globe, and 'made in Germany' has become a household saying the world over. At first German employers protested that Bismarck's policy would bankrupt them and, especially, that it would shut them out of

the markets of the world, inasmuch as their commodities would have to meet in the open market the commodities of other countries in which the cost of industrial accidents was thrown upon the workers instead of upon the employers. Bismarck told them not to worry; that the nation that took the best care of its workers would prove the most efficient, and therefore the cheapest, producer. It was so, and today German products compete successfully with British in all the markets of the world. All of continental Europe soon saw the beneficial results of Germany's experiment, and made haste to follow Germany's example.

Great Britain also saw, but hesitated to undertake compulsory insurance, as Germany had done, for the reason that British genius and inheritance do not so well lend themselves to compulsion as to persuasive and permissive methods, reinforced by individualistic initiative. Nevertheless, British sentiment had long ago resented the heartless doctrines of Lord Abinger and Parliament had greatly modified them, but still made negligence the basis of claim until 1897, when compensation without regard to negligence was made compulsory as to certain hazardous occupations. The new order was extended in 1900 to cover farmers, and, in 1907, to cover all employers in Great Britain. Nearly all of the British colonies have followed the example of the mother-country. Insurance is not made compulsory, as on the continent of Europe, but compensation is compulsory as to all employers, if not as to all employees.

The United States, deriving its laws mainly from the Common Law of England, and not, as on continental Europe, from the Civil Law of Rome, has followed the British example as to compensation for industrial accidents with the exception that employers are afforded the right of a choice between a reformed law of liability, still based on negligence, and compensation without regard to negligence. This has been done because the courts have taken to themselves powers of nullification of legislative acts, on grounds of unconstitutionality, that no court in Great Britain has power to exercise in relation to any act of Parliament; the authority of Parliament, and not that of the courts, being the supreme law of that land. Nothing in this country becomes compulsory that a united public sentiment does not force upon Congress, legislatures, and courts alike, and public sentiment has not, in this state and country, as yet become sufficiently educated to the need for, and justice of, compensation to justify compulsory measures.

Therefore the new order in this country, including California, mainly consists in abolishing the infamous old common-law defenses of assumption of risk and fellow-servant, and in the modification of the doctrine of contributory negligence to a doctrine of comparative negligence, under which injuries will be recompensed in damages in proportion to the degrees of negligence which employer and the injured person respectively contribute to the injury. This new order is supplemented with an optional compensation system, without regard to negligence, which the employer may or may not operate under, as he chooses. Every employer of labor in California must do business under one or the other of these two laws, liability in damages for negligence or liability for compensation without regard to negligence. No other country gives the employer any such power of electing what law he will do business under. In all countries where the compensation theory has been adopted in lieu of the negligence theory, the employer is bound absolutely. In Great Britain the employer is bound, but the employee is not. In that country the employee may, after he has been injured, elect whether he will proceed against his employer, first, for damages under the common law, with the old common-law defenses about as they were when Lord Abinger laid them down, or under the employers' liability law of 1897, which greatly modified those defenses, or, finally, under the compensation law without regard to negligence, as provided by the statute of 1907. But so satisfactory is compensation, with its limited payments, that during 1910, out of, in round numbers, 282,000 accident claims only 217 cases were carried into the courts outside the compensation law.

The abrogation and modification of these old defenses by the first two sections of the Roseberry law have probably increased the liability of employers in damages for such accidents as occur to their employees, three or four times over. In other words, instead of having to pay damages for injuries in only 8 to 12% of the actions brought against them they will probably have to pay damages in 25 to 50% of all such cases. Furthermore, the tendency in suits for damages is for juries to come closer year by year to allowing the claimant all that he has lost, including payment for pain and suffering and disfigurement, as well as for loss of earning power for the rest of his life. The value of an industrial life has been rated ridiculously low by courts and juries, but the sums assessed in damages have doubled within ten years, although they will probably have to double again before reaching a parity with the losses suffered by those who are hurt.

It may be of interest to note, just here, how actuaries estimate the value of a life as a basis for annuity insurance. A man of 21 years, in good health, is estimated as having a capitalized value of $6303 for each dollar-per-day of wages earned; a man of 30 years is set down at $5883 for each dollar-per-day; at 40, $5235; at 50 he still has a value of $359 for each dollar-per-day of earning power, and at 60 he is worth $3309. Even at 70 he is rated at $2244. These figures are based upon actuarial mortality tables of long standing and are used to compute the present value of annuities, and, taking into account, as they do, the uncertainties of life, afford a very good standard for measuring the monetary loss to a family of the life of a breadwinner. A miner who earns $3 per day would have a capitalized value to his dependents of three times the figures above quoted for the ages given. If ever courts and juries resort to such tables for computing damages as insurance companies use for computing the value of lives there will be such a rush of employers to get under compensation with its limited liabilities as will give the compensation provisions of the Roseberry law all the efficacy of a compulsory statute, and the trend of events is unmistakably in that direction. In my next letter I will set forth the four-fold justification of compensation, as a principle to be applied to the settlement of claims for industrial accidents as contrasted with the negligence theory of adjustment.

A. J. PILLSBURY.

San Francisco, March 25.

THE U. S. Geological Survey's estimates of the coal areas of Texas show that the bituminous fields known to contain workable coal cover 8200 sq. mi., and that 5300 sq. mi., not so well known, may contain workable coal. The known lignite areas cover 2000 sq. mi., and there are 53,000 sq. mi., extending from Sabine and Red rivers on the east and north to the Rio Grande on the southwest, which may contain workable beds of lignite. The estimated original supply of bituminous coal in Texas is placed at 8,000,000,000 short tons and of lignite at 23,000,000,000 tons, making a total of 31,000,000,000 tons as the original supply. From this there had been mined to the close of 1910 a total of 20,056,941 short tons, which represents an exhaustion of approximately 30,000,000 tons, the exhaustion being one-tenth of 1% of the original supply. The supply left in the ground at the close of 1910 would be equal to 19,000 times the production of that year.

MAMMOTH COPPER CO., of Klondyke, Queensland, is engaged in the preliminary work of smelter construction. The following are the principal mines under control of the company: Chieftain (working), Allen, Koeppeck, Lochinvar, Ladrone, Lamington, Noonday (working), and Mountain Maid. The erection of the smelter will be an inducement to other owners in the district to develop their claims.

ORE shipped from Norwegian ports will hereafter be weighed by public weighers, who at the request of shippers will weigh or control the weighing of ores for export, and for each shipment will furnish a certificate of weight to accompany the ship's papers.

Special Correspondence

NEW YORK

MEXICAN DEVELOPMENT AT A STANDSTILL. — PORCUPINE ISSUES DISCARDED. — COPPER SITUATION. — COMPANY NOTES.

The mining situation in Eastern financial centres, particularly in New York, is a peculiar one. There is not at this time any mining district in process of exploitation in which any part of the market public is interested. A very large share of the mining activities in New York is curtailed by reason of existing conditions in Mexico. Mining men who have recently returned from the other side of the Rio Grande are apparently a unit in declaring that intervention is the last thing that is wanted. On the other hand, intervention appears to be the next important move on the program. New Yorkers are told that American mining properties in places such as Guanajuato, Pachuca, El Oro, and similar centres have been turned into fortified camps and provisioned with rations, arms, and ammunition to withstand long sieges. Naturally, under such conditions there cannot be any steps taken in the development of new enterprises.

The formal opening of the mill of the Dome property at Porcupine was an event which passed without exciting any comment. The destruction of the power-plant by fire marred the celebration a little, but damage was repaired in time to proceed without interruption. The market followers have almost entirely discarded Porcupine issues, and so far as New York is concerned, the district can hardly be said to be now on the map.

Sixteen-cent copper is having a reviving effect upon many of the producers that have lain idle for a time. The old Santa Fé Gold & Copper M. Co., with properties in Santa Fé county, New Mexico, is to be once more placed on a producing basis if present plans mature. The property is equipped with a small smelter, to be blown in during the present summer. The property is capable of a production of 3,000,000 lb. copper per year at a cost of 11c. per pound. This property is a subsidiary of the General Development Co. Granby made up some of the ground which it lost a year and a half or more ago when it made its sensational drop in price, and scored a rise of about ten points on its improved prospects. A rumor was at once started that dividends were to be resumed, but this is authoritatively denied by officials of the company. There has been a great improvement in conditions at both the Grand Forks property and the Hidden Creek ground. The old property is now earning about $100,000 per month net, while the conditions at Hidden Creek justify an estimate of a production of 30,000,000 lb. per year, at an 8c. cost within the next two years. Granby is one of the older properties that is due for a new and vigorous lease of life under the stimulus of 16c. copper. At present the company is spending about $20,000 per month in the development of the Hidden Creek property. Plans for a smelter are for the present held in abeyance, but it is realized that before the Hidden Creek property is brought up to its full capacity the question of a smelter must be determined. The improved outlook in copper has had its effect upon even such issues as Ohio Copper, in which the trading has reached a fairly respectable volume recently in New York. The reports from the property are not altogether encouraging. A. E. Wall has been handling the mill; the tonnage being treated, and the results obtained are said not to be by any means satisfactory. Ohio Copper is one of the porphyries that ought to show great improvement if it ever comes into its own.

The annual report of the Nipissing Mines Co. has just been issued; the most interesting item being the production of 5,197,042 oz. silver at a cost of 13.95c. per ounce. This cost compares with 14.71c. in 1910 and 16.39c. in 1909.

A special meeting of the Guggenheim Exploration Co. has been called for April 17 to authorize a division of the present stock issue into shares of $25 par value. This will not change the outstanding stock of the company, but will simply give the shares a lower denomination, so that trading will be easier to handle. The Guggenheim Exploration is to be listed on the New York Stock Exchange and will undoubtedly be one of the market favorites. The Greene-Cananea management is considering plans to alter the par value of its stock, with the idea of reducing the number of shares from 2,500,000 to 1,000,000.

Shareholders of the Utah Consolidated are feeling somewhat discouraged. This is one of the copper properties that has not been rejuvenated. The annual report recently

MEXICO MINES OF EL ORO.

put out shows less than one year's supply of ore in sight, and unless future developments are much more favorable than those shown during the past year, the end of operations is apparently close at hand.

BOSTON

PRODUCERS' REPORT ENCOURAGES BULLS.—MAYFLOWER AND OLD COLONY 'GUESSING CONTEST.'—BOSTON INTEREST IN GRANBY.

The Copper Producers' statement, made public April 9, supplied an additional bull feature to the copper-share market. It had been predicted in Boston that the statement would show about a stand-off between production and deliveries. A further decrease in the supply of 572,431 lb. was favorably construed by market interests. Boston believes that the surplus of 62,327,557 lb. as of April 1 has reached as low an ebb as is desirable for the healthy maintenance of the copper industry. This surplus is the smallest amount reported since the Copper Producers' Association was formed and began to give its monthly statistics. With a record output of steel, with which copper travels as a companion, and the extraordinary foreign demand for copper, Boston is of the opinion that the metal will hold its rise, subject to the ordinary ebb and flow, for some time to come. Copper has sold higher than 16c. in Boston, and predictions are freely made that 18c. will be reached in the near future.

Boston is being treated to something of a guessing contest on both Mayflower and Old Colony. Anonymous letters have been circulated freely for the special purpose of boosting Old Colony, asking the question whether it is not as cheap as Mayflower. Almost before the No. 14 drill had got fairly started, the news was wired here that Old Colony had found the Mayflower lode. The facts were that it had not had time to find anything. It is not likely that the lode will be encountered above 800 ft. depth. Mayflower has its No. 18 drill down over 700 ft., with about 600 ft. more to go, which will take until the latter part of April. Mayflower recently sold at 17¾. Old Colony has not yet reached its high price of 21½.

made in 1909. It has about 10 points to go yet in that direction. These stocks are still very closely held, within a few hands, this being especially true of Mayflower, and the putting up of prices has been an easy matter.

The recent interest in Granby's market revival is natural in Boston, since Boston got in early in Granby's promotion a few years ago. The Granby management expects to start building this spring the proposed new smelter at Goose Bay, B. C., where it will treat northern British Columbia and southeastern Alaska custom ores. The Hidden Creek property, recently acquired by the Granby, is being put in condition for production during 1913. It is expected that the new property will produce around 30,000,000 lb. copper at a cost of not over 8c. per pound, with combined output of the new and old properties around 50,000,000 lb. at a cost of 8½c. per pound. The new smelter is to be built for custom purposes and to treat the Hidden Creek ore. Granby's market improvement is due to work getting under way at the old property and 16c. copper. There is some talk of an early resumption of Granby dividends, but this is denied.

PIOCHE, NEVADA

EARLY HISTORY OF THE DISTRICT.—W. S. GODBE'S WORK.—EFFECT OF RAILROAD FAILURE.—LEADERSHIP OF E. R. WOOLLEY.

Since the Salt Lake railroad was washed into the Pacific Ocean on January 1, 1910, no one at a distance from Pioche could gather satisfactory and conclusive information about the district from any of the ordinary sources of publicity. Certain officials of a great corporation, whose interests are closely interlinked with those of the district, gave interviews apparently intended to induce a belief that Pioche had proved a failure. Spasmodically certain brokers in various cities wasted much good paper and ink in telling of wonderful impending developments which never developed. Lawyers were much in evidence and, however it might be with others, they were continuously 'working' the district for profit. Only recently has there been a prospect so definite that a prudent man could have been justified in making plans, as based upon reasonable certainty. So many changes have taken place here in corporate ownership and control that a brief review of the salient facts in Pioche history is essential to a lucid understanding of present conditions and probabilities.

Mining began here in 1868, when Pioche was three hundred miles from the only railroad in the West, with scarcely a hundred white neighbors in a hundred miles. The heaviest producing mines were owned by the Raymond & Ely M. Co. and the Meadow Valley M. Co. The banner year was 1872, when three companies distributed nearly $3,000,000 in dividends. The ore was milled at Bullionville, twelve miles distant, where at one time practically a hundred stamps were in continuous operation. Water was met at a depth of 1200 ft. in 1874, and near the water-level the character of the ore changed and it could no longer be treated by amalgamation. In 1876 the light flickered for a few months, and finally went out.

In the eighties and early nineties W. S. Godbe, a man of remarkable energy and ability, and with strong backing, made heroic efforts to revive the district, but in 1892 misfortune befell the U. P. R. R. Co., which had graded to within sight of the town, and compelled that company to abandon its plans for Pioche. Coma followed for twelve years.

In 1894 the best of all the old properties were gathered together by the Nevada-Utah Mines & Smelters Corporation. This company also included in this district the Day mine, on this side of Bristol mountain, fourteen miles northwest of Pioche, the narrow-gauge railroad leading to it from the Pioche depot of the Salt Lake, thirty-two mile branch line, and certain disconnected properties in the region, more or less in the prospect stage. About that time the mines on the farther side of Bristol mountain, sixteen miles distant, were gathered together under the corporate control of the Bristol Consolidated M. & S. Co. The Bristol mountain mines on both sides of the range were very rich, and for many years yielded large amounts. When the Godbe campaign collapsed, these mines also went into enforced repose. W. S. Godbe died, leaving three sons, who always held the district in the same esteem as their father had done. They obtained, through their father's estate, a half interest in the Pioche Water Co., which is a very valuable asset, because it is the town's only source of water supply. This they held jointly with the Nevada-Utah, and also certain valuable mining property.

In 1906 they began to develop the Susan Duster mine, then a recent discovery, owned by the Ohio Kentucky M. Co. In this virgin ground they opened an enormous deposit of silver-lead-zinc ore, similar to the ore of the Black Ledge, to be referred to again. Later the Ohio-Kentucky M. Co. took over another old property, with similar ore, which had not been secured by the Nevada-Utah. But the great achievement of the Godbes consisted in opening an early-day mine, rechristened the Prince, under the corporate ownership of the Prince Con. M. Co., which was controlled by them. Just before the railroad went out, the Prince mine, at an expense exceeding $30,000, was exhaustively examined by an engineer of national reputation, and a tonnage running into the millions disclosed of the most desirable fluxing iron-manganese-silver-lead ore ever known in the West.

Negotiations for acquiring control of the Prince in the interest of the U. S. S. R. & M. Co. were nearing completion when arrested by the destruction of the railroad, which caused them to be abandoned. For half a year the engine and passenger coach left here by the receding floods remained chained to the track. A little desultory work was done and a few cars of ore shipped. The most important prerequisite to satisfactory activity was a spur track to the Prince mine, a distance of eight and three-fourths miles. Its fluxing ores were of too low grade to stand wagon haul for that distance. Its vertical and bedded veins of silicious ore, while sufficient in themselves to make a great mine, could be worked with proper economy only in conjunction with the fluxing ore. With this spur once built, there could be no doubt about the outcome for both the railroad and the district. But railroads cost money. The Prince treasury had been exhausted in opening the mine, previous to the disaster. At the conclusion of its period of 'innocuous desuetude' the railroad resumed its old train schedule, soon changed this to semi-weekly, and as if with a fatuous purpose to destroy the district, immediately reduced that to weekly. All who could escape fled precipitately.

Such were the conditions when Ernest R. Woolley, of Salt Lake City, suddenly came into the limelight as the controlling factor in Pioche affairs. A professional promoter, with limited means of his own, and without any large backing that was ever disclosed, the announcement was suddenly made that he had secured control of the Nevada-Utah and been elected its president. The Nevada-Utah Mines & Smelters Corporation, with its 1,500,000 shares, distributed among 8000 shareholders, had for years been a football of mining speculators. With a par value of $10, Thomas W. Lawson, shortly before the panic of 1907, during one of his characteristic campaigns, ran the shares up to $8, giving the property a nominal market value of $12,000,000 and filling its treasury with a handsome development fund. When Woolley was elected president this fund had been virtually dissipated by injudicious methods and the company's affairs were in a precarious condition. He, however, appointed Harry C. Parker superintendent, and work was resumed on the Day mine, which soon began producing 50 tons per day, and this output was gradually increased to 100 tons. At about the same time work was resumed on the No. 1 mine of the Consolidated Pioche M. Co., a corporate name which had been given to a former consolidation of certain conflicting interests of the Nevada-Utah and Ohio-Kentucky. This work was pushed to a junction with the old Raymond & Ely 1200-ft. level, and resulted in finding the old Black Ledge, a

lead-silver vein opened by the Raymond & Ely in the '70s. H. H. Day, manager of the Raymond & Ely, believed it would restore that company to great prosperity. W. S. Godbe explored it to the 1500-ft. level and found it so promising that, largely because of it, he persuaded the Union Pacific railroad management to start building to Pioche. The meteoric Woolley regime, its conclusion and results, make a story of absorbing interest, which must be deferred to another letter, as must also the story of how the Prince Con. M. Co. found a way out, and why it is today constructing its own railroad to the Prince mine.

JOHANNESBURG, TRANSVAAL

DIFFERENT PHASES OF THE EAST RAND PROPRIETARY MINES AFFAIRS DISCUSSED.

After all, there was no struggle for the control of the East Rand Proprietary mines, a compromise having been mutually arranged between Sir George Farrar and the Central Mining & Investment Corporation. This arrangement was fully endorsed by the shareholders at the annual meeting, the majority of whom fully recognized the past services of Sir George, the principal founder of the company, as far outweighing any advantages likely to be gained at this late hour by the change of control of the company's affairs. It is quite true that many shareholders were somewhat disappointed at the apparent shrinkage in the ore reserves after so much prominence had been given at the previous annual meeting to the excess development, but it is not difficult to see that this shrinkage is more apparent than real. Those who are thoroughly acquainted with the property will know that Ross Skinner's report shows all the bad features it can and fails to recognize any encouraging feature the mines may seem to possess. When this is properly understood neither Mr. Skinner nor Mr. Anderson, the acting general manager, can be blamed, for the lower they can base the start the more will be the aggregate success they can show. Nevertheless, while the property in parts has bad prospects, there are some good points about which even the shareholders should know. It was disappointing that Mr. Skinner, when appealed to at the meeting of the shareholders, did not on the spot refute the figures given by one shareholder that this huge property had an estimated life of only ten years. Then again it seems due to the shareholders that when they are told of the water feeders likely to be found when the water-dike is intersected they should also be made acquainted with the fact that wherever this water-dike has been cut, sufficient improvement in ore has always been found to more than pay for the extra cost of pumping. No one will attempt to justify the sending of waste rock to the mill or abnormal quantities of low-grade ore, but in such a property of varied ore grades as that of the East Rand Proprietary Mines, where many million tons run close to the profitable grade, it frequently becomes necessary to work low-grade ore to get at one of better grade. Such a well equipped property as the East Rand must be worked and handled in a liberal manner. There is also something to be said in the case of the East Rand Proprietary Mines as regards large-scale working and bringing down working costs so as not only to maintain the recent profits but to mine many million tons of ore which at a fair working cost would be profitable.

The prevailing opinion here is that Messrs. Skinner and Anderson have, not unwisely perhaps, represented the property at its worst, so as to make it all the easier to earn credit for the results bound to follow the adoption of a good, sound, and straightforward method of mining. The recent disclosures in connection with the East Rand Proprietary Mines with regard to the calculation of tonnage milled continue to cause discussion. It does not seem to be generally known that the method of arriving at the tonnage milled is, with very few exceptions, on the Rand a loose one. At not a few mines it is based on results or even merely guessed. No wonder need be expressed that at the East Rand Proprietary Mines, where so many irregularities existed in the late administration, the manipulation of the tonnage milled should be regarded as of small importance. Those who have had any experience outside of the Rand will know that, were it desired, absolute accuracy could be obtained.

A writer in a local mining paper professes to be incapable of understanding Mr. Skinner's explanation for the apparent increased costs of working during the latter end of 1911. He suggests that the mine manager would be 'emancipated' by the adoption of the idea of working profit for work-cost as a means of comparison of efficiency. It is quite clear from Mr. Skinner's report that the working costs at the East Rand Proprietary Mines have been apparently increased, or, perhaps it would be better to say, brought to their proper level by more accurate calculation of the tonnage milled through not using a too small unit of measurement, and also by charging the whole mining cost to that instead of to the development capital account. It is clear that the new policy of calculating the working cost must have a double-barreled effect, by decreasing the tonnage estimated to be milled through adopting a correct unit of measurement, and thereby creating a smaller division, and charging the full mining expense to revenue. The plan of 'emancipating' the mine manager by adopting the profit for cost as a means of comparison is generally recognied on the Rand, but not perhaps in the sense I have suggested. During the past six months as many managers have been 'emancipated' because they failed to produce the expected profits. It was this race after profits that delayed and intensified the clean-up at the East Rand Proprietary Mines.

BLACK HILLS, SOUTH DAKOTA

NEW ASSAY SCHEDULE.—MOGUL TO REBUILD MILL.—HOMESTAKE REPORT.

A new schedule of prices for ore-assays has been put into effect by the United States assay office, at Deadwood. An assay for gold and silver will be made for $1, and iron, lead, zinc, tin, and copper will be determined for $1 each. It is stated that this is the only Government office where this price has been made effective, and it will no doubt be liberally patronized. Formerly $3 was charged for an assay for gold and silver. The insurance companies have made a satisfactory adjustment with the Mogul company for the damage sustained by the recent fire at that company's cyanide mill, and as soon as the money is paid over the work of rebuilding will be started. A sweeping decree in favor of the defendant, in a case brought in Detroit, Michigan, clears up the Golden Crest situation to a marked degree. In the suit a stockholder sued for an accounting of the money spent on the property. He wanted to know what had become of $750,000. Mr. Bailie, president of the company, was able to explain the matter fully, and in addition to finding for the defendant, the court also ordered a large amount of stock and two large notes cancelled. This leaves the company with only a small bond issue and a judgment for $125,000. It is understood that the money is in sight to pay the judgment and resume work. The property is one of the best equipped in the Black Hills, having a 40-stamp mill, a tube-mill, and a Moore filter. Everything about the property is in excellent shape, and it should be one of the most economically operated in the country. The shaft is 300 ft. deep and shows a large body of milling ore. The mill has never been operated, and it seems to justify the old saying, 'a good mine must be tested by litigation.'

The Homestake M. Co. has issued a report covering nineteen months' operation, from June 1, 1910, to December 31, 1911. The fiscal year of the company being changed to conform to the calendar year caused the company to hold back the report for the past fiscal year. The report shows the following for the year ended June 1, 1911: Ore milled, 1,468,263 tons; recovery, $5,251,454; per ton, $3.5766; dividends, $1,310,400; hydro-electric plant expenditure, $393,088; net loss, $397,537. For the seven months ended December 31, 1911: Ore milled, 888,057 tons; recovery, $3,661,152; per ton, $4.1205; dividends, $764,400; hydro-electric plant expenditure, $231,134; surplus, $414,261.

There is broken in the stopes 1,883,277 tons, and there is enough blocked out and unbroken ore to supply the 1000 stamps for twenty years. A recent development of fluorite in the property of the Echo G. M. Co., at Maitland, is causing much discussion. The body is an inch to a foot in width, and carries a little gold. It is near a phonolite dike, and work is under way to explore its junction with the dike. Should it follow the Cripple Creek precedents, a body of high-grade ore may be developed.

LONDON

PLANS OF THE SOUTH AMERICAN COPPER SYNDICATE. OROVILLE DREDGING REPORT. PATO PLACER MINES.

I have referred briefly to the reopening of the Aroa copper mine in Venezuela. Further particulars of recent output and intentions are now at hand. The South American Copper Syndicate was formed in 1907 for the purpose of reopening this group of copper mines, which is situated on the Barquisimeto railway, fifty-five miles from the port of Tucacas, Venezuela. These mines have been known since

DREDGING AT OROVILLE.

the sixteenth century, and from 1882 to 1894 were worked by an English company, the Quebrada Railway, Land & Copper Co. From 1887 to 1894, over half a million tons of ore averaging 8½% copper was mined. In the latter year the workings collapsed, owing to inefficient provision for the support of the overburden. At the time, the price of copper was exceptionally low, so that it was impossible to raise the necessary capital required to recover the mine. The present syndicate acquired the property, after it had been inspected by George Grant Francis, and the reopening has been conducted under the management of W. J. C. Scrutton. The capital of the syndicate is £7500. The amount of cash spent in purchase and development has been £19,950; while £20,625 has been distributed in dividends. The shipment of ore to Europe to December 31 last totaled 31,674 tons, averaging 9¾% copper and yielding 2674 tons of metal. Since the first of the year 4200 tons has been shipped. The directors plan a rearrangement of the capitalization and the raising of £75,000 working capital for the purpose of extending development and providing metallurgical plant.

Last year the Oroville Dredging Co. promised earlier publication of results than hitherto. However, the report for the year ended July 31, 1911, has just made its appearance. As the relations of the English and American Oroville companies and of the English company operating as a subsidiary in Colombia are complicated, it is advisable to give a résumé. The American Oroville company was formed in 1905 to consolidate a number of gold-dredging companies operating in California. As a large proportion of the shares are held in England, a new company was registered in England in 1909 to acquire the shares in the American company and eventually to take over the direct management. As the exchange of shares is not complete, owing to some American holders declining the offer, the American company is still in existence and is responsible for the management. Another step has been the formation of the Pato Mines (Colombia), Ltd., under English law, to acquire gold placers of that name in Colombia, South America, the working capital of which was supplied on loan by the American Oroville company. The report of the American Oroville company for the year ended July 31, 1911, has now been published. As regards the operations in California, 4,433,262 cu. yd. was dredged, yielding gold worth $462,286, at an expense of $261,832, leaving a profit of $200,454. The figures per cubic yard were: revenue 10.42c., cost 5.90c., and profit 4.52c. The yield per cubic yard was 0.5c. less than the year before, and the cost was 1.81c. greater. The figures relating to output and cost for the previous year were: Cubic yards treated, 5,661,612; yield, $561,569; and profit, $275,452. The decrease this year has been due partly to fewer dredges being in operation and partly to a decrease in the content in one part of the property. The profitable ground left to be treated is sufficient to last for five years. Repairs and improvements in the Oroville plant have been suspended until no further funds are wanted at Pato. As regards the latter property, the expenses have been greater than expected, owing chiefly to the cost of the dam. Up to July 31, 1911, $534,129 had been advanced by the American Oroville company to the Pato company, and until the Pato property becomes a producer, no dividends can be paid to the shareholders in the American and English Oroville companies.

AUSTIN, TEXAS

NEW CONCENTRATOR FOR VAN HORN DISTRICT.—TERLINGUA RAILROAD HALTED.—QUICKSILVER PRODUCTION.

Activity in the Van Horn district, west of here, shows a decided revival. The most notable improvement is that of the Hazel M. Co., which is erecting a new concentrating plant at the Hazel mine near Van Horn at a cost of $50,000. Charles A. Cutler, of Dallas, is a heavy stockholder of the company. For several years this property was a large producer of rich copper and silver ore. Operation was suspended a few years ago, but recently development was resumed, and it is stated that a large amount of good ore is now blocked. When the concentrating plant is finished about three hundred men will be employed by the company, it is announced. The improvement which this company is making is causing much attention to be turned to the Van Horn district by prospectors, and a number of claims have been located recently. Several old mines which have been closed for some time will be opened.

The receivership of the Kansas City, Mexico & Orient railroad has caused a temporary suspension of the construction of that road through the district between Alpine and the proposed crossing of the Rio Grande. A. E. Stilwell and associates planned to run a branch line from a point about thirty miles south of here to the Terlingua quicksilver district, but it is now considered doubtful if this road will be built. There is said to be a prospect of the Pecos Valley Southern railroad being constructed through Alpine and thence south to either Terlingua or Boquillas. The territory in Mexico just opposite Boquillas is known to be rich in minerals and a few mines have been opened in that region, but owing to their inaccessibility comparatively little in the way of development has been done.

W. P. Gaines, of Austin, recently organized a company of New York men, in which B. F. Yoakum, chairman of the Frisco board, is interested. The company has taken over a large tract of mineral land in the Terlingua district. Some prospecting has been done. Several outcroppings of rich cinnabar ore have been found. Preparations are being made to develop the property. The value of the quicksilver output of the Chisos M. Co. at Terlingua has averaged about $15,000 per month for several years. The ore is said to be increasing in richness as the depth of the workings becomes greater. Recently new and rich bodies of cinnabar were found in the mine. Several new claims have been opened recently in the Shafter district. A large number of Americans who were prospecting in Mexico at the time revolutionary disturbances began in that country have gone into the district recently and are said to be meeting with success in finding veins of silver.

General Mining News

ALASKA

Prince William Sound

The Cliff mine, says a Valdez report, in March produced $36,000. The last shipment, amounting to $10,000, was made from the mine March 31. A compressor and pump have been ordered, in preparation for developing deeper levels. Ray Millard, who has been superintendent since the operation was started, has resigned his position.

The Tanana

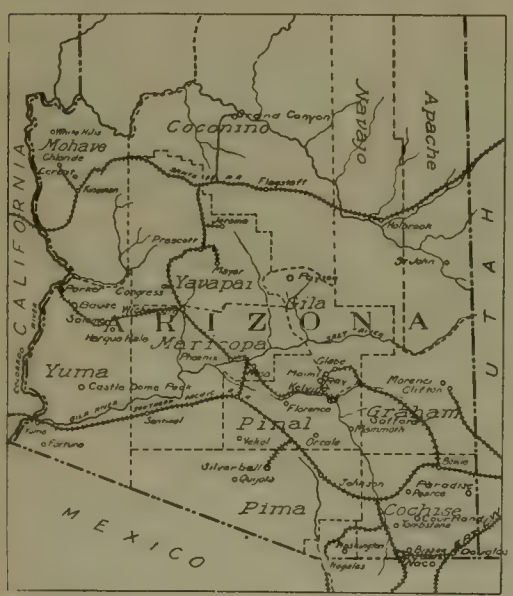
Reports from Dawson state that the Guggenheims are planning to start extensive dredging operations in the Tanana. The Yukon Gold Co.'s No. 1 Bucyrus dredge, which has been operated on Hunker creek, near Dawson, has been dismantled, preparatory to removal to Fairbanks.

Mining has been started on the creeks near Fairbanks. Eglar, Howe & Peterson, laymen on the upper 800 ft. of the Abe Lincoln Association, sank three shafts 60 ft. to bedrock, and found ore assaying as high as 50c. per pan.

ARIZONA

Cochise County

A report from Willcox says that the Calumet & Arizona company has bought from J. N. Kinney his contract with



ARIZONA.

the Commonwealth company for the old tailing dump at that property. The Calumet & Arizona company uses the tailing for converter linings, and formerly obtained it through Kinney.

Gila County

(Special Correspondence.)—The March production of the Old Dominion smelter was 2,412,000 lb. fine copper, of which about 95% was derived from ore from the Old Dominion and United Globe properties, the rest coming from custom ores. A contract has recently been let to the El Paso Foundry & Machine Co. for the construction of a separate flue and dust chamber for the converter plant. Plans are being prepared for the enlargement of the present concentrator 50%, and the classification and mill work are to be improved. The payroll has been considerably increased during the past three months until at the present time the number of men working, including lessees, is about 1200. While the production shows a considerable increase over the February production, the tonnage mined was much greater, owing to the higher price of copper, which makes it profitable to mine ore of lower grade. The concreting of the Kingdon shaft at the United Globe mine has been completed for 305 ft. below the collar. The third section has been started at a depth of 525 feet.

L. D. McClure, managing director, and H. E. Dunn, manager for the South Live Oak Development Co., are superintending work preparatory to exploring, by churn-drilling, the Schultze group of 16 claims southwest of and adjoining the Southwestern Miami. At the Five Points mine of the Manitou Copper Co., eight miles west of Miami, the Cracker Jim shaft caved in last week, burying, under 20 ft. of rock and timbers, Henry Peryam, a miner, who was rescued alive and unhurt after four days and nights. The Miami Copper Co. is mining and concentrating 3000 tons of ore per day and the mill is reported to be doing excellent work. Experiments are being made in the sixth unit with a roughing system, with a view to increasing the efficiency of the crushing department. Emil Deister, formerly of the Deister Concentratior Co., has erected one of his new six-decked slime-treating machines below the first unit.

Globe, April 11.

Maricopa County

Reports from Wickenburg state that the Old York mine is to be unwatered. Thomas Williams is in charge of the property. Work will be resumed also at the Yarnell, where a small force is now preparing for actual production.

Mohave County

Ore said to assay 70% tungstic acid and to be the richest tungsten ore in the United States, is being mined at the Williams property in the Big Sandy district. Kingman reports say that a mill will be built soon on the property to handle the low-grade ore. Seeley W. Mudd represented the investors who recently took over the mines. Ralph Bulkley has obtained rich tungsten ore from his property north of the Williams mine. The C. & O. Development Co. mill is reported to be ready for operation. The Tom Reed shipped a 5705-oz. bar of silver bullion, valued at $70,000, to the mint as the result of its monthly clean-up.

The Shooting Star mine, Stockton hill, soon will make shipments to the smelter, according to a statement by Robert Gray, owner of the property. The Shooting Star vein contains gold, silver, lead, zinc, and copper. Thomas Gray is in charge of the mine. Development has been carried on for the last six months. It is rumored that the annual meeting of the Tom Reed company, to be held soon, will result in plans for enlarging the mill. Charles Grimes, president of the company, states that a larger output than ever before is being made by the mill.

CALIFORNIA

Eldorado County

(Special Correspondence.)—The Crane's gulch quartz property, near Placerville, has been purchased by H. D. Jerrett and brothers. It is said to have a recorded output of $175,000. The owners state work will immediately commence, and, if satisfactory, a mill will be built. The Placerville Gold Mines Co. is planning deep development of its holdings in the Placerville district. The company controls the Pacific, Excelsior, and other noted mines. It is reported the main shaft at the Pacific will be deepened to determine the nature of the ore deposits. British capitalists are interested. A. Baring-Gould is manager. The New Linden Gravel M. Co. has been incorporated to operate the Alderson mine, recently taken under bond. The property lies in Cedar ravine. The company is capitalized at $100,000, par value of stock $100. D. David, of San Francisco, and J. F. Owen and L. N. Stickler, of Placerville, are the incorporators. It is reported Plumas capitalists have resumed operations at the Cora Dora mine, adjoining the Mt. Pleasant in the Grizzly Flat district. Arrangements are under way for the reopening of the Union mine, near El Dorado. It is planned to sink to a sufficient depth to explore the ground lying beneath the barren belt.

Placerville, April 15.

MARIPOSA COUNTY

(Special Correspondence.) The Pocahontas copper mine, at Lewis, will resume operation and shipment of ore, according to a recent announcement by David Ross, superintendent of the property.

Lewis, April 16.

SISKIYOU COUNTY

(Special Correspondence.)—The Michigan Salmon M. Co. is operating its placers with an elevator. A good deposit of gold bearing gravel has been opened and a profitable season is expected, provided the water-supply proves sufficient. The holdings are at the mouth of Know-Nothing creek. L. E. Tagget is superintendent. The Bennett company is operating with a full crew on the Crapo and Forks of Salmon claims. Sufficient water has been developed to operate three giants. It is stated that recent developments on the Crapo have been particularly satisfactory. The company has leased its Bloomer claim to Wilson & McLaine, and the Nigger Hill claim to Gorham McNeil. The Bennett properties are situated in the Salmon river district. B. McNeil has taken a lease on the McNeil claim, owned by the Nordheimer M. Co. Sufficient water is stored to keep the giants active until the end of June. Hydraulic mining throughout the county is in full blast, and indications are favorable for a fairly prosperous year. It is reported interests identified with the Siskiyou Syndicate are endeavoring to consolidate several small properties in the Happy Camp district. Bradshar & Wyrick report the cutting of a good quartz vein about two miles from the forks of Salmon river. The vein is stated to be three to five feet wide and has been driven on about 125 ft. Sluicing is about to start at the Indian Flat placers. The Minnetti B. ditch and flume system has been completed to the claims, and abundant water is available. The properties are owned by the Siskiyou Mines Company.

Yreka, April 14.

TRINITY COUNTY

Press reports state that the Craig M. Co. will build a mill on its property at Dedrick.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—Advices concerning the transfer of the Colorado Central mine on Leavenworth mountain to Henry B. Clifford & Co. of New York are to the effect that work will be started within 60 days. The plant will be situated at Georgetown, and an aerial tramway will be constructed. In the Lost Treasure mine, on Columbia mountain, a streak of ore 8 in. wide has been uncovered that mills 582 oz. silver and 40% lead per ton. The discovery was made 215 ft. from the portal of the adit. William Kramer is owner. Work will be resumed in a few days on the Homestake property. The adit will be driven ahead with machine-drills. A. L. Stephens is manager. At the Ohio property, on Bard creek, a 15-in. streak of $60 gold-silver ore was cut. More ore is going out from the Capital mine than at any previous time, the estimated production being $80,000 per month. E. C. Bauman is manager. Work will be started at the Waldorf mines during the next 30 days. C. L. Tingle is superintendent.

Georgetown, April 10.

GUNNISON COUNTY

The Forest Queen shaft will be unwatered and sunk 200 ft. deeper. It is reported that the owners of the Sylvanite mine will resume operation soon. The property is in the Crested Butte district.

LAKE COUNTY

The experimental mill at the Helena property has been completed, and will be started soon. A rich streak of ore was cut recently on the 230-ft. level. During March the Wolftone property produced 12,000 tons of ore; the Yak, 11,000 tons; the Iron-Silver, about 4000 tons; the Ibex, 7000 tons, and the South Evans about 6000 tons. Outlying portions of the district will be more active than for several years past, say reports from Leadville.

OURAY COUNTY

The Brown Mountain Smelting Co., of Ouray, has completed the purchase of the Hill smelter from J. M. Tenney, of Methuen, Massachusetts. The smelter will be ready for operation, according to present plans, by June 15.

SAN MIGUEL COUNTY

The Junta Gold Mines Co. has awarded O. M. Sackett a contract for a tramway from the Junta mine, in Junta basin, to the Bear Creek mill, on which the company has a ten-year lease. There will be a curve-station at the Jim Crow group of mines. A shortage of ore has caused the shut-down of the Pandora mill. It is said that the agitating-tanks at the Smuggler-Union, at Pandora, will not be in operation before July 1, unless the railroad uses more speed in delivering the steel. Rich ore was found recently at the San Bernardo property, at Matterhorn.

TELLER COUNTY (CRIPPLE CREEK)

The El Paso shaft has been sunk to the level of the Roosevelt deep-drainage adit. The deepening of the shaft was accomplished by driving a raise, which for the 328 ft. accomplished cost about $10 per foot, a saving of $7.50 as compared with the expense of sinking.

The Kavanagh cyanide plant has a new crusher, installed at a cost of about $1000. It is rumored that the operators in the Beacon hill part of the district may establish a mine-rescue station on account of difficulty caused by accumulations of gas.

Mail advices state that the sump of the Golden Cycle shaft, which is 1650 ft. deep, is dry. The present flow necessitates pumping 450 gallons of water per minute throughout the 24 hours. The Progressive M. & L. Co., a Denver company, has secured a long-term lease on the Chickenhawk mine, Guyot hill, and will sink the shaft to the 1100-ft. level.

IDAHO

SHOSHONE COUNTY

(Special Correspondence.)—The Federal M. & S. Co. at the Morning mine is reported to be making $3500 per month since tube-concentrators were set up. A duplicate of the present plant has been ordered.

Wallace, April 15.

Four years reserve supply of ore has been blocked out on the 900 and 1200-ft. levels at the Hecla mine in the Coeur d'Alene district, according to a report by James F. McCarthy, president and manager, at a meeting of stockholders of the company in Spokane. There is also a small reserve on the 600-ft. level. The plan is to keep the development work ahead of production. The company paid $100,000 in dividends during the five months ended December 31, making total net earnings of $2,370,000 at that time.

The Hypotheek M. & M. Co., operating in the Wallace district, plans to enlarge its mill equipment, set up an electric hoist, and obtain other supplies. To meet the expense, an assessment of five mills was levied at a recent meeting of the directors, when the officers were reëlected. George V. Harrington, former manager, has been made vice-president, and P. F. Rogers, former superintendent, becomes manager. The Culvor Mining Co., operating the Amy and Matchless on Pine creek, in the Coeur d'Alene district, under bond, has acquired the crusher, jigs, and other milling apparatus formerly used at the old Antimony mine near the Amy.

MONTANA

LINCOLN COUNTY

(Special Correspondence.)—A. M. Balfour states that the Blacktail property was damaged during the winter by a snowslide which came down the side of the mountain and wrecked a portion of the mill. The damage will not prevent operation, however, although some delay will be caused. Mr. Balfour thinks that the plant can be operated by June 1. The Blacktail is a gold property in the West Fisher district.

Libby, April 15.

SILVERBOW COUNTY

(Special Correspondence.)—The first move in bringing to trial the suit of the Anaconda Copper M. Co. against the Butte-Ballaklava came up a few days ago when a motion was made on behalf of the defendant for a transfer of the case to the federal court. The judge took the matter under advisement. In another week the Leonard mine, which has been closed down since the first of the year, will again be in operation.

In the course of development on the 500-ft. level of the Ophir mine of the Butte Central Copper Co., a fine body of copper ore about 8 ft. wide, and containing 2½ to 3% of the red metal, has been cut. The Pilot Butte company has commenced sinking its shaft from the 900-ft. level to explore at depth for some of the rich copper veins which are supposed to extend from adjoining mines. Recently on the 900-ft. level a rich body of zinc ore was cut. After many demonstrations the Butte & Superior company has decided to construct, near the new concentrator, a one-unit plant for testing the Peterson process of zinc smelting. It will be ready in about ten days or two weeks. P. E. Peterson, the inventor of the process, claims that he can save 95% of the zinc, 95% of the copper and gold, and 70 to 95% of the silver. The copper, silver, and gold is to be saved in the form of a matte. The Butte-Alex Scott is now shipping 200 tons of ore per day to the East Butte smelter, which is just about the capacity of the equipment. Samuel Newhouse, of Salt Lake City, has become interested in the Madison district through coming into possession of the Revenue mine by foreclosure. This mine has been a fine producer in the past, and mining men declare that under modern methods it can be made a profitable mine. The San Francisco men who have secured possession of the Gold Coin property in the Rochester district will start operation in a few days on a large scale. New equipment has been installed and the property can be worked at depth. There is much ore on hand awaiting treatment. A new orebody is reported to have been opened on the 2600-ft. level of the North Butte, but official confirmation cannot be obtained. The work of cutting through from the 2800-ft. level of the High Ore to the North Butte to afford ventilation on that level is well under way, but five or six weeks will be required before the work is completed. The work of lengthening one of the furnaces of the East Butte smelter will be completed in June, and there will be as little delay as possible in extending the other one.

Butte, April 13.

NEVADA

CHURCHILL COUNTY

(Special Correspondence.)—Work was resumed on April 15 in the mill of the Nevada Wonder M. Co., after a shut-down of three months, due to shortage of electric power. No trouble was experienced in starting, and the mill has been operating smoothly since the power was turned on. During the shut-down some repairs and improvements were made which have bettered the operation of the mill, and changes are now under way which will increase its capacity and efficiency. These alterations will consist principally of changing from intermittent agitation to continuous agitation and placing another Dorr thickener ahead of the filters. By these alterations, it is expected to improve the already good rate of extraction and to balance the capacity of the different units so that the mill will be able to handle its rated capacity of 100 tons per day with the best results. The necessary machinery has been ordered. During the period of enforced idleness at the mill, development was continued at the mine. The two-compartment shaft was sunk from the 500-ft. level to the 715-ft. point. The last 115 ft. of the sinking was done at the rate of 6 ft. per day with three shifts at a cost of $26.31 per foot. Driving was carried on at several points and considerable ore was opened up on the 400 and 500-ft. levels. The property is in much better shape than it was when the power was shut off.

Wonder, April 16.

CLARK COUNTY

Reports from Searchlight say that operation has been resumed at the Johnnie M. & M. Co.'s property, of which Miles S. Gregory is manager. The mill will be started in the near future. A 12-ft. vein was cut recently on the 300-ft. level of the Rand mine, formerly known as

JOHNNIE M. & M. CO. MINE.

the Black Hawk, in Eldorado canyon. The ore is said to run about $35 per ton. Robert Dunbar, the principal owner, is in charge of the property.

ELKO COUNTY

The U. S. Geological Survey has just issued a 162-page bulletin, No. 497, entitled 'A Reconnaissance of the Jarbidge, Contact, and Elk Mountain Mining Districts.' The work is by F. C. Shrader. In addition to giving a geological description of the districts, and other purely scientific information, a short history of their development, and lists of the principal properties are given. The bulletin can be obtained on request from the U. S. Geological Survey, Department of the Interior, Washington.

ESMERALDA COUNTY

A deep shaft will be sunk soon on the Sandstorm-Kendall Con. property. The old Kendall shaft will be used to prospect both properties in depth.

HUMBOLDT COUNTY

(Special Correspondence.)—The National Mines Co. has temporarily suspended milling mine ore, pending the crushing of about 3000 tons on the old Stahl dumps. Much of this assays about $125 per ton and the mill is treating 30 tons per day. It is handled for the owners of the old lease on a royalty basis. The high-grade quartz is separated from the ordinary ore and stored in an underground vault. Exploration is being done at the Mammoth National claim, but mining is prevented by the litigation between the National and Workman interests. It is reported the Arizona mine, near Unionville, will be shortly placed in operation. C. S. Floyd has obtained a five years extention on his lease on the Harnan property, near Erlach. The 4-ft. vein is lead-silver, and has some iron and a little gold. Arrangements have been made for the erection of a concentration plant, including three sets of rolls, three tables, two vanners, and other equipment. The capacity is to be 50 tons. It is expected to complete the plant by July 1.

Winnemucca, April 13.

NYE COUNTY

Efforts are being made toward a reorganization of the old Tonopah Golden Crown M. Co., a Utah corporation. In a statement to stockholders in the old corporation, they are reminded that the company was formed in 1905, and operation was continued through sale of the stock, which was non-assessable, and when this source of revenue was closed, through funds advanced by four directors, W. H. Dickson, C. K. McCornick, Ernest Bamberger, and A. C. Ellis, Jr. When the loans and interest had reached about $55,000, a judgment against the company was secured, and at a sheriff's sale these directors purchased the property. Since the sale, in March 1911, the directors claim to have expended in assessment work, taxes, and patenting, $1442. The company had six months from March 21, 1911, to redeem the property. The directors now offer the

stockholders the property on payment of both sums named, aggregating $61,229, or as an alternative submit a plan for reorganization on an assessable basis. The new company would be capitalized at $1,500,000, with shares $1 each. Of this, 500,000 shares would be set aside to pay the indebtedness referred to, 500,000 shares would be put in the treasury, as working capital, 450,000 shares would be used for exchange for stock of the old company, on a basis of one share of new for two of old stock, and 50,000 shares would be used for promotion purposes.

The Tonopah M. Co. in March milled 14,706 tons of ore, and shipped 260,600 oz. gold and silver bullion, valued at $206,650. One hundred tons of concentrate, valued at $44,700, was shipped. The net profit for the month is announced as $150,940. The Tonopah-Belmont Development Co. in March milled 8047 tons of ore, and sent 562 tons to the smelter. The total net value of the ore is announced as $230,882. The production of gold bullion for the month amounted to 3203 oz., and silver bullion to 311,091 oz. The company's net profit for March is given as $146,629.

The production of the Tonopah district for the week ended April 13 is thus summarized by the *Tonopah Miner:* The Tonopah M. Co. sent 3150 tons, the Belmont company 1750 tons, the Montana-Tonopah 1053 tons, the Tonopah Extension 1012 tons, the West End 600 tons, and the MacNamara 390 tons, making the total production for the week 7955 tons, the estimated value being $198,875.

Storey County

The customary weekly reports of the superintendents of the Comstock properties for the week ended April 13 show, among other things, that the Ophir, in the course of development, produced about 200 tons of ore, and shipped to the Kinkead mill about 368 tons of second-class ore. In the east cross-cut on the 2500-ft. level of the Union Con. M. Co. property, a 2-ft. quartz vein was cut during the week. The cross-cut was driven 21 ft. in the week. Samples from six cars assayed an average of $21.12 per ton. A geological study has been made of the Patton cross-cut. In the Con. Virginia the three-compartment raise is now 37 ft. long, and during the week some low-grade ore was saved in making the raise. Work in the mine was stopped four days to allow the Pumping association the use of compressed air in pumping out the 2500-ft. level and the 2200-ft. level winze of the Ophir. The Mexican mill ran 81% of the time, crushing 459 tons of ore. The average head was $24.88 per ton and the apparent extraction 90%. Some low-grade ore was saved in development. The Crown Point put 1119 tons of ore in the bins of the Yellow Jacket mill during the week. Along with other work, the Pumping association pumped dry the 2500-ft. level of the Ophir, and constructed a dam in the old north drift. The usual activity was seen at other properties. The Ophir company last week reported receiving $25,000 from a shipment of concentrate to the smelter.

White Pine County

Work will be resumed in the near future at the Butcher Boy claim of the Coppermines property by the Thompson-Gunn interests, according to recent reports. Arthur Smith is general manager of the property. The American Rare Metals Co. is to start development immediately on its property, which is about seventy-five miles from Ely, and five miles from the Utah line. The claims are said to have rich tungsten ore. Jeremiah Nolan, president of the company, and sons are visiting the property. The journey was by way of Oasis and required a stage ride of 100 miles.

NEW MEXICO

Dona Ana County

The Turgite M. Co., capitalized at $250,000, with shares $100 each, has been formed at Las Cruces. The list of incorporators is headed by E. C. Wade.

Grant County

It is rumored that the Eighty-five company will build a reduction plant for its property, near Lordsburg. Last month 148 cars of ore was shipped from Lordsburg.

On Lone mountain a prospector named Elliott found high-grade silver ore recently. Near his discovery he also found old implements such as were used by the early Spaniards and by the Indians in mining. J. E. Pierson has put in operation his cyanide plant and is treating the tailing from the site of the old Hearst mill, two miles from Pinos Altos.

The third unit of the Chino Copper Co.'s concentrator was started about two weeks ago. The fourth unit should be ready by May, and the entire plant operating by July 1. The Hearst part of the mine is about ready for production, which will mark the company's first treatment of sulphide ore. The two units of the concentrator which have been in operation have approached 1100 tons per day, as against a rated capacity of 1000 tons. Costs are said to have been well under 8c. per pound.

Sierra County

John Calvin is about to secure a set of hand jigs for his mine on Percha creek. The experimental plant at the U. S. Treasury property, in the Black range district, has proved satisfactory and a larger mill will be ordered.

OREGON

Baker County

The Yuba Construction Co. has started work on the dredge ordered by the Powder River Dredging Co. Fred Deland and F. J. Ryan have charge of construction.

C. D. Snyder and son, of Parma, Idaho, with Joseph Watts of Granite, are planning extensive development of their placer property in the North Fork district as soon as the spring floods start. The Granite Con. Placer Co. also will start operation soon.

Jackson County

Letters from friends in South America have caused about twenty-five Medford citizens to plan a trip to Bolivia, to investigate gold properties, says a report in the *Medford Sun* of April 16.

UTAH

Juab County

The Iron Blossom company on April 25 will disburse its second quarterly dividend of the year, which will be 10c. per share, as against 7c. paid for the first quarter on January 12. While no financial statement has been issued, it is rumored that after $100,000 disbursement required for the dividend, the company will have $150,000 in the treasury.

Tooele County

The plant of the Ophir Hills company, owned by W. A. Clark, in the Ophir district, is to be doubled, to have a capacity of 300 tons per day.

CANADA

Ontario

March ore-shipments from Ontario properties amounted to 1714 tons, as against 2099 tons in February. As a rule, only high-grade ore was shipped, and the low-grade ore properties were not on the list of March shippers.

The shippers in detail were as follows:

	Ounces.	Value.
Nipissing	343,706	$202,711
Crown Reserve	65,181	37,266
O'Brien	19,870	11,277
Buffalo	7,670	4,500
Cobalt Townsite	3,000	1,750
Trethewey	2,024	1,093
Totals	441,451	$258,597

(Special Correspondence.)—The Domes Mines management report good results from the mill output. So far the extraction will average 97%, and has reached over 99%. The results of the underground work has been encouraging. The West Dome is cross-cutting from the No. 1 shaft at the 100-ft. level, and is driving west and cross-cutting north from the No. 3 shaft at the same depth. The Crown Chartered expects to begin operating the new compressor soon, and to reach the 200-ft. level in its shaft by April 20.

The Scottish Ontario is still closed down pending a visit from one of the board of directors. The stock having been underwritten in Great Britain, the managing director is to inspect the property and, after consultation with the management, to decide on the plant and other equipment to be installed. Excavating is well under way for the 20-stamp addition to the McIntyre mill, and work is being rushed on sinking No. 1 and 4 shafts.

South Porcupine, April 11.

The McIntyre mill, Porcupine district, during March, although running less than three weeks owing to power difficulties and the installation of boilers, produced $9000 from its ten stamps.

MEXICO

Hidalgo

The mill of the El Oro M. & R. Co., controlled by the Exploration Co., Ltd., in March ran 29 days, treating 21,300 tons of ore and 11,410 tons of tailing. The bullion production amounted to $172,120. Operating expenses and cost of development amounted to $118,830, leaving a net profit of $53,290. Adding the profit on the railroad, $8820, the total net profit for the month was $62,110. On permanent improvements $1150 was spent.

Jalisco

A branch power line is under construction to the Casa dos mines in the Hostotipaquillo district from the transformer station at El Favor. The properties, which are owned by the Con. M. Co., of which W. R. Ramsdell is president, are under option to William Bailey of Los Angeles, California. The price named is ₱4,500,000.

As the result of arrangements just completed, several carloads of copper ore from the Zapote mine in the Ameca district will be shipped in a few weeks. The properties are under option to E. A. Montgomery, at a price of ₱100,000. Shipments are planned also at the Magistral mine of the Magistral Ameca Copper Company.

Among the Copper Mines

The Nevada Douglas company is shipping 340 tons of high copper ore per day to the smelter. W. C. Orem, general manager, states that development in the Ludwig and Casting mines is better than the company hoped for.

Henry R. Merton & Co., copper brokers of London, who are credited with having played a large part in the recent moves which rescued the copper situation, estimate the world's production for 1911 at 1,956,350,400 lb., as compared with 1,916,734,000 lb. in 1910, an increase of 2.1 per cent.

South Utah Mines & Smelters, the former Newhouse property, is slowly working out its problems and is one of the string of producers that at low prices was obliged to operate without much hope of profit, but which can now make a little money. E. P. Earle, of the Nipissing Mines Co., handles the copper of the South Utah.

'Standard' copper shows an advance of £6 10s. per ton during the past month, says James Lewis & Son's monthly report. From £64 2s. 6d. cash rose to £65 2s. 6d. on March [illegible] [illegible] There has since been a steady advance, with but slight fluctuations, to £70 [illegible] [illegible] £71 [illegible] being paid April 1 for three months' [illegible] [illegible] to £71 10s. Sales [illegible] [illegible] tons. The strong statistical position [illegible] [illegible] recognized, a further reduction [illegible] 1482 tons in the European stocks having taken place [illegible] English deliveries [illegible] [illegible] sales of refined copper have been [illegible] [illegible] for delivery over the next [illegible] in an advance to 16c. per pound [illegible] for Lake copper, with [illegible] [illegible] £75 [illegible] ton [illegible] £73 15s. 0d. being now asked. The New York Custom House advises an error in the exports to France for the month of February of 3524 tons, which reduces the consumption of France given in our last report by that quantity to 12,736 tons. German consumption for the months of January and February amounted to 33,974 tons, as against 25,838 tons for the same months last year, an increase of 8136 tons, making the total European increase in consumption for the two months this year over last 13,247 tons, or at the rate of nearly 80,000 tons per year. With an increase in the American consumption of 11,596 tons, or at the rate of 70,000 tons per year, a total increase of production of about 150,000 tons will be required to maintain American and European stocks at the low level attained on January 1 should this increased consumption be maintained throughout the year in the same ratio. American exports from northern ports for March are advised as 26,764 tons. European stocks have decreased 1482 tons and the visible supply 1932 tons during the month. Imports are 1027 tons less and deliveries 1926 tons greater than during the same period last year. The total arrivals in England and France for the month have been 17,078 tons, and the deliveries 17,960 tons. The arrivals in England from Chile during the month have been 1705 and the deliveries 1337 tons, and from other countries 10,623 and 12,325 tons, respectively. The arrivals at Liverpool and at Swansea from the United States have been 2914 tons bars, 1014 tons plates, and 17 tons matte, equal to about 3911 tons, in London 225, and in France 4300 tons fine. The Chile charters for the month are advised as 1600 tons, including 425 tons for the United States.

March Copper Review

By Misha E. Appelbaum

The statistics for the month of March show an increase in domestic deliveries of about 11,000,000 lb., a slight decrease in exports, and an increase in production of about 7,000,000 lb., due to the fact that March has 31 days against February's 29, so that, on the whole, the production and the exports are about the same, but the domestic consumption is showing signs of sharp improvement. The visible supply is now the smallest since 1907 and domestic deliveries can with reasonable safety be counted on at about 70,000,000 lb. per month for the next two or three months and it can also be expected, since the coal strike is settled in England, that there will be a revival in industry and that Europe ought to take 60,000,000 to 65,000,000 lb. per month, so that even if the production is increased to 135,000,000 lb. per month, the visible supply will not increase, although, personally, I expect that small decreases will take place.

In view of this, it is difficult to foresee anything else but higher copper prices, although the market is now entering upon an era of prices which, if carried much further, will undoubtedly some day check the consumption. If the market, therefore, can be kept between 16 and 16½c., it will not interfere with the consumption and leave a remunerative profit to the producers. I understand from the majority of the copper people that they are doing all in their power to keep the market from getting beyond them, but with most of the producers sold out and the demand keeping up, they really are powerless to do much, and it is therefore likely that, from time to time, sharp bulges will occur when the market through the consumers' anxiety will be carried higher than the producers themselves would like to see it go. A favorable influence on the copper market which I have not mentioned before is the fact that the entire country seems to be recuperating from the depression from which it has suffered during the last four or five years. The conservative element is bound to dominate both of the political parties, and I do not think it will make any difference to legitimate business interests which party is in power, so that the entire aspect of the business situation is such as to make me feel optimistic, and that, in addition to the sound statistical position of copper, naturally makes the outlook for the next few years one of great promise to the copper trade.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

K. C. Parrish is in Columbia.

Frank Dennis has gone to Chicago.

D. J. Sullivan has returned to Arizona.

Webb Smith was in San Francisco Tuesday.

M. P. Morris has returned to Salt Lake City.

H. S. Denny is returning to London from Mexico.

O. R. Whittaker is at 932 Equitable building, Denver.

R. S. Botsford has gone to Vladivostok from London.

Ritter von Grot has gone to Chicago by way of Los Angeles.

John H. Buxton, of Baltimore, was in San Francisco this week.

M. J. Monnette was in San Francisco from Los Angeles this week.

H. W. Hardinge was in San Francisco and Los Angeles last week.

J. M. Mitchell is now at 71 Jamaica avenue, Flushing, New York.

Charles Janin is at the Hotel Russell, Russell Square, London, W. C.

David Muir is manager for the Needles Smelting Co., Needles, California.

H. A. Linke is manager for the Nevada Central Copper Co., Cedar, Nevada.

H. F. Lefevre has gone to Guatemala, expecting to return by the middle of May.

H. R. Plate has an office as consulting engineer at 14 Wall Street, New York City.

C. O. G. Larcombe has returned to Kalgoorlie from a trip through Eastern Australia.

Oliver B. Finn has returned to Colorado Springs from a professional trip to Alabama.

R. S. Stockton has returned to Strathmore, Alberta, Canada, from a visit to Denver.

Philip Argall & Sons are consulting engineers for the Ozark Smelting & Mining Company.

J. E. Spurr and M. B. Huston have been at Ely, Nevada, sampling the Taylor and Ward mines.

C. B. Lakenan is in New York, attending the annual meeting of the Nevada Copper Company.

Irving H. Reynolds, former chief engineer for the Allis-Chalmers Co., has returned to that company.

J. Emerson Gee is resident manager for the Indiana-Oaxaca Mining Co., at Sola de Vega, Oaxaca, Mexico.

C. T. Durell has arrived in Denver, on his return from the Philippine Islands by way of Australia and Peru.

L. Stewart and J. I. Kane are on the engineering staff of the Tiro General mine, at Charcas, San Luis Potosi.

Walter Neal is general manager for the El Favor and Mololoa mining companies, at Hostitopaquillo, Jalisco, Mexico.

James Heggie is superintendent and R. B. Green is assistant superintendent of the A. S. & R. Co. smelting plant at Hayden, Arizona.

George Watkin Evans has resigned from the Washington Geological Survey and will practise as consulting geologist at the Leary building, Seattle.

Young men who understand work with Empire and Keystone drills and are willing to take employment abroad are asked to register their addresses with the Editor.

Mark L. Requa will discuss the 'Problems that Confront the Oilmen of Today,' before the Mining Association, the student branch of the American Institute of Mining Engineers, in room 200, University of California, at 8 p.m., Wednesday, April 24. The public is invited.

Market Reports

LOCAL METAL PRICES

San Francisco, April 18.

Antimony	11—11½c	Quicksilver (flask)	41.50
Electrolytic Copper	15¼—15½c	Tin	47—48¼c
Pig Lead	4.15—5.10c	Spelter	7¼—7½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

Average daily prices in cents per pound, based on wholesale transactions, standard brands.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Apr. 11	15.75	4.20	6.60	58⅛
" 12	15.75	4.20	6.60	58⅛
" 13	15.75	4.20	6.60	58⅛
" 14	Sunday.	No market.		
" 15	15.80	4.20	6.65	58⅛
" 16	15.80	4.20	6.65	58⅛
" 17	15.80	4.20	6.65	58⅛

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, Apr. 18.		Closing Prices Apr. 18.
Adventure	10¾	Mohawk	$ 66
Allouez	48	North Butte	33
Calumet & Arizona	74	Old Dominion	55½
Calumet & Hecla	495	Osceola	118
Centennial	26½	Quincy	89
Copper Range	65½	Shannon	15½
Daly West	6¾	Superior & Boston	3¾
Franklin	14¾	Tamarack	47
Granby	57¾	Trinity	8
Greene Cananea, ctf.	9¼	Utah Con	14¼
Isle-Royale	29	Victoria	4¾
La Salle	7½	Winona	7
Mass Copper	8¼	Wolverine	115

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, April 18.

Atlanta	$ .30	Mayflower	$ .03
Belcher	1.00	Mexican	3.65
Belmont	10.25	Midway	.35
B. & B.	.19	Montana-Tonopah	3 15
Booth	.13	Nevada Hills	2.45
Chollar	.13	Ophir	1.40
Combination Fraction	.17	Pittsburg Silver Peak	1.42
Con. Virgina	.69	Round Mountain	.47
Florence	.82	Savage	.27
Goldfield Con.	4.25	Tonopah Extension	2.17
Gould & Curry	.12	Tonopah of Nevada	8.00
Jim Butler	.70	Union	1.17
Jumbo Extension	.49	Vernal	.16
MacNamara	.25	West End	2.27

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, April 18.

Associated Oil	$43 62	Palmer Union	$ .31
Brookshire	.60	Premier	.55
Caribou (New Stock)	1.20	P. S. Petroleum	.17
Claremont	.57	Republic	.38
Coalinga National	.15	Silver Tip	.90
Con. Midway	.02	Sauer Dough	1.10
Empire	1.17	Sterling	1.40
Enos	.07	S. W. & B.	.20
Maricopa 36	.64	Turner	.80
Midway Premier	.51	Union	100.50
Monte Cristo	1.35	United Oil	.30
Palmer	.64	W. K. Oil	2.20

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. Apr. 18.		Closing Prices. Apr. 18
Amalgamated Copper	$ 83¾	Miami Copper	$ 26
A. S. & R. Co.	85⅝	Mines Co. of America	3¼
Braden Copper	5¼	Nevada Con	19⅞
B. C. Copper Co.	5⅝	Nipissing	8
Camp Bird Ltd.	7¼	Ohio Copper	1½
Chino	29¾	Oroville Dredging	1 1/16
El Oro	4	Ray Con	20
Esperanza	8⅛	Santa Gertrudis	7⅜
First National	3¼	Tenn. Copper	41¼
Giroux	6⅝	Tomboy	5½
Goldfield Con.	4⅜	Tonopah Belmont	10¼
Greene-Cananea	9⅜	Tonopah Ex.	2¼
Hollinger	12½	Tonopah Mining	8
Inspiration	19¾	Trinity	8
Kerr Lake	2⅞	Tuolumne Copper	3⅜
La Rose	3⅝	Utah Copper	64½
Mason Valley	13¼	West End	2¼
McKinley-Darragh	1⅜	Yukon Gold	3⅜

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

ASSESSMENT WORK PENDING PROCEEDING FOR PATENT

Where a locator filed application for patent, published notice, and thereafter failed to perform the annual representation work on his claim for several years, it was held that a second party might re-locate his claim as forfeited, at any time before payment of the purchase price therefor, and then obtain an injunction restraining the original locator from continuing patent proceedings. Assessment work must be continued up to the time when payment of the purchase money is made to the Government.

Poore *v.* Kaufman, (Montana) 119 Pacific, 705. November 24, 1911.

PLACER LOCATION REQUIREMENTS—NUMBER OF CLAIMS THAT MAY BE TAKEN BY ONE LOCATOR—MONUMENTS—DUMMY LOCATORS

There is no limit to the number of placer claims that may be located by one person or association of persons; hence, the location of a second claim cannot be urged as indicating the abandonment of a former location whose boundaries do not conflict with those of the second. Monuments found upon ground at the corners of a placer claim may be adopted by the locator as his own and will meet the requirement that the claim be marked on the ground by substantial monuments. The Government alone can complain of fraudulent locations by 'dummy' locators. Except in adverse proceedings, where the Government is a silent party, such a location is not open to collateral attack by individuals.

Riverside Land & Cement Co. *v.* Hardwick, (New Mexico) 120 Pacific, 323. December 1911.

OIL LEASES—RIGHTS OF SUB-LESSEES

An oil and gas lease for fifty years gave the lessee the right to develop land described for oil, gas, and mineral, and to sell the same when acquired. The lessee sub-leased to a third person for twenty years the exclusive right to drill wells on a part of the land, work to commence within a specified time. The sub-lessee went on the land and deposited a wagon-load of well-drilling tools thereon, intending to commence work, but was stopped the next day by the original lessor, who claimed that the lessees had forfeited their rights in failing to develop the property themselves and in assigning their lease in part. It was held that in the absence of an express covenant to the contrary the first lessees could sublet all or part of the land described to a third party, to develop for oil or gas, and that the entry of the sub-lessee was sufficient to support his suit against the original lessor for possession, for an injunction preventing the lessor from further interfering with him, and for damages.

Chandler *v.* Hart, (California) 119 Pacific, 516. December 1911.

MINING CLAIMS—EFFECT OF CANCELLATION OF FINAL RECEIPT AND ENTRY

The Secretary of the Interior cancelled the final receipt and entry for patent of certain placer claims, on the ground that two of the affidavits required were sworn to in the wrong land district. Prior to the cancellation adverse locatinos were made covering the same claims. Subsequent to the cancellation, the former applicant resumed possession of his claims and started patent proceedings anew. The adverse locator filed a contest and brought suit claiming that when the first entry was cancelled the land in question was thereby restored to the public domain, and thereupon became subject to his locations. But the court held that such was not the case; that the cancellation of the patent proceedings merely operated to restore the applicant to his status as a locator, and that, providing he had performed his assessment work, his first locations were still effective.

McKnight *v.* El Paso Brick Co., (New York) 120 Pacific, 694. December 23, 1911.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

SIDE-LATCHES on ore-cars are apt to prove objectionable in underground work, as they are apt to catch on the timbers in narrow workings.

FREE-MILLING ore in California always contains a certain amount of sulphides, usually about 2%. These are concentrated and then either shipped to the smelters, ground in tube-mills and cyanided, or treated by the chlorination process.

WORK on a mining claim used in application for patent must have been performed by the applicant or his grantor. Work existing on claims when located cannot be entered except by fraud, but work done by the locator may be counted toward patent by one who buys from the locator, if it be otherwise applicable.

ORE should not be roasted before concentration, as it is too expensive. Roasting will ordinarily cost from 75c. up per ton, depending on the method employed, while concentrating can ordinarily be done for little more than half that sum. In addition, better results can ordinarily be obtained on raw ore than on roasted material.

PRESSURE of the wind on a building varies nearly as the square of the velocity. Thus a wind with a velocity of 20 miles per hour produces a pressure of 2 lb. per square foot, while a wind velocity of 40 miles per hour has a pressure of 8 lb. per square foot. It is probable that the pressure on large surfaces is greater than on small ones, owing to the disturbing effect of the edges.

LARGEST gas-engine units ever constructed are those installed in the new power-house of the Indiana Steel Co. at Gary, Indiana. They have a rating of 3200 kilowatts (4228 hp.) each. The new engines are of the twin tandem double-acting Allis-Chalmers type, with cylinders 44 by 60 in. The engines will operate on blast-furnace gas, and are to drive alternators delivering 6600-volt, 25-cycle, 3-phase energy to the power network of the Gary mills.

KNOCKING in the cylinder of a straight-line air-compressor is often caused by the reversal of the connecting-rod function in the middle of the stroke. If the thrust of the cross-head is downward at the beginning of the stroke it will be upward at the end, and conversely. Tho prevent knocking, the bearings and connections should be kept set up as snug as possible, and vertical play between the cross-head and the slides should be especially guarded against.

LARGE vertical drawing-boards may be arranged conveniently in the following manner. Screw a pair of bearings to the top edge of the board; through these pass a rod or piece of small shafting, running the entire length of the board and extending sufficiently beyond at each end to receive a pair of sprocket wheels. Attach chain belts to each end of the movable straight-edge, and pass over the sprocket wheels, and attach to a pair of counter-weights sufficiently heavy to balance the weight of the straight-edge when at the position most used. As both sprockets are firmly keyed to the shaft, any movement at one end of the straight-edge insures an equal amount of motion at the other. Sprocket wheels and chains, of the type used in bicycles, will be satisfactory for the purpose, though chains of lighter weight, such as are used for hanging pictures, if constructed without play, will perhaps be more desirable. A small clip or slide fixed to the projecting ends of the straight-edge at the back, and passing under the edges of the cord, will prevent the straight-edge from lifting away from the face of the board.

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EDITORIAL

CANADA will begin minting $5 and $10 gold-pieces at Ottawa next month, and presumably American gold-pieces will begin soon to find their way back across the border.

COAL LANDS in Colorado amounting to 8465 acres have been returned to the United States by the Denver & Rio Grande railway, as a result of suits brought by the Government, alleging fraudulent entry.

BILLS have been introduced in Congress at the instance of the Alaska committee of the American Mining Congress, providing for needed railroad building and leasing of the coal lands. In the meantime Democrats and Republicans jockey for position and the Government charters eight British steamers to transport coal from the Atlantic to the Pacific coast.

REPORT of the Nipissing Mines Company for the year 1911 shows a production of 4,678,074 ounces of silver; somewhat less than the preceding year, but a worthy record none the less. Nipissing is the chief producer of a notable group of silver mines at Cobalt and South Lorrain, the La Rose having produced 3,691,797 ounces in 1911; the Crown Reserve, 3,430,902; Coniagas, 3,273,464; McKinley-Darragh, 2,551,884; Kerr Lake, 2,238,353; and Buffalo, 1,644,245, while three other mines produced over a million ounces each. The total silver production of Ontario in 1911 was 31,507,791 ounces, all derived from the vicinity of Cobalt.

EXTRALATERAL rights are not to be granted with claims hereafter located, if the bill introduced in the Senate at Washington by Mr. Reed Smoot becomes a law. All claims are also to be recorded in the local land office within a year of their location. Both of these changes are important and should be made, but the particular bill is not well drawn and falls far short of the thorough general revision of the mining law that is needed. In the series of articles on the birth of the American mining law, written by Mr. H. W. MacFarren and concluded in this number, it will be noted that while specific changes proposed are approved, strong ground is taken against a general revision. We do not, in this, agree with our contributor, but we must admit the probability that the needed changes will be made piece-meal.

MIAMI has made a good record during its first year. Production was begun on March 15, 1911, on a small scale, which was gradually increased during the year. The output was approximately fifteen million pounds of copper, or a little over one-third of normal production, at an operating cost of 9.325 cents per pound. Mr. J. Parke Channing, the consulting engineer, draws attention to the fact that the cost of mining at the top of the orebody, where the covering of the orebody with a mat of timber is in progress, is necessarily greater than for subsequent operation, while the ore from this part of the orebody yields a less percentage of extraction than it is hoped to attain later. Under Mr. Channing's direction the Miami is evidently operated to

produce sound technical and financial results, rather than to secure spectacular effect.

RAND MINES made another record output in March, the production for that month reaching 830,723 ounces. During 1911 the Crown Mines milled 1,613,400 tons, at a working profit of £1,272,944, or 15 shillings 9 pence per ton. This tonnage was exceeded by both the East Rand Proprietary and the Randfontein Central, which milled 2,194,552 tons at a profit of £913,862, and 2,157,331 tons at a profit of £862,000, respectively. The record for productivity belongs to the Robinson, which yielded £910,949 from 591,700 tons, or 30 shillings 11 pence per ton. This is a notable record, and none the less so that while output has been expanding profits have been contracting, while operating costs show a deplorable tendency to increase in many instances. Operations suffered, in several instances, from what in America would be called 'shake-ups.' In his speech at the annual meeting of the Transvaal Chamber of Mines, Mr. H. O'K. Webber sounded a cheerful note of optimism as to the outlook for future mining, and it is to be hoped that his predictions may be justified by the event.

METHODS of presentation and keeping of accounts by mining companies are of almost infinite variety, not to say complexity. This is in part due to the fact that the necessary accounts of a small company are naturally much fewer and simpler than those of a large corporation where, for convenience, separate departments are often organized in the form of subsidiary companies. Waste of experience is the rule, however, and it not uncommonly happens that the system employed represents the development of ideas as worked out by the chief accountant. But an unsatisfactory system gives nearly as much trouble in its readjustment as in its continued operation, and a broad familiarity with the successes and failures of others would often prevent the inception of a system of accounting which affords present advantage at the expense of great future inconvenience. We welcome, therefore, the organization of the International Society of Mining Accountants, which announces as its object "to promote the science of accounting and allied subjects connected with the production of useful minerals and metals on the American continents." Much good may result from its activities, and we wish it a full measure of success.

BUTTE faces the possibility of labor troubles, as the agreement which has been operative for the past five years expired April 1, and agitation for an increase of wages is being mooted. The former agreement produced great general satisfaction, and it is to be hoped that a similar one may again be made. It is not unnatural that workingmen should consider that the increased operating profits of the companies resulting from the increased price of copper ought to give rise to larger returns to the miner in the form of wages, but if this principle is asserted the miner should be equally ready to accept a cut in wages when the copper market declines. This plan obtains in the anthracite fields, but has its defects and limitations. A theorist might propose to reckon each week's wages upon the basis of the average selling price of copper during the week, but aside from the practical difficulties of such an arrangement it has the disadvantage of transferring the burden of fluctuation from the corporation of large resources, which is prepared to bear it, to the individual of small resources, who is not prepared to carry it, thus reversing the line of social economic development. Periodic readjustment of wage schedules, whenever changed conditions may require it, seems the best method of securing satisfactory relations between employers and those employed.

THE value of a man is something hard to translate into figures, and the time has passed when men can be bought and sold. Judged only as a working machine, however, it is possible by use of mortality tables to determine the probable future earning capacity of any individual. This is the figure that actuaries use as a basis for annuity insurance, and it is interesting to see that a miner in good health at 30 years of age and earning $3 per day is worth over $17,600 as a working machine. The value decreases with age and increases with earning capacity. At 50 years the value is $4359 for each dollar of daily wage—not $359, as stated through a typographical error in the letter on 'The Mine-Owners' Liability for Accidents,' by Mr. A. J. Pillsbury in our issue last week. Mr. Pillsbury's letters now being published, by the way, will repay the thoughtful reading of everyone interested in the betterment of labor conditions, as well as those concerned with the economics of mining.

ELECTRIFICATION of the lines of the Southern Pacific railway which circle San Francisco bay is of interest to the copper miner as creating a considerable local demand for that metal. But trade follows regular channels, so that this supply will be drawn from Eastern points. Practically all of the copper of the United States is produced west of Chicago, yet six of the eight refineries, representing 95 per cent of the total output, are situated on the Atlantic seaboard. This is the result of present economic conditions. Nearly all the manufacturers, both of finished and unfinished products, and a large majority of consumers are in the Eastern states, while a minor point is that the associated gold and silver must usually be sent East, and can be shipped more cheaply and safely by freight while locked up in blister than by express in the form of doré bullion. Reasonable continuity of operation is essential to the success of refining and manufacturing industries, and this is conditioned upon continuity of demand. Until the Pacific seaboard is much more densely populated than at present, so as to afford continuity of demand through force of numbers, local metal refining and manufacturing will continue to grow but slowly.

RIVERS exemplify the law of compensation. By their work they build up alluvial plains of great fertility, and then proceed to devastate them in times of flood. Conditions have been serious in the Mississippi Valley recently, but public attention has been diverted from them by absorbing interest in the *Titanic* disaster. The natural action of a large river traversing a flood plain is to build up levees which serve to confine it to its course under ordinary circumstances, especially when these are reinforced by human effort. But when the river rises unusually high in times of flood great destruction will result unless the levees can steadily be maintained. In 1890 the Mississippi broke through its levees near New Orleans and, flowing with a current of 15 miles per hour through Lakes Ponchartrain and Borge, spreading devastation in its course, entered Mobile bay in such volume and velocity as to destroy the fishing and oyster industries. A worse offender is the Yellow river (Huang-ho) of China, which traverses for hundreds of miles an extensive plain that is almost without relief. Within historic times it has more than once completely changed its course, and has wrought so great destruction as to well deserve the name of 'China's Sorrow.' Considerable sums are required to control the activities of these vagrant rivers, and in a special message to Congress the President has asked for an appropriation of $787,000 to supplement that of $350,000, made earlier in the year, for the up-keep and protection of the levees along the Mississippi.

Progress of the Zinc Industry

Zinc metallurgy has gained in importance of recent years, as a comparison of the United States output of 1911 with that of 1896 shows. Production of spelter in 1896 was 77,637 tons and the average price per pound at New York was 3.94 cents. In 1911 the output was 268,526 tons and the average price per pound 5.76 cents. Compared with the advance in production and price the improvements in the metallurgy might seem disproportionate, for the century-old Belgian process still largely holds its own in spite of much study, for zinc is an unruly metal and offers stubborn resistance to the metallurgist. Most of the zinc ores treated today throughout the world are complex, containing important quantities of silver, lead, and copper. In the Belgian plants the recovery of lead and silver is seldom over 70 per cent, and is often much less, while a most important factor which militates against the further extension of the process in old regions and its introduction in new is the question of labor. Not only are the demands of labor increasing, but also it becomes increasingly difficult to replace men of the older generation with skilled furnacemen. Even in Belgium, where perhaps the greatest skill in operating retort furnaces is to be found, this pressure begins to be felt, and tends to become more aggravated each year. Improvements which will do away with the requirement of skilled labor and yield an increased saving of associated metals are at a corresponding premium. Two electric zinc plants are now in operation in Scandinavia and though the technical results, judged from a Belgian standpoint, are low, the operating profit is considerable, thus meeting the requirements of the basal definition of metallurgy as the art of making dollars out of ores. The art of electric zinc smelting is in its infancy, improvements must and will be made, and there seems good reason to believe that electric furnaces embodying the essential features of the Belgian process and duplicating or improving on its conditions as to chemical reactions, temperature, and physical conditions are likely in the near future to receive increasing application.

In the meanwhile attention has been generally focused upon better dressing of the ores preliminary to furnace treatment. In the United States this took shape first in development of magnetic, and later of electrostatic, concentration. Fine concentration has only been used in special cases, and, while the Wetherill and Bartlett processes have permitted direct treatment of low-grade and mixed ores in special furnaces, they have only been adapted to the making of pigment. Spelter is still made here, as abroad, in retorts. In Australia, as in the United States, there are large bodies of low-grade mixed sulphide ores containing zinc that formerly were valueless. With the successful development of the flotation processes these came to yield valuable concentrates. At first they were shipped to Europe for treatment but eventually a zinc smelter was built at Port Pirie. It is interesting to note that this plant was constructed along standard lines and that the chief troubles that have been met in getting it to running smoothly arose from the lack of a sufficient supply of specially trained laborers. That success has been achieved proves again that in building up a new zinc smelting centre there is nothing inherently impossible, but merely an unusual number of minor and annoying difficulties. With the high labor costs obtaining in Australia, an electric furnace would seem to have advantages, but when construction began there, the work in Sweden had not gone so far as now, and it is said that even in Sweden a quarter of a million dollars was spent before the present practice was developed.

In California conditions are similar to those in Australia. There are considerable bodies of complex zinc ores, and at least a small local market for spelter with easy access to the sea. Flotation can be applied to the ores and a satisfactory concentrate can be made. To ship this to existing furnaces absorbs the bulk of the possible profit. To establish an ordinary retort furnace would be to face labor troubles under all the usual disadvantages, with a few peculiar to California. Electric smelting is being tried with good prospects of success, but leaching processes, to be followed by electrolytic precipitation, are also being studied, and at the moment it seems probable that development in California will be along this line.

In Canada a determined attempt is being made to find a process that may be applied with profit in zinc smelting, and a Government commission is now studying the subject. An electric furnace was built and a series of trial runs made, but the large scale work was stopped before final results were obtained. For the present the commission seems to be content with watching work elsewhere, though doubtless in time the experiments begun in British Columbia will be resumed.

The latest country to attempt local treatment of its zinc ores is Japan. In that country there are, as in the United States, Canada, and Australia, considerable bodies of mixed sulphide ores of which the zinc content has heretofore been largely wasted. In part these ores have been dressed and shipped to Europe. Export shipments of zinc in ore in 1909 amounted to 152 tons, and in 1910 and 1911 the figures were 140 and 143 tons respectively. This zinc was valued at $320,000 to $400,000, but in the same years spelter was imported into the Empire as follows:

	Short tons.	Value.
1909	3,206	$995,663
1910	6,786	1,407,151
1911	7,395	1,587,339

It is now announced that the Mitsui Mining Company will build a smelting plant at Omuta on the island of Kyushu. The principal source of ore will be the Kamioka mine, which belongs to the same company, and which is situated near Toyama. The ore at this mine contains 10 to 25 per cent of zinc, 2 to 14 of lead, about 15 ounces of silver, and a small amount of gold. The present annual output is about 10,000 tons. Wet concentration followed by flotation treatment of zinc middling from Wilfley tables is employed. The flotation process was developed locally, and a technical description has not been published. It is interesting to learn that the new smelter is to be of standard type, though owing to the absence of clay of the best quality a special process is to be used in making the retorts. This follows American experience, where great improvement has resulted from introduction of the hydraulic press into retort making. One peculiarity in the new Japanese plant is that the retorts are to be heated with waste gas from the by-product coke ovens now being built at the Miike coal mine. In the United States natural gas and producer gas have both been used, but we believe this is the first attempt to utilize coke-oven gas in this manner. That there will be many difficulties before the new works run smoothly is to be expected, but with cheap fuel, abundant labor, a satisfactory supply of ore, and a high price for metal, the project is certain of final success. Whether Japan will become an exporter of spelter is a problem for the future. Too little is known yet of the available supplies of zinc ore and Japanese workmen have still to be trained in the difficult art of zinc smelting. It is believed that the ore supply is sufficient, and it is known that on the Siberian coast, as well as in China, there are deposits to supplement those of Japan, but the training of a large group of workmen in an art new to them is a long task, and for some time even the capable engineers of the Mitsui company will have their hands full supplying the local market.

Possibilities of British Papua

By A. W. Allen

The results of exploration into the interior of British Papua have shown how little was known of the country at the time of my stay there, for some 15 months, ten years ago. The intrepid daring of the bands of explorers who have of recent years contributed so much to our knowledge, is an object lesson; and their experiences and records, apart from claiming our interest, are of considerable economic value in estimating the potentialities of that part of the world.

The search for gold in New Guinea was the object of a party of Australian prospectors, as long ago as 1878. Their quest was, however, unsuccessful; and the death roll disheartening. In 1884 a British Protectorate was proclaimed, the first Commissioner succumbing from malaria. The Protectorate was subsidized by three of the Australian states to the total amount of $75,000 per annum; and, in 1888, a year marked by the discovery of the first goldfield, the portion annexed was proclaimed a part of the British Empire, and became a Crown Colony. In 1902 the administration and control was placed in the hands of the Commonwealth of Australia, the title being afterward altered from British New Guinea to Papua, the original native name of the island.

The first Lieutenant-Governor appointed was Sir William McGregor, at one time principal medical officer at the Fiji Islands, where his capabilities, beyond his medical duties, had been duly recognized by the Colonial Office. His appointment to British New Guinea was a particularly wise one, his natural administrative ability being coupled with a knowledge of hygiene and medicine which was of inestimable value in the pioneer work connected with the development of a tropical country. To the soundness of the first administration Papua owes much of its present stability, and the white population their personal security. The law as to the confiscation, and prohibition of manufacture, of any kind of weapon among the natives, did much toward the elimination of inter-tribal feuds; and the strict measures taken in respect to the sale or gift of alcohol to the natives were of considerable benefit to the community. The two principal towns, Port Moresby and Samarai, were laid out on healthful sites, the latter being situated on an island a short distance from the mainland. Swamps were drained, cocoanuts were planted, and strict by-laws dealing with the question of the exposure of even small quantities of fresh water on private property resulted in a marked diminution of malaria and the local extermination of the mosquito. The system of recruiting the native police from the ranks of the discharged prisoners from the jails was a bold but successful move, a neat uniform and an antiquated carbine giving them a sense of importance and authority incompatible with a lapse to criminality; and, at the same time, placing the demonstration of the majesty of the law in the hands of a body of men who were feared by the natives on account of their knowledge of the country and their acquaintance with suspicious characters.

To the east and northeast of the mainland the Possession includes several hundred islands, the healthfulness of the climate varying indirectly with size. A number are of coral; others are of volcanic origin, with or without associated coral. The coral islands are, necessarily, low-lying, and the temperature is remarkably equable, necessitating an absolute minimum of clothing, day or night, throughout the year. A cruise among these islands is an experience not soon forgotten. On all sides are seen brilliant patches of green foliage, in a sea of a clearness and color never found outside the blue Pacific; the general effect being often accentuated by a beach-line of bright yellow coral sand. The rate of growth is phenomenal, and the tidal formation of a diminutive island is followed, almost immediately, by signs of vegetative activity; and a few months will see the starting, by a cocoanut or two and a few rubber seeds, of what, in a few years, will be a dense tropical jungle.

The reefs and reef-flats form aquaria of intense interest to the marine zoölogist. On the reefs may be seen the cheaper varieties of sponge; and tidal exposure to the blazing sun seems to cause no retardation of growth or development. In the shallow waters may be found a number of forms of diminutive mother-of-pearl oysters, with vivid nacre colorings. Immense anemones provide homes, in the protection of their tentacles, for shoals of small fish whose distinct and brilliant markings are in strange contrast to the coloring of their protectors. In return for lodging they doubtless act as lures for the benefit of their hosts. In the deeper water of the lagoon, sponge of excellent quality, *beche de mer*, and pearl shell are recovered by naked divers; and the bed of the lagoon is clearly visible, on a calm day, to a considerable depth. Green, or alderman, turtle are plentiful in season and form a meat supply for the remainder of the year, the flesh being salted and 'jerked' in South American fashion. Tortoise-shell is exported, but because of the great length of time taken by the turtle to reach maturity, the amount of it is not likely to increase. Nature endeavors to make compensations, the number of eggs from a single 'sitting' often exceeding one hundred. These are left to hatch themselves in the sand, but the advent of the young turtles is awaited, with hungry anticipation, by a score of predatory fish, and few are allowed to survive their first swim.

The flora of the islands is not without interest. The rainfall in Papua would be viewed as phenomenal in other climes; and the frequent and alternating applications of heavy rain and blazing sun on decaying vegetation has produced a soil unexcelled in fertility. Tropical flowers, in immense variety, are found; and the air is laden with their heavy perfume during the short space between daybreak and sunrise. Few of these survive the heat of the sun, the majority withering almost as soon as open. Interesting examples can be found illustrating transition stages between wind and insect fertilization; and the insects and bees often show an absence of the trained (or natural) sense of selection in the source of their food supply. The result is that cross-fertilization between different varieties is common, producing abnormalities in what are generally distinguished as fruit and vegetable. Pawpaw, banana, and plantain are grown between cocoanut trees; and these, with yam, taro, and sweet potato form staple articles of diet. The sweet potatoes produced are very small, and a native once explained to me that, in the soft loamy soil of the coral islands, the tuber had no stones to grow against and expand! Timber is available in quantity and most of it is unusually hard. I observed more than one instance of a mode of protection against 'leaf-cutting' ants, noticeable in South America. A fighting variety of ants is given housing in hollows in the tree trunk, and is supplied with food obtainable from nectaries in the base of each leaf. The constant patrolling of the trunk, branches, and stems serves as a protection for the leaves against the destructive variety of ants, and is an interesting example of the interdependence of plant and animal life.

The coral islands are generally protected by outlying reefs, so that so far as bad weather is concerned, they are habitable. The natives, however, have different views on the matter, and numbers of families leave for the mainland, or the larger islands, before December. That month sees the commencement of a period of calm weather until the tail end of the Indian monsoon makes itself felt, in a terrific tempest, about the middle of February. The usual trade winds then set in for nine months, and the natives return in their canoes to their island homes and congratulate their less timorous countrymen on the fact that the

great upheaval has again been postponed.

In British Papua there is no area, of any extent, where gold has been looked for and not found. In the larger islands, Normanby, Sudest, St. Aignan, Rossal, and Marua, considerable quantities have been obtained from alluvial deposits. At Marua (Woodlark Islands) several veins are being worked; and, from an interesting article by H. Mahon in the *Australian Mining Standard*, it is seen that there are several mills at work there, and at least one cyanide plant, the latter handling the tailing from one-ounce gold ore at the rate of 250 tons per week. A number of properties are being opened in the vicinity, and there is little doubt that later on attention will be re-directed to the other islands, whose prospects may be gauged from the amount of gold which has been recovered from the beds of all the watercourses. Little or no prospecting has been done, the miners preferring a profitable alluvial claim elsewhere to the search for vein gold, and possible disappointment. In Papua the prospector, with the help of a few 'boys', expects a much higher return than would satisfy him elsewhere.

The unhealthful conditions prevailing on the mainland are no encouragement to systematic prospecting for gold. As the country is developed the general conditions will doubtless improve in every way. Large amounts of gold have been obtained from alluvial deposits in a number of localities; and fresh deposits are being discovered as the yield from the older ones decreases. There is little doubt that dredges could be worked in the rivers with considerable profit.

J. P. Thomson makes the following statement in his interesting book* on the country: "It is a somewhat remarkable fact that the geological features of British Papua are, in a considerable degree, identical in character with those of Australia, some of the specimens being coincident with those of the Silurian series from goldfields in New South Wales; while some of the fossiliferous rocks were obtained from beds of clay similar to those at Geelong and Cape Otway, in Victoria. From the foregoing remarks, it may not altogether be unreasonable to assume that mineral areas of great value may yet await discovery . . ."

*'British New Guinea,' by J. P. Thomson, p. 191.

The total exports from the colony during 1910 were valued at about half a million dollars. Of this amount, the gold production accounted for $300,000, nearly half of which came from the Woodlark Islands. The white population of the colony has increased steadily since annexation, but the total number is still under 1000 persons. The development of the interior will, doubtless, give opportunity for the development of mining and other enterprise, and the profitable investment of capital.

Labor is plentiful and the Papuans are willing to work if handled cheerfully. One weakness was very apparent at first—homesickness. To counteract the effects of this, the natives are indentured under Government supervision, generally for a year, and sign on and off before a magistrate. This arrangement is an excellent one, and protects both employer and employee. The wages paid amount to about $2.50 per month, and rice. The natives are kept in thorough check by wise legislation and official action.

NATIVE MORTUARY PLATFORM.
PAPUAN NATIVES.

NATIVE WOMEN AND HOUSE.
SAMARAI, BRITISH PAPUA.

Any description of the country would be incomplete without a brief reference, at least, to local habits and customs. These, together with the language used, seem to vary with every tribe; and, doubtless, much remains to be discovered. Primitive simplicity prevails in matters of dress; a piece of pandanus leaf for the men and a shredded cocoanut-leaf petticoat for the women. 'Wives' are bought, sold, or exchanged, but any form of marriage is unknown. Dissolution of the equivalent contract, if any, is common as soon as a change seems desirable. Foodstuffs are obtained from neatly kept gardens, and the love of barter is a significant trait in their characters. Smoked clams are exchanged for sago; tobacco changes hands for betel-nut; and cooking utensils for a supply of sugar cane.

Disposal of the dead is made in curious fashion. In some places the corpses are placed, naked, on a shaded platform, some height above the ground, and allowed to decompose. In other cases burial, in a sitting posture, is the custom, the corpse being made to face the east. The possibility of meeting the ghost of a dead person is a constant source of terror for three nights after death. After that time the spirit is supposed to cease to exist. There are no evidences of a native religion, or of any form of worship.

Tensile Strength of Electrolytic Copper on a Rotating Cathode

By C. W. Bennett

As early as 1865[1] it was noticed that during electrolysis, if the cathode were rotated, a higher current density could be used. Among those actually making use of this was Wilde, who patented a process in 1875, using for the cathode a vertical iron cylinder which was rotated. The current density used in this process was never more than 20 amperes per square foot (2.2 A. per sq. dm.).

The next important commercial application of this principle was the Elmore process. In this, the cathode was a mandrel, rotating vertically, over which agate burnishers rotated, keeping the deposited copper tubes smooth, and of constant thickness throughout. This process is used commercially in Europe at present in the manufacture of seamless copper tubes. The current density used is not more than 30 amperes per square foot (3.3 A. per sq. dm.). The copper thus obtained has a tensile strength of from 36,000 to 50,000 lb. per square inch (25 to 35 kg. per sq. mm.), depending, it is stated, on the speed of rotation.[2] However, a part of this increase in tensile strength over that of copper precipitated on a stationary cathode is most likely due to the increase in the rate of burnishing, for we have here a true analogue to the process of rolling. Due to the increased rate of rotation, the tube passes under the agate burnisher faster, thus giving more and more an approximation to the cold-rolled copper, with its correspondingly higher tensile strength. The Dumoulin process substituted a burnisher of sheepskin for the agate of the Elmore process. It was claimed that the animal fat insulated the projections, thus tending to give a more even surface. The current density was run up to 40 amperes per square foot (4.4 A. per sq. dm.). No mention is made of the strength of the deposit. This was tried commercially in England, but failed completely.

Emerson, in 1899, patented a process[3] for making a copper wire by plating copper on a rotating mandrel, wound around with a spiral of insulating material. The strip between the insulating material was then pulled off and drawn down. In 1899 he likewise patented a process[4] for making copper bars. A copper strip was wound spirally around a cathode which was rotated. The strip was thickened to a bar by depositing the copper on it while rotating. A large [*sic*] cathode was rotated slowly.

S. O. Cowper-Cowles patented[5] practically the same process, using a smaller cathode and rotating it more rapidly. The U. S. patent called for a process using a cathode moving "at such a rate of speed that will cause the hydrogen bubbles to be thrown off from the metal deposited on the cathode, and cause such friction between the metal deposited on the cathode and the electrolyte as to yield tough and smooth deposits."[6]

Using a cathode 12 in. (30 cm.) in diameter rotating 1000 r.p.m., and an electrolyte of 12.5% copper sulphate and 13% sulphuric acid, at about 70°C., with a current density of 200 (preferably 170) amperes per square foot (22 to 18 A. per sq. dm.), copper foil was obtained which was even stronger than the best cold-worked copper. The results would have been more conclusive if a thicker deposit had been precipitated and tested.

Five reasons are given for rotating the cathode:

1. The electrolyte is stirred and impoverishment is prevented.
2. The copper is burnished by the friction with the electrolyte.
3. Foreign matter is eliminated, thus preventing 'tree formation.'
4. Air bubbles are brushed away, thus preventing 'nodule formation.'
5. Thickness of deposit is uniform.

There is little doubt that all of these factors enter into and tend to increase the tensile strength, and to enhance the character of the deposit. However, it seems highly improbable that the factors given above are the only ones entering into the equation. For this reason it was deemed expedient to make some experiments, to see if other factors could be found, and to find their true relation to the tensile strength of the deposit. Then the principle was to be applied to the brasses and bronzes with the hope that alloys of high tensile strength would be obtained.

With the copper the various factors were studied by holding others constant and varying one for a series of runs. In this way the effect of speed of rotation, current density, concentration of electrolyte, and temperature were determined. The apparatus consisted of an electrode holder designed to rotate continuously at any speed up to 6000 r.p.m., and carry 300 amperes.

The test pieces were 0.04 to 0.06 in. (1 to 1.5 mm.) thick. The actual deposit before turning down was much thicker. The measurements of the cross section were taken with micrometer calipers, reading directly to 0.001 in. (0.025 mm.). These pieces were then broken in an Olsen testing machine. Five or more tests were made, and their average taken as the true tensile strength.

During the runs it was found necessary to burnish the deposit once or twice. A mechanical burnisher was not desirable, for it would be open to the objection that the copper was being 'rolled' as in the Elmore process. Therefore it was deemed best to stop the run once or twice, depending on the relative rate of stirring and on the current density, and burnish with emery paper. This was done by holding the paper against the rotating tube. The surface was then washed, treated with a strong solution of potassium cyanide to remove grease, and then with 1:1 nitric acid solution to slightly roughen the surface and insure the adherence of the next layer of copper deposited.

In general, if a solution be stirred during crystallization, the crystals resulting are smaller than those from the same solution without stirring, because more nuclei are formed. In depositing a metal, then, if it be precipitated directly in the crystalline state, smaller crystals should be produced if the solution be stirred vigorously. However, the precipitation of the metal in the crystalline state directly is not at all probable. It is likely that the metal comes down in a condition analogous to a 'melt,' and then crystallizes from this. By rotating the cathode the uncrystallized material is agitated and smaller crystals result. The force of the rotation tends to move the material, forcing it to develop new crystal centres, and in this way prevents the growth of large crystals. Hence in precipitating copper, smaller crystals were expected from the run where the rotation was rapid.

It is also known that the tensile strength of steel, copper, etc., is increased by rolling. Rolling, it is generally admitted, does nothing more than break down crystal aggregates, giving a more finely crystalline mass. Hence, with the precipitated copper an increase of tensile strength was expected with a decrease of crystal size, as the rotation was increased. When this was tried the results showed that the theory was correct.

A solution containing 20% $CuSO_4.5H_2O$ and 12% H_2SO_4 was used. The temperature at starting was 35°C. This was desirable, for trial showed that this was the temperature maintained throughout a run at the current density used, 500 amperes per square foot (55 A. per sq. dm.). The deposits were treated alike, and every precaution was used to keep all conditions, save speed of rotation, constant. The experiments showed that:

*Excerpt from a paper presented at the Twenty-first General Meeting of the American Electrochemical Society, in Boston, Mass., April 18 to 20, 1912.

[1] See *Electrochemical and Metallurgical Industry*, 6, 412 (1908), for review of these processes.

[2] *Electrochemical and Metallurgical Industry*, 3, 83 (1905).

[3] U. S. Patent, No. 395,773, January 8, 1899.

[4] U. S. Patent, No. 638,917, 1899.

[5] English Patent No. 26,724, 1898. U. S. Patent, No. 644,029, February 20, 1900.

[6] 'Mineral Industry,' 9, 229 (1900).

1. Copper has been deposited electrolytically at a current density of 4000 amperes per square foot, or about 430 amperes per square decimetre.

2. In the electrolytic precipitation of a metal the crystal size decreases as the cathode is rotated more rapidly, other things being equal.

3. The crystal size decreases as the current density increases, and increases as the temperature rises.

4. The concentration of the electrolyte can be varied quite a little without changing the character of the deposit.

5. If the precipitation is carried on at a high temperature an effect similar to annealing is accomplished during the electrolysis.

6. The tensile strength of metals varies inversely as the crystal size, and hence any factor tending to decrease the crystal size tends to increase the tensile strength.

7. The effect of rapidly rotating the cathode and of increasing the current density is to increase the tensile strength, the crystal size being decreased.

8. A good deposit of copper could apparently be obtained at an infinite current density if the stirring were efficient enough to prevent impoverishment.

9. The current efficiency at a high current density with rapid rate of rotation, is high, it being 99.6 per cent.

10. Hard-drawn copper can be deposited on a rotating cathode at almost any current density, if the temperature be kept down; and likewise annealed copper, if the temperature be kept at about 75°C.

11. Electrolytic copper has been obtained having a tensile strength of 68,000 lb. per square inch (47.6 kg. per sq. mm.).

12. A deposit as good as the best can be obtained with a current density of 2400 amperes or more per square foot (264 A., per sq. dm.) with the rate of stirring used.

13. With the alloys, the trouble is most likely a question of colloidal material.

14. Acid solutions, with readily soluble salts and no possibility for the formation of colloids, should be sought for as electrolytes in alloy precipitation.

Russian Platinum Market

ST. PETERSBURG CORRESPONDENCE

The position of the platinum market is a weakening one. The demand is very limited; in fact, it is confined to 'asking prices.' It is said that the stagnation and weakening in price for platinum on the Ekaterinburg market is connected with the sales of larger parcels of platinum by the platinum industrial company under official prices. Offers of platinum on the part of the *staratelli* (local semi-independent workmen) remain as before. Larger supplies are expected to be offered shortly, because some of the *staratelli* who had not worked in the winter time are getting to work again now. Speculators positively refuse to pay high prices. They have considerable stocks which, however, are in strong hands; consequently are not likely to weaken the market. The price for 83% metal is now 9 rubles 90 kopeks per pood. A considerable increase in the production is expected in the course of the present year at the mines of the Platinum Industrial Co. in the Verchotur district, which has decided to extend and develop as far as possible the exploitation of its platinum-bearing areas.

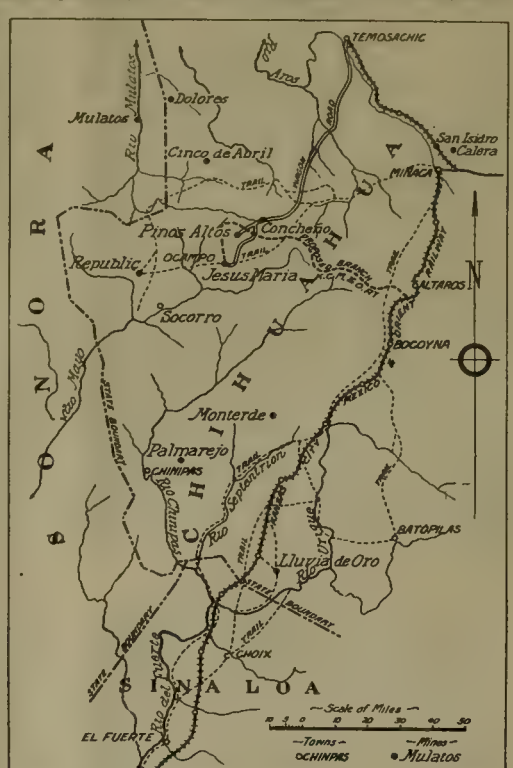
PRODUCER-GAS PLANTS have been utilized to drive centrifugal pumps at Greenbushes, in Western Australia, and the experiment has been so successful that it is probable that this method will be feasible in the Pilbarra district, where the greatest drawback to development is the shortage of fuel supply.

LEAD DEPOSITS on Dolgoi island, which is south of Nova Zembla, have been investigated by Russian engineers, who find that six veins of lead ore occur, estimated to contain altogether 800,000 tons of ore. The climate is said to be favorable for working.

Mines in Northern Sinaloa

BY AN OCCASIONAL CONTRIBUTOR

The town of Fuerte, in northern Sinaloa, was first settled in 1556 by the Spaniards. The ruins of the old stone fort, on the river bank, north of the church, could still be seen a few years since. Choix is 40 miles from Fuerte, only nine hours ride away. The lost Gloria Pan mine, according to Spanish records, is about 15 miles east from the Lluvia de Oro mine, on the south of the trail to Urique. The ruins of the old *hacienda* on the creek below can still be seen, and pieces of ores, similar to the Batapilas ores, can be found there. The old trail can also be seen where it starts up the mountain. Many parties have spent much time and money trying to find this mine, and even Porfirio Diaz is said to have had a party there for a month. The Guadalupe Viejo, from all accounts, is a comparatively



low-grade silver mine; the Gloria Pan was high-grade.

There is no trail from Urique to the Fuerte river, locally called the San Miguel, at San Ignacio; it is near Tuvaris, 15 to 20 miles below. The Oro Fino never was a mine or had any value, being simply a stock-jobbing scheme. At the Calabacillas mine there are only two known ore-shoots, the El Poro, which is not extensive and was worked only about 150 ft. deep, and the San Geronimo, discovered in 1900. Here the ore-shoot is 300 ft. long and developed 500 ft. on the dip; the vein is on the contact of rhyolite and andesite, entirely free, even on the lowest level. This shoot has averaged a yield of $16 gold per ton for the whole production over an average width of about 16 ft. The production has been $3,000,000. There is an old tailing pile of 10,000 tons of an average value of $4, made by the Mexican owners, but since A. H. P. Wynne took it over, the tailing probably averages 60 to 70c. They grind coarse, amalgamate on plates, and leach in cyanide vats. The production of the San Pedro and San Anastacio mines (one) according to Manuel Perez, has been $2,500,000; silver was then $1.29 per ounce. It was worked to a depth of only 350 ft. and not far on the strike. The La Dura mines, unless quite recently, have not been worked for a year or two. The management has a lot of machinery at Fuerte, but lacks the money to transport it to the mine.

Birth of the American Mining Act—III

By H. W. MacFarren

(Concluded from page 561.)

The Apex Right

It has been said that the apex right was inserted in our mining statutes through a misconception of the nature of ore deposits. This is not entirely correct. The apex right was coined through necessity at a time when the lode was considered the principal thing, when the miner wanted only the lode, and laid claim to merely sufficient ground about it to work it, whether he had found the lode upon its outcrop or through running an adit to cut blind lodes. As economic conditions changed through the working out of rich lodes that could be worked at small cost and thereby requiring only a short length along the lode, large investments of capital and extensive underground explorations became necessary. This required a change from the idea that the lode was the main thing to the consolidation of large surface areas under the strong grasp of fee titles to justfy the big expenditures necessary. With this change, and the discovery and working of deposits of such geologic structure as the old-time miner never thought of, the usefulness of the apex right has waned, but no change in the law has been made accordingly. At the time of the passage of this act the apex right was a part of the mining regulations of every district. It was one of the 'miner's bantlings.' Firm in the belief that the lode was the principal thing, the miner believed the apex right to be the corner-stone of successful lode mining. In all the mining communities there was perhaps not one man who was not in favor of it. In 1866, a bill without the apex feature would have been looked upon as a monstrosity. The temporary disturbance from the passage of an anti-apex clause would have been a calamity to the quartz miners. Yet there are those who criticize the framers of the act of 1866, as men of little wisdom and ability because of the insertion of the apex right.

Local Courts Recognized

One of the most original features of the act is that adverse claims or assertion of ownership by virtue of separate and distinct locations, are, at time of asking for patent, to be fought out in the recognized courts. This is a departure from all preceding and later public-land procedure. All adverse or contesting claims to public land other than mineral are fought out in the 'land office court'. Each contestant, with or without counsel, appears before the register and the receiver of the local land office and a hearing or trial proceeds along informal lines. The register and receiver render a verdict from which there are appeals to the Commissioner of the General Land Office and the Secretary of the Interior. After final decision, the winning contestant may proceed with his land entry. This is an easy, inexpensive, and well adapted form of litigation upon public-land questions which registers and receivers are reasonably well able to handle. It it could be indulged in in the case of mining claims, every land office in the mining localities would be deluged with true and 'hold-up' adverse claims against nearly every patent applied for upon a mining claim, resulting in a tremendous amount of litigation involving difficult points of law. All this is avoided by requiring the miner to fight his adverse claims out in the courts, and then come into the land office with his decision as to his possessory right to the claim. But this was so arranged for an entirely different reason. Mr. Stewart said: "It [the bill] also provides, in case of dispute as to the right of possession, for the determination of that question in the local courts where the miner's laws are understood and fairly administered." Mr. Conness said: "We do not propose to occupy the register of the land office by determining that question [adverse ownership]. Why? Simply because it would be changing the entire system that the people themselves have established. They are to be remanded back to settle that question of possession according to the system established by the people themselves; and when that is settled, then the party in whose favor it is settled makes his reappearance in the land office and proceeds to deal with the United States in every step necessary to obtaining title." Mr. Ashley said in the House: "It is objected to the bill that we are to settle that question in our local courts. I tell you all our rights in those mining regions depend upon local rules and customs, and they must be settled there, we will trust to a jury of our countrymen and to the mode of procedure in our courts, our interests, our homes, our whole possessions, much more freely, and with much more confidence than we will trust them to anyone who happens to be appointed to a political position in the government, whether he be Commissioner in a Land Office or Secretary of the Interior, or a clerk who may be deputed to decide upon our disputes."

What Might Have Been

It is an interesting subject for contemplation as to what would have been the results had only the opening clause been enacted—had only the miners' occupation of the mineral land under local rules and customs been authorized and no provisions made for granting fee title. As the local rules, with the single exception noted, required more or less constant development to hold a claim, would the so-called 'paralysis' of mining camps and districts have been avoided? Would the holding of large areas of patented claims without doing further or continuous development work have been prevented? However, the attitude of Congress was almost wholly that the miners should be enabled to obtain the fee title. The single exception was the attitude of the Western members who could not see how a satisfactory method of giving the fee title could be arranged. Of these, Mr. Williams, the dissenter from the bill, advanced the only argument against allowing patent:

> Under the terms and provisions of this bill, as it seems to me, a person may take a claim according to the local usages and customs of a mining district, and he may file his plat and obtain patent; the title becomes perfect in him, and then he may cease operations upon the claim and he may hold it for an indefinite length of time. He may proceed in the same manner on another claim, and so in this way claims may be acquired by individuals, not for the purpose of mining, but for the purpose of holding until they shall be increased in value by the operations of mines in the immediate neighborhood and vicinity; and in this way property may accumulate in the hands of individuals or in the hands of companies; the business may come to be a monopoly in the hands of corporations or of capitalists, while under the present system, as a general rule, a man must remain in possession of his mine, he must work it, he must make it productive; otherwise he forfeits his right to the claim. I think that this part of the bill which provides for the sale of the mineral lands is exceedingly defective. While I admit that it is the most unobjectionable bill of the kind that I have seen, and perhaps is as perfect as any such bill can be made, but it is because in the nature of things you cannot pass a general act of Congress that will be adopted to the varied circumstances and conditions and interests of the different localities upon the Pacific coast, but if you have a rule that applies to one it may operate with injury and injustice to another. I admit, too, that it would be desirable if titles could be obtained to these mining claims, as titles can be obtained to agricultural portions of the country; but I insist that it is impracticable at the present time to obtain such titles.

Mr. Sherman said:

> I think it is to the interest of the United States to get rid of the mineral lands of the United States, to get them into the hands of private individuals; to give them title by patents in the ordinary way, so that the United States will be divested of all proprietary right over mines. I might produce the opinions of Mr. Benton, Mr. Clay, and many

of the most eminent statesmen of America to show that the title to the mineral lands is of no benefit to the United States. From time to time the principle of disposing of mineral lands, salt lands, iron lands, etc., has been adopted, so that now I believe we have no proprietary title in the United States to any but gold and silver mines. I am therefore in favor of the general principles of the bill, and thus dispose and get rid of the mineral lands of the United States. I believe that it would do more to encourage the settlement of the mining regions, to induce people to go there to make permanent improvements if they can get a good title, than any other measure that can be proposed. It seems to me that no man with our ideas of prudence and care would be willing to build expensive improvements upon lands the title of which he does not possess, and that that general idea is sufficient to induce all of us to vote for this disposition of the mineral lands.

Mr. Stewart said:

It [the bill] provides that when a man has found a vein and improved it to the extent of $1000 he may get a title. That is the very thing that the tunneling companies want. I know a great many men engaged in that work. I have many constituents engaged in it. They are all pressing for title when they find a vein. They say, if we run into the mountain and take the chances we want the privilege of buying the vein when we discover it.

Mr. Julian said in defense of his bill:

Years ago we adopted the policy of leasing those mineral lands [the copper and lead mines of Michigan], and retaining the fee in the National Government. The result was an utter failure, financial and otherwise. We established at length the policy of survey and sale. The moment we instituted this policy of survey and sale order began to bear rule in the mining regions, sober and intelligent citizens became purchasers and settlers, and organized and prosperous communities were established.

John A. Kasson, representative from Iowa, proposed as an amendment the sale and patent not of the mine, but of the *use* of the mine. He stated that he was in favor of the United States retaining the fee title to mining property, also that it should have a right to regulate the production. The amendment was to be made active by the following section:

That Congress reserves the right of forfeiture and of redisposition of all claims patented under the provisions of this act, which shall not be in good faith developed, used, and worked within three years from date of such patent, and with reasonable continuity thereafter; and to provide all rules, regulations, and conditions for ascertaining the same and relating thereto; and if any such claim shall be abandoned, the same shall be thereby forfeited, and may be again patented to any other claimant on the same terms as before, * * * and Congress further reserves the right to adjust by general law, in any mining district, any discrepancies, irregularities, or uncertainties touching the character and management of mining claims.

He concluded his remarks with the following statement: "The great object of the Government should be to develop the mineral resources of that part of the country; and in doing that it can best be accomplished by providing that they shall not absorb these lodes and veins and hold them, as they do the public lands of the United States, for purposes of speculation, but they shall go and continue in good faith to develop them. If they do that, then the title will be granted; if they do not, the title reverts to the United States. Unless this is done, I see no safety in passing the bill as it comes from the Senate." This amendment was objected to without discussion, for, as said before, the sentiment of Congress was almost unanimous that the miners should have their fee title, if possible. Today, such an amendment would provoke a profound discussion, in which the 'paralysis' of mining districts and the value of throwing land open to further prospecting and development that is now held idle under patent, would be balanced on one hand by the effect of the amendment upon the investment of capital and the making of large-scale permanent improvements on the other hand.

Development of Practice

The act of 1866 met at once with the general approval of the miners, especially the opening section confirming their possessory rights. During the first 18 months the number of applications for survey and patent was not large, owing to a lack of knowledge of just how to proceed in the details. But gradually the Land Department evolved a set of regulations and the number of applications kept increasing.

The success and increasing satisfaction in obtaining the fee title to lode claims led to the desire for a law authorizing fee title to placer claims. Many of these were used partly as gold diggings, partly for agricultural purposes, and partly as a home site. Naturally there was as strong a desire to obtain patent on the part of their owners as there was on the part of the lode-claim owners who had invested large sums in improvements. On December 13, 1869, A. A. Sargent, representative from California, introduced H. R. bill No. 562 to give title to placer claims, giving it the name, 'An act to amend an act granting the rights of way to ditch and canal owners over the public lands, and for other purposes.' It was considered by the House on March 17, 1870, when Mr. Sargent explained the purpose of the bill, which, in the language of the bill and the present statute, is, "That claims usually called 'placers', including all forms of deposit, excepting rock in place, shall be subject to entry and patent under this act, under like circumstances and conditions, and upon similar proceedings, as are provided for vein or lode claims." Mr. Julian, still smarting under his failures and rebuffs of four years before, was at once upon his feet. Referring to the original act, he said that "It had a false title, calculated to mislead every man who read it; and under a false title it was passed through the Senate and the House, without opportunity for any thorough discussion of its propositions. It not only had a false title, but I hold that it was based upon false principles of legislation." Following which he launched into a general tirade against the bill without producing any definite arguments. After a few favorable remarks by others and some amendment it was passed by the House.

Mr. Stewart reported the bill in the Senate from the Committee on Mines and Mining on March 22, 1870. Later, after some desultory discussion regarding certain amendments which were added, the Senate passed the bill. The House refused to accept the amendments and the bill was sent a conference committee of both houses, from which it emerged it an acceptable form on June 28. On July 9, 1870, it became a law through the approval of the President.

The Placer Law

The act of July 9, 1870, has been called the 'placer-mining act' because it related to placer claims only. It provided that the price should be $2.50 per acre and that two or more persons as associations could make joint entry, but no person or association was to take up more than 160 acres in one claim. Nothing other than this was said as to the size of the claim or how many claims could be located by one person—that was to be left to local rules. The later act of 1872 limited the claim of a single individual to 20 acres, and proportionately for each individual in an association up to the maximum of 160 acres. The clause that two or more persons or associations of persons having contiguous claims could make joint entry—the clause allowing 'association' placer claims—was stricken out in the Senate on the motion of Mr. Harlan of Iowa on grounds that it might allow a species of monopoly of mineral land. But in the conference this clause was put back in the bill at the instance of the House. It will be noted that the bill read, just as retained in the present statute: "Claims usually called 'placers', including all forms of deposit, except veins of quartz, or other rock in place." Why was the bill not more specific in its wording, so that confusion between what should be located as a lode and what as a placer could be avoided? In 1870 a placer meant only a deposit of gravel containing gold, either surface diggings or the deep-lying gravel deposits. But the framers of the act, wishing to extend the boon of fee title to all miners and all mineral deposits, added the all-inclusive "including all forms of deposit, excepting veins of quartz, or other rock in place." They undoubtedly meant all deposits which could not be located as so many feet in length along a lode and which could not claim apex rights. With the discovery

and location of deposits of 'vein origin' or lode formation, in which so many feet in length of a lode could not be claimed and which were not properly subject to apex rights, the idea became defective. Recourse was then had to the language of the statute, both regarding lodes and placers. In this way there have been formulated certains rules* as to what is to be patented as a lode and what as a placer as viewed by the Land Department. These are liable to be upset or changed at any time by court decisions as to what constitutes a lode or placer, and by the coming to light of some deposit having a geologic occurrence of such new and novel form that it cannot be correlated to either class of deposit under the present rules. However, I believe that the indefiniteness of the statute, so far as it tended to all inclusiveness, is good. Applications for patent are constantly being made on substances and types of deposits that well informed mining engineers have never heard of. It is a safety measure by which the miner has been enabled to get his patent, no matter what his deposit was like. And certainly, the Government can afford to part with a small amount of its resources, rather that that an honest and deserving applicant of small means beyond the hope of original and remedial legislation should have the work or hopes or savings of years swept away because the law just fell short of including him. It is true that congressional legislation can extend the placer act to any form of deposit, and so it did in three distinct subsequent cases, those of building stone, petroleum, and salt deposits. But these were mainly at the behest of bodies of men who waited with bated breath to learn if their rights would receive full protection. There can be one form of location to cover both classes of deposits only after the apex law has been abolished, after all attempts to require the claim to be located with the lode in a particular position has been abrogated, and after the association clause has been annulled to reduce all placer claims to the same maximum area as lode claims.

A bill was introduced by Mr. Stewart at the next session of Congress 'To define and protect the rights of miners and to encourage the development of mines.' This bill with some small changes was the same as that which became the act of 1873. Mr. Stewart made the following explanation: "This bill makes no change in the principles of legislation heretofore had as to mining claims, except that it limits in certain instances the rights of miners to make laws for themselves and defines the shape of their claims more definitely. It is a bill that has been sent out five or six times in various forms through the mining states and territories." The bill involved three ideas: to harmonize under one general system the main features of the thousand and one sets of district regulations to restrict the miners in any district from making regulations that would not work in step with other regulations and statutes, and finally to build up the mining law into a good working machine. The bill passed the Senate after a very brief discussion. In the House Mr. Julian was gone, but the bill failed through want of time to consider, even though the Committee on Mines and Mining was ready to report favorably on the bill through its introduction by Mr. Sargent.

Revision of the Law

The opening of the next session of Congress saw the old guard at it again with hammer and tongs. Mr. Sargent introduced the bill into the House as H. R. No. 1016, where it was discussed and passed on January 23, 1872. Reaching the Senate, it was amended by Mr. Stewart, who said:

> I wish to state that in the first instance the miners legislated for themselves. Congress finally in 1866 passed a bill embodying many of the principles of this bill, and from that time to this the Land Office has been operating under it, and for the last three years we have been attempting to codify it and bring it into a shape that will be satisfactory and more certain and correct abuses. Last year a bill was introduced here and passed which was quite similar to this. A bill has passed the House which is similar to the one that was passed here last winter. Since its passage by the House the delegates from the territories and those familiar with mining rules have had a great many meetings over this bill in connection with the Committee on Mines and Mining, and the result is a codification, which is the best they can do. I believe it will meet with universal favor. This is the best we can get with all the experience we can bring to bear. It is no one man's work, but it is the work of a great many men interested in this business.

On April 16, the bill passed the Senate under the title of 'An act to promote the development of the mining resources of the United States,' and on May 10, 1872, was signed by the President.

The Final Act

The act of May 10, 1872, the third and final act and our present mining law, changed the size of a lode claim from the heretofore unspecified width to a maximum of 300 ft. on each side of the vein or lode. It also changed the maximum length that could be taken up by a person or association to 1500 ft. along the lode, instead of 200 ft. for each individual and a maximum of 3000 ft. for an association. The bill as first introduced by Mr. Stewart in 1871 provided 200 ft. in length for each locator and 3000 ft. for an association just as the act of 1866, but allowed the maximum width of 300 ft. on each side of the lode; and in this form it passed the House in 1872. But Mr. Stewart and his associates afterward changed it while in the hands of the Senate committee to give a maximum length of 1500 ft. to both an individual and an association. Mr. Stewart explained this as follows:

> In the act of 1866, it is true, the locator was confined to 200 ft., and 200 ft. additional for the discoverer of the lode, making 400 ft. It allowed them to unite in companies until they got 3000 ft. In practical operations it is thought by the delegates generally, and that is the experience, that 3000 ft. is longer than can be worked at one place conveniently, but 1500 ft. makes a very reasonable claim. The practice under the other law was for them to put in fictitious names and buy them out, and you could not prevent them from doing it. This matter was discussed considerably, and we had several meetings on this point, and the committee thought it best to let them do directly what was reasonable, and not have them do anything indirectly.

The act provided for the present annual labor or assessment work of $100 upon each claim, which matter the act of 1866 had left wholly to the district regulations. Mr. Stewart's original bill of 1871 required labor to the amount of $25 for each individual holding or location of 200 ft. Mr. Cole, senator from California, proposed to require annual labor on patented claims as well as unpatented ones by adding the three words in italics to what is now the present wording of the law: "and upon a failure to comply with these conditions [the performance of annual labor], the claim or mine upon which such failure occurred shall be open to re-location in the same manner as if no location of the same had ever been made *or patent issued.*" He said: "The danger we are under in this country, where we have the richest mines that can be found in the world perhaps, is that they may be purchased up at these government rates in large tracts or quantities. We wish to avoid that very thing, and require the miner to use some little diligence and exertion in the working of his mine or the mine-owner to expend some industry or capital upon it, or else leave it subject to a beneficial use by some other party." Mr. Stewart replied to this: "Requiring work to be done after the patent has been issued would destroy all the virtue of your patent. The object of the patent is to give title; it cuts off all uncertain title; if the person wants to improve a claim he can go and buy it, and it becomes private property, and it is certainly the best policy to have any kind of property improved that it shall become private property. Men think more of a patented claim than they do of one that is not patented. They will spend millions in prospecting a patented claim where they will not spend hundreds of dollars to prospect a claim where the title is uncertain and liable to be disturbed by somebody outside. A patent title is the best for mining operations. Now, for want of a more definite rule the whole region is in litigation. Every man who goes from here West to locate a claim finds so much local legislation which is uncertain that he is discouraged; he finds the neighborhood in litigation." The amendment requiring annual labor upon patented claims

*"Mining Law for the Prospector, Miner, and Engineer," H. W. MacFarren, page 87.

was rejected. The act reduced the amount of improvements required upon a claim to secure patent from $1000 to $500. It provided for the location of tunnel sites, mill sites, veins within placers, and for a number of important details.

Minor Changes

No legislation and no modifications, except by Land Department regulation and court construction of the statutes, has since been made that can be considered of importance. The following is the substance of the more important subsequent acts: The period of annual labor shall commence on January 1, following location [January 22, 1880]. Building stone may be entered as placer [August 4, 1892]. Lands containing petroleum may be entered as placer [February 11, 1897]. Lands valuable for salt springs or salt deposits may be entered as placer [January 31, 1901].

It was fitting that the honor of signing the first mining act as President of the United States should fall to Andrew Johnson. In 1846, Mr. Johnson as a representative from Tennessee introduced the first homestead bill in Congress. For 16 years until its passage and approval by Abraham Lincoln in 1862, he labored so unceasingly for it with the assistance of such men as Webster, Seward, Douglas, and Horace Greeley, and against the other representatives of his own Southland, that he achieved national fame as the great champion of the homestead bill. The homestead act and the mining acts have been alike in principle and doctrine. One gave free land to the landless individual who would settle upon the land and improve it, and there create a home and subsistence for himself and his family. The other by the system of free mining encouraged the individual to go forth and try his luck and seek his own aggrandizement upon the public domain. Both have added vastly to the wealth and prosperity of the nation. Both were an appeal to the man of more time and muscular ability than means and profitable business connections. The principal beneficiary under the mining acts has been the poor man. H. F. Bain has said*: "We are not aware of any great successes attained by the development of virgin mineral resources that have not been the result of endeavor in the first instance by men who had all to gain and nothing to lose. Prospecting and initial development are essentially functions of the poor man, and the law that does not give the man of small means a chance distinctly limits the expansion of industry." Over the whole of the West is found the man with claims who goes forth each year to do his annual labor or assessment work. If he has no dependents upon his income, he may spend several months each year hunting for signs of mineral and driving his shafts and adits. If he has a family to support he may spend only a few weeks. His task may be hard and his hope deferred ten times over, but still he persists with sublime faith. He knows that in every city of the West are magnificent residences and handsome office buildings and in every fertile valley are fine ranches that are monuments to the fact that men even more humble, more lowly, more unlearned than himself have 'struck it rich.' Examine the abstracts of title of any mining claim and you will find that the locator has held it for years and that there are no 'dummy entrymen' under the mining acts—unless we consider locators of association placer claims as such—and exceptionally few corporation locations. A touch of sentiment is found in these abstracts, for the first quit-claim deed of a claim having a feminine name usually shows that it was named after the better half of the locator.

The Law and the Prospector

The true worth and greatness of a law is not measured by the material prosperity it may bring. A law that raises up trusts but produces a nation of slaves, tenants, and wage-earners may increase the wealth of a nation, but a law that clearly shows and gives the individual of small order a chance to raise himself as well as to add to the nation's prosperity is a law of which all may be proud. Would any system of selling the mineral lands as so much land, any system of Government exploration and ownership, or any leasehold system with onerous terms of development have attained this end? Perhaps a leasehold system with convenient and easy terms of development would, but before approving of it for metalliferous minerals, many things should be known. Will it send an army of prospectors into the mountains and deserts? Will it honeycomb the mineral lands with evidences of where a great body of adventurous men have spent their surplus time and energy in the effort to make a stake for themselves? Will it cause them to dig and starve and thirst and freeze for the fifteen or twenty-five years of individual effort that Mr. Stewart, even in 1866, said it took to find and make a mine? Will it keep them hammering away at the face of the drift, until, 'down to their last bean,' they break into a rich body of mineral? Or will it drive from Alaska the 'sour dough' who is happiest when exploring some creek 'where no white man has ever been before,' and from off the Nevada desert the knight of the narrow-gauge mule and the 'dutch oven' who will be peculiarly contented if he finds a spring of sweet water at the end of the day's journey? If the leasehold system will attract capital and induce extensive improvements equally as well as the present system, but will render the prospector's playground more attractive to him and cause him to go forth and dig with greater zeal, then we want the leasehold system, or any system that will produce such desirable results.

What a wonderful act it has been. Child of a thousand regulations scattered over the Western Empire, born in an atmosphere of hostility far from its native hills, conceived by strong and fearless men and brought forth by a series of masterly forced marches, baptized in the fire of congressional battle, even its framers knew not with what an enduring act they wrought as they brought forth something that others of learning and experience had declared impossible. It is imperfect—so they said in their sincerity and humility at its birth. For six years they nursed it and added to it until it could stand upright, and then made no boast, only saying, 'We have done our best, we can do no more now.' Can they, by any stretch of imagination, be expected to have believed it would stand without change for forty years? Or to so successfully pass through the ordeal that those forty years have brought? And yet today, with critics and scolds on every hand, there is only one specific improvement—the abolishment of the apex right—upon which there is any pretence toward agreement. Why is it that with all the pro and con about the mining law, no specific and substantial improvement beyond the abolition of the apex right has been submitted, or at least none is on general and accepted record? Is it not that it is felt, if not admitted, that the mining law can be amended for the better; but need not be abolished?

A fact that stands out prominently in public-land history is that claimants of public lands under any unperfected rights, and a large portion of those closely allied to that class, are always against change in the laws. They say, "We are satisfied with the law, we don't want it changed," meaning that they understand the present law and wish to perfect their existing rights under it, and feeling that a change in the law will not help, but in nine cases out of ten will cause them serious loss and trouble or hinder their future operations. Therefore, it cannot be expected that those men who 'have claims' and the allied interests will take kindly to any innovation. It is also a well known fact that Congress is conservative, especially in public-land legislation. If the mining acts must become as ill-suited to conditions as the other public-land acts are before they are repealed or remodeled, then our present mining acts are still in their vigorous youth. It is generally understood now that, owing to the peculiar public sentiment at present regarding public-land matters and public resources, Congress does not wish to take any more action on questions relating to the public lands than may be absolutely necessary. All these conditions lead us to the belief that the defects in the mining laws should be met by strengthening the organic act and providing for new conditions, but without altering the doctrines or principles along which

*Editorial in *Mining and Scientific Press*, January 7, 1911.

the laws themselves have been operating. It should not be made harder to locate, hold, develop, or sell a claim than it now is for the man who tries to live up to the letter and spirit of the present law. But the claim-owner should be made to live up to the spirit and letter of the law, and the law should be kept so broad that the miner may not be interfered with by technicalities.

Needed Changes

First in the list of proposed changes is the apex question. I do not believe that the retention or repeal of this feature will increase or decrease by a fraction of one per cent the number of mines found or opened. Its repeal will stop a lot of expensive litigation, but will not stop that upon claims already located, unless the repeal is made retroactive. To make the repeal retroactive would be to establish a new principle in legislation that would be generally undesirable, and I hope it will never be done. Judging by the record of the past, a goodly number of mining attorneys, engineers, experts, and witnesses now employed in apex suits will find, if the apex law is repealed, just as remunerative employment in suits for underground trespass and ore-stealing as at present. The good to come from repealing the apex law is largely that provisions could then be made for locating lode or quartz claims as so much land with any kind of boundaries, end lines would not need to be parallel, and the claim would not require adjustment to the outcropping lode; however, this would not do away with adverse claims and other troubles from overlapping claims. It should always be borne in mind that the apex right is a distinct feature unrelated to the remainder of the law, except as previously suggested.

The next proposed change, one that can readily be made and that should work no hardship, is a codification of the state laws and national statutes. This should include working out new laws, and, when enacted into the federal statutes—into a new mining act—should serve two purposes: (1) through uniformity and resulting wide comprehension of all the necessary details, to do away with all necessity of state statutes on the subject of locating and holding a claim, of which the present exceeding great diversity does not effect a single good end; (2) to enable the simplifying and strengthening of the weak and ill-suited parts of the present law without working any hardships on the miner or embodying any new doctrine. This last would relate to simplifying the method of laying out a claim if the apex law was repealed, to requiring development in such a way that 'paper' locations would be of no avail, to making it easy for another to locate a claim upon which the required development work had not been done, to requiring the claim to be kept marked so that it can be readily found and identified, and similar measures. Also, allied to the second, is the formulating of suitable laws for exploring and developing peculiar deposits and such deposits as gas, oil, phosphate, and others, and the location and development of lands upon which no mineral discovery can be made except by and after extensive development. Following this the question of leasing metalliferous mineral deposits may be considered. Likewise, the effort may be made to find some way to prevent the 'paralysis' of mining districts, both with respect to claims patented heretofore and hereafter; but this is a dangerous subject and one that needs careful consideration.

Method of Revision

In case an attempt is made to improve the mining laws along these lines, the greatest trouble will be caused through inability to know where to stop. To some the revision will not be carried far enough; to others it will be carried too far; nobody will be quite satisfied, and if the revision is carried too far and the law is not broad enough, many with unperfected rights will be caught between the millstones of adverse legislation, and future prospecting will be retarded. It is well known that the miner will fight to retain a claim that may be acknowledged to have little value, and that no topographical or climatic conditions will hinder him from prospecting and locating claims. But the truth is not so generally known that the mine hunter cannot brook restraint by 'red tape' and technicalities of legislation and Government control in locating claims. If he cannot slap down his location and go to digging without being interfered with by a lot of regulations in which he is able to see no wisdom or expediency, he at once gets discouraged and goes away without making locations. It is said that some other class of people will be willing to undergo the trouble required to locate the claims and will take up the ground. Before accepting this, go into the mineral districts and inspect the unpatented locations. See how unencouraging and unpromising looking they are. Then consider if anyone would go to much trouble to locate the virgin surface, or whether, in a large number of cases, anyone would try to develop this unpromising ground into mines were it not for that contagion caught from acquiring ownership through easy location—a contagion that is unexplainable, but that draws the prospector back year after year.

It is to be hoped that whoever may undertake the revision of the mining laws will bring to bear the same wide and intimate experience, the same abiding respect for the gravity of the subject, and the same hard and careful work that Stewart and his fellow-laborers had, and that they will be guided by the same lofty sentiments and the same wise consideration and respect as were expressed by the statesmen of that day for the individual who skirmishes in advance of the army of capitalists, investors, promoters, engineers, and workmen, and who is the foundation of our mining prosperity.

Mineral Resources of Nigeria

London Correspondence

The annual report on Northern Nigerian affairs just issued by the British Colonial Office remarks that the exploitation of the tinfields in Bauchi has already attained considerable proportions, and that a large amount of capital—at least twelve and a half million dollars, says this report—has been invested in the various enterprises. The stanniferous areas are undoubtedly large and valuable, but in several cases company promoters and others have expressed hopes and forecasts which can never be fulfilled. As far as is known at present, tin is to be found in more or less profitable quantities over 9000 square miles of territory, extending from Ningo in the extreme east to Duchin Wei, situated about 40 miles east of Zaria, to the extreme west; and from Liruen-Kano in the north to the Ninkada and Mada districts in the south. Mining leases have been granted over about 12,000 acres and exclusive prospecting licenses over about 355 square miles. Prospecting rights have been granted to 149 prospectors. During the year under review (1910-11) 800 tons of cassiterite was exported. Opinions vary as to the probable future prospects of the tinfield. It is safe to say, however, that the existence of the tin over a large area has been proved, but that up to the present time sufficient prospecting has not been effected to render it possible to draw any conclusion regarding the value of the field as a whole. The report also mentions that rich deposits of galena, containing silver, are known to exist in the province of Muri, and adds that these reefs, which have been to some extent worked by the natives, are now being closely prospected by European engineers. Pockets of native silver have from time to time been discovered in the vicinity of Orufu and Wukari.

The question of transport has been the great trouble. From the nearest available spot on the Niger the so-called Kano main line is being extended across Northern Nigeria. This was planned before the discovery of tin ore and was part and parcel of the general colonial development of the territory. With the finding of tin and the necessity for quicker transport, a special branch line was started from Zaria on the main line to run for about 100 miles to the west and to terminate at the foot of the Bauchi plateau at Warno. The question of labor supplies has also been raised, and many conflicting views are held.

A Convenient Slag Furnace

By J. D. Hubbard

A description of this slag furnace and the method of reduction of slags obtained from the melting of cyanide precipitate at the Oriental Consolidated Mining Co.'s plant at Taracol, Korea, were given in the February 5, 1910, issue of the *Mining and Scientific Press*. A further description, and details of construction, may be of interest to the profession and assist some one who is confronted with the same problem. In the preceding article the cost per ton of slag treated was given at $32.89. This was no doubt a shock to the economical, and prevented any further consideration of the furnace, as many could ship their slags to the smelter for a less cost per ton than $32.89. In actual practice with the furnace it has proved conclusively that the costs were much less. The elimination of coke for fuel (which costs $30 per ton at Taracol) and the substitution of charcoal, also the reduced labor and other costs, have resulted in lowering the net cost to $7.51 per ton of slag treated, as follows:

Charcoal	$4.50
Labor	1.66
Power	0.17
Iron, etc.	0.12
Firebrick	0.84
Depreciation (25%)	0.22
Total	$7.51

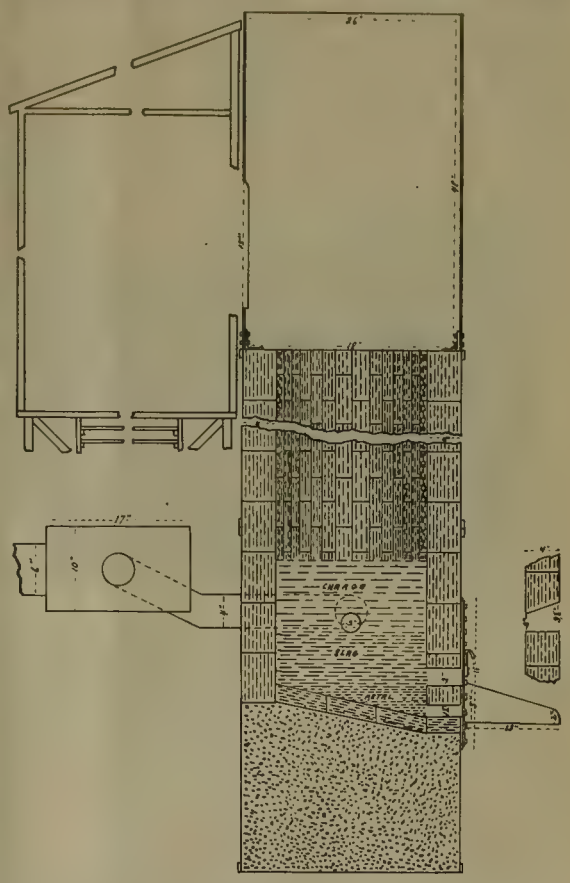
This cost is less than the treatment charge at the smelter, to say nothing of freight. Adding the advantages of local treatment products where possible, and the high net extraction obtained on a refractory slag, this slag furnace offers advantages.

Of course, the labor item would be cheaper in the Orient or other low-priced labor countries than in the United States; but, on the other hand, fuel, especially where oil can be used, would be much cheaper than in the States. One-half ton of coke is amply sufficient to reduce one ton of the most refractory slag. Where the slags contain only shot gold or silver, re-grinding in a clean-up barrel with quicksilver would practically recover all of the precious metals, but in most cases where they are held in matte, drippings from crucibles, scales from the roasting-pan, etc., from a low-grade bullion product, it necessarily follows that a different metallurgical process must be employed. The cleaning property of lead on a charge is too well known to require reiteration. It follows that if the proper amount of lead be added to a slag containing gold and silver in a metallic form, a satisfactory elimination of gold and silver will result. Acting upon this principle, this slag furnace was evolved and perfected as far as possible. It has proved quite satisfactory in Korea and has saved the Oriental Consolidated Mines Co., where it was developed and put in use, much money.

The plan of the furnace is simple, as can be seen by the drawing, and any small blacksmith shop would be equal to the construction of one. The furnace shown in the drawing is large enough to treat two tons of slag in ten hours. But the capacity can easily be increased by proportionately increasing the dimensions of the furnace. The shell may be made of any old sheet iron available, as its use is merely to hold the inside lining in shape. The shell will last indefinitely if the lining is kept intact. It is always necessary to renew a portion of the lining after every heat. At first firebrick alone was used for the lining, but I found that a mixture of red clay, broken fragments of graphite crucibles, and discarded firebrick, all broken to pass a 1-in. ring, was just as effective for lining, and of course much cheaper. The only firebrick used are to line draft-holes and tap.

Another point of economy was that it was not necessary to buy a single pound of lead for use in the furnace, as slag from the assay office, which always contains unreduced litharge as well as borax and sodium bicarbonate, both useful in liquefying slags, was used for the purpose. The charcoal used as fuel brought all the lead down in good shape.

The method of treatment was fully described in the article mentioned. Briefly, it is to mix the slag with the required amount of fuel and assay slag, and feed it in slowly at the top of the furnace. A proper amount of forced draft must be maintained, and care taken not to overfeed the furnace. A roof over the feed platform is quite desirable for protection from red-hot cinders and particles of melted slag. It is essential to keep the draft-hole in good shape by reducing the diameter of the inside end of the opening, as shown in the drawing. The sharp angle formed



A CONVENIENT SLAG FURNACE.

by the top brick prevents the slag from backing up in the draft-hole. Also the hinged door at the tap or some other arrangement for opening and removing the residue of the charge at the end of the heat is necessary, so as to leave a clean furnace for the next charge.

The actual extraction by bullion returns, and assaying the final slag at Taracol, Korea, was 98% on over $40,000 worth of slag. The bullion produced is necessarily base, averaging at Taracol 34.45 gold and 259.51 silver. There is enough excess lead in the base bullion for satisfactory cupellation, yielding clean doré bullion. A shallow cupel, 3 in. deep in the centre and 10 in. wide across the top, is a satisfactory size to use, and does not require a very large cupelling furnace. The cupelling furnace may be of simple construction, care being taken, however, to have it sufficiently large on the inside to allow plenty of fuel around the muffle. The muffle should be large enough to admit two cupels 3 by 10 in. Each cupel will hold 25 lb. of bullion. A patent has been applied for on this furnace to protect it from speculators, but it is freely offered to metallurgists and mining companies who may find it useful. My thanks are due to W. H. Aldridge, master mechanic, and B. Pedersen, his assistant, for valuable hints given in the construction of this furnace.

The Chilean Nitrate Industry

The nitrate industry of Chile enjoyed a prosperous year during 1911, according to consular reports from Iquique, with exports at about 2,000,000 Spanish quintals, or 101,400 tons, above that of 1910 and an advance of 5 to 10% in prices. This is owing quite largely to the work done by the Nitrate Propaganda Association in Europe and the United States. Several new nitrate works have been opened during the year, and others have been enlarged. There is a bright outlook for this industry during 1912, which means that business in general will be good in Chile during that time, for this is the important industry of the country. The nitrate industry is not only an important factor in the commercial interests of the country, but it supplies a very large part of the nation's revenues, as may be seen from the following table:

Periods.	Amount.
1880 to 1884	$ 26,364,415
1885 to 1889	40,724,145
1890 to 1894	58,533,795
1895 to 1899	74,886,320
1900 to 1904	86,696,625
1905 to 1909	113,866,130
1910	28,977,725
Estimate for 1911	29,000,000
Total for 21 years	$459,249,155

As showing the comparative importance of the several Chilean ports from which nitrate is shipped, the following schedule gives the quantities (in quintals) exported during the first nine months of 1911: Province of Tarapaca—Pisagua, 1,938,142; Junin, 1,127,500; Caleta Buena, 3,675,850; Iquique, 8,011,983; total, 14,753,475. Province of Antofagasta—Tocopliia, 4,615,572; Mejillones, 4,920,049; Antofagasta, 4,172,119; Caleta Coloso, 2,011,927; Taltal, 4,146,904; total, 19,866,571.

The market price of nitrate of soda declined during November 1911. The first part of that month there were sellers at $1.95 American gold per Spanish quintal for immediate delivery alongside vessel, and buyers at $1.94 gold. The last part of November, sales were made at $1.89 American gold per quintal, and for delivery during all of 1912 the price was $1.85 American. On December 6 there were sellers at $1.84 and no buyers in the market. There is no explanation offered for this slump, but as it has been a slow steady drop, it is probably more than a temporary fluctuation. There is a scarcity of labor in the pampas (plains), and many of the nitrate works are advertising for laborers in the daily papers. Gangs of men are being brought up from the south of Chile to supply the demand.

The Antofagasta pampa seems to be the more prosperous at present, as the grounds are newer, whereas in the Province of Tarapaca many of the grounds being worked are partly exhausted. The Government of Chile is contemplating the auction of public nitrate lands in Tarapaca, which, although adjacent to existing nitrate extraction plants, are large enough to warrant the construction of new works. The law authorizing this auction is under discussion, but has not passed the Congress, as it is being strongly opposed by the Antofagasta interests, on account of the fact that a part of the proceeds are to be expended in public works in the Province of Tarapaca. The minimum prices specified in the bill are considered extraordinarily high in view of the low grade of the 'caliche' (native saltpeter), of which some lots run as low as 10 or 15% nitrate, being the poorest quality which has been offered for sale so far. In consequence, it is not expected that there will be many purchasers; in fact, it is doubtful if a sale will be made at these prices. Maps of the grounds are not printed, but may be seen in the office of the Asociación Salitreria de Propaganda, in Iquique, and in the offices of the Secretaría del Consere Salitrero, and of the Delegación Fiscal in Santiago, Chile.

The Chilean Government has collected an export tax of about $12.34 per metric ton (2204.6 lb.) since October 1880 with the above result, and of late the Government has been discussing the advisability of increasing the tax. It is claimed the supply is sufficient for many years at an even greater production than at present, which means much for the future of the country and its people. On the strength of this, extensive internal and port improvements are planned for the next few years.

The Gee Centrifugal Concentrator

By Edward Walker

Some attention is being attracted in Cornwall at present to a centrifugal machine invented by W. J. Gee, originally intended for the purpose of rapidly settling china-clay slime, but more recently proposed to be applied in concentrating metallic slime. I am not aware that the machine is in actual practice, but as the principle is of interest, I will give a short account. The machine as applied to settling china-clay slime consists of a vertical cylinder revolving at a peripheral speed of 100 to 200 ft. per second. Inside are fixed vertical radial vanes held in place by vertical rods and removable liners. The slime is fed at the top, and the coarser and heavier particles are caused at once to fly to the periphery and build themselves into a wall. As the water gradually passes down the sides, the finer particles range themselves to the periphery. The water also forms itself into a wall, and when its internal surface comes to the edge of the bottom plate, it commences to discharge through orifices. The rate of feed and of revolution are so adjusted that the effluent is quite clear. After a time the machine is stopped, the liners and adhering slime removed, and other liners put in their place. The cakes of slime may be divided into as many grades as desired, it being remembered that the particles are largest at the upper end and finest at the bottom end. The inventor claims that the classification of china-clay is done more efficiently than in the usual 'drags' and settling pits, that the removal of water is more complete, and that the time occupied is greatly reduced. The high velocity of rotation is a disadvantage and involves the use of special foundations and bearings. The fact that the working is intermittent may also be considered as against the process, not because of the actual time lost, but on account of the labor required.

When applying the principle in the concentration of slime, a different motion is required. The inventor makes the vanes independent of the shell, and revolves them in the same direction and at a rather higher speed. The separation of the mineral from the gangue could not be effected at all unless the feed is accurately sized, so that the finer the slime the better. The difference in the speed of revolution of the vanes causes a washing effect at the point of deposition, so that the particles of lower specific gravity are kept in suspension and are eventually removed with the effluent water. Many adjustments will be required, namely, the speed of the cylinder and of the vanes, the distance of the vanes from the periphery, and the rate of feed. In carrying out the process, the feed would be stopped when a sufficient amount of concentrate had accumulated, and clean water substituted, so as to remove all the gangue still in the cylinder; afterward the concentrate is removed by retarding the revolution of the cylinder but not of the vanes. If all these delicate adjustments can be easily made, and if not too much skilled labor is required, the process may prove applicable to the treatment of tin or copper slime, where there is plenty of room for improvement in present practice.

Prussia owns many of the mines within its borders, but these state-owned properties are not great sources of profit. During the past year the gross receipts were M.290,073,320 and expenses M.267,427,097. Of the remainder, M.16,735,950 was written off for ordinary expenses, leaving a net revenue of M.5,910,273 for the year.

Smelter Building in Chile

By Frank Langford

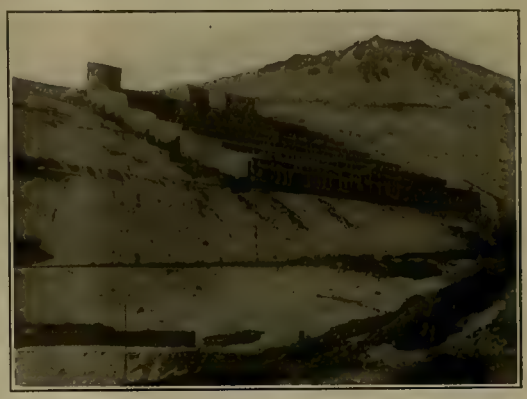
Chile is not a Latin-American country in the common North American sense of the term, either in climate, habits, or temperament of its people. It has a large element of the best Spanish stock, tempered by two hundred years of serious-minded conquest of a rugged and arduous country, difficult of development in comparison with our own prairies or mountains. It has a considerable mixture of the same class of pioneers who came to California; many of them sailing for California in the fifties, and, finding the coast of Chile attractive, remained there. It also has a large German element, of the type of our own sturdy agriculturists who have done so much to 'make Milwaukee famous.' Chile has, besides, a large native Indian element of the strongest and most industrious type, many of whom have become skilled mechanics and farmers.

The business men of Chile are quite as reasonable to deal with as our own, and will sacrifice far more for the development of resources than we individually will do. For example, the Braden company had to build its railroad 36 kilometres and its high-tension electric transmission line 26 kilometres through the ranch of Don Carlos Irarrazoval. For these rights of way a merely nominal charge was made. The same might be said of nearly all of the numbers of *hacendados* who opened their farms to permanent occupation and the free passage of thousands of workmen and teams, in the construction of canals, railroads, electric lines, and plants, and under the unusual condition that much of the work was actually done, and all of it known to be necessary, before the prices were fixed. Here is the difference between the Latin and the 'Gringo'; to buy required property at a reasonable figure in the States it must not leak out that anything is to be done, while in Chile it is required to be demonstrated that something is going to be done, before the required privilege can be had, in many cases.

The 'graft' that so much is heard about in Latin countries does not exist in Chile to hinder the investment of outside capital. In my two years as manager of the Braden Copper Co., during the busiest construction period, not a dollar was paid out to 'grease wheels' of any kind; and during that time 25,000 tons of machinery and materials was landed, passed through the customs, and moved over the state railroads to our own railroad, and to ox-carts. An ox-cart is not to be sniffed at. A two-wheel bull-cart carried seven tons at a load, over 75 kilometres of mountain road, at $9 per ton. The regular loads of three tons to each cart were, of course, carried at a much lower rate, where feed is as high as it is in California. The Chileno is a splendid horseman, but has found the ox to be the best and most profitable draft animal. He is not slow, like Tolstoi's ox or the Mexican ox, but travels as fast with the plough as our horses do.

The Chileno workman is industrious, working long hours cheerfully if paid for it. He is often keen to pick up suggestions. As an illustration: the cart road to the mines was impassable six months of the year, and before the completion of our railroad our winter stock of Huntington mill die-rings ran short; the supply had arrived in the country too late in the fall to move up. These rings, weighing a ton each and 6 ft. in diameter, were placed on the cart wheels as tires, over the regular tires, keyed up with wooden wedges, and rolled into camp 75 kilometres through mud and snow knee deep, with the usual string of oxen for a three-ton load. At the same time, a bridge on the cart-road crossing the Coya river gorge had to be taken out to permit the blasting of a heavy rock cut on the railroad construction a thousand feet vertically above it. The ox-cart with its novel broad tires must cross the bridge or the mill would be shut down. The railroad contractors were ready to put off the big blast, though the bulls might be several days coming up. The generally expedient plan of not waiting for anything was followed; the rock blast was put off and completely filled the canyon at the bridge site, making a rock bridge of boulders as big as a house, with the river running under it, that was available at once and has been used ever since.

Here, in the mountains of the roughest country in the world, and side by side with the ox and the wooden plow, the Braden Copper Co. has one of the most complete mining installations anywhere to be found, including its own power canal, diverting a river, and carrying it 13 kilometres in rock-cuts and tunnels, and developing 12,000 hp.; its own railroad 75 kilometres, climbing a mile high in half that distance, with more degrees of curvature than any other railroad in existence; a concentrating plant of steel and concrete to treat 2000 tons of ore per day; its own smelter, an acid plant, and leaching and electrolytic plant; electric haulage underground and to the mill direct without rehandling; its own town, hotels, stores, barracks, schools, and chapel. This development was due primarily to a few



NEW MILL, BRADEN COPPER CO.

men with pioneering courage, like M. Chiapponi, William Braden, Barton Sewell, Mr. Nash, and their associates. After all, it makes no difference whether the incentive was profit, or the strong man's ambition to do a new thing in a new region, or a big thing well.

Mining in Morazan, Salvador

The Monte Mayor Gold & Silver Mining Co., of Salvador, an enterprise composed of Salvadorean and foreign capitalists, has recently denounced what are supposed to be valuable silver and gold-mining properties in the Department of Morazan, Republic of Salvador. The mines lie within a rich mineralized zone of 16 *hectares*, between San Jose del Penon and the San Antonio Guayoto ranches, and 12 well defined gold and silver-bearing veins have been discovered. The mines are at a distance of about two leagues from the celebrated San Sebastian mine and about two and a half leagues from Sociedad. Modern machinery and equipment for working the mines have been ordered abroad and part of it has already been received at the port of La Union. The company proposes to work the ore, which assays ₱12 to ₱14 gold per ton, by the cyanide process.—*Pan-American Union.*

The Peruvian Government has granted a concession for a period of two years for the exploration of gold-bearing sands and gold mines along the banks of the Chinchipe river from the point where it enters the Marañon river to its confluence with the Canchis river. The object of the exploration in this territory is to determine the feasibility of establishing on a large scale the exploitation of gold placers and deposits. The tributaries of the Chinchipe river and the islands lying therein are embraced under the terms of the concession.

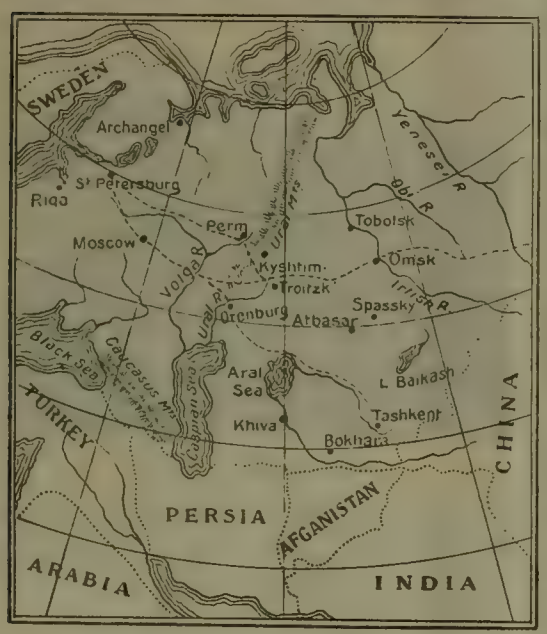
Argentiferous galena has been found at Barranca Oscura, in Guatemala, and the discovery has been denounced.

Gold Workings in Central Asia

By Ellsworth Huntington

*At Karbu, in Ladakh [76°E., 34°N.] I found the terraces pitted with numerous inclines, dug for the gold which is contained in the gravels. There I met an English mining engineer prospecting for a mining company. He was disgusted with the meagre quantity of gold; it was not worth looking at, he said. He had found just one thing that interested him: a fragment of good ore said to come from a mine near Lhassa, owned by Buddhist lamas. He was going home to tell his company that Thibet was the place to hunt for gold.

The people of the Karatash valley [81°E., 37°N.]



RAILWAYS. BOUNDARIES.

A PART OF CENTRAL ASIA.

herd sheep at the upper end, mine gold at the middle, and farm lower down, below an elevation of 8000 ft. The gold occurs in the gravel terraces, just as in California. The women and children bring the gravel in bags on their backs to the stream, where it is panned by the men in sub-conical wooden bowls eighteen inches in diameter. A miner told me that the sluice where he was working was the common property of twelve men, belonging to five or six families, every member of which, from six years old upward, is engaged in the work. The men own a few fields, but by no means enough to support their families. Their only live-stock is a few donkeys. The profits of the united labor of the twelve and their wives and children during the preceding month had amounted to 200 'tengehs,' or $10, and during the month before that to $8. According to the Chinese regulations, all the gold must be turned over to certain native officials, who pay for it what they choose, often only half the real value. The slight return from gold-mining is credible only when one sees the clumsy method of work, the frequency with which a pan of gravel yields nothing, and the deliberation of the movements of the miners. Yet, with the help of their fields, the people manage to live on a dollar or so a month for each man and his family.

The gold-mining town of Sorgak [83°E., 37°N.] lies on the enormous fan delta of gravel which the Niya river has deposited where it suddenly emerges from the Kwen Lun mountains and crosses the old fault-line to the relatively level basin floor. Sorgak presents the essential features of a mining town in the southwestern part of the United States. Perhaps it is a trifle more barren and unattractive than the worst of our mining towns, but from a distance it gives the same impression of rawness to the traveler. It lies in a basin-shaped valley a quarter of a mile or more from the edge of the deep gorge of the Niya river, whence water must be brought up on the shoulders of the women, or the backs of donkeys. Not a vestige of verdure can be seen; nothing but gravel with dug-outs half buried in it. Here and there a blatantly new shanty with a mud roof and an unseasoned wooden front stands among the older duskier structures. The population of the region is said to be between three and four hundred families, and the total number of men who work as miners, including those who stay only a month or two, is about two thousand a year. The annual output of gold is only $26,000, or $13 per man. Thirteen dollars a year does not seem to be a sum calculated to encourage lavish expenditure. Nevertheless, the uncertainties of the miner's life and the possibilities of sudden wealth lead to the same extravagance in central Asia as in western America. The bazaar is surprisingly large and busy, considering the size of the population, and it is filled with idlers. As I walked about to take photographs I counted a hundred and twenty men and boys following close behind me, and there were certainly fifty more sitting idle in places which we passed. I did not count the baby which lay in its cradle in front of a closed shop.

Many of the miners at Sorgak are at work on the top of the great gravel fan, far from the gorge of the river. Accordingly the miners winnow the gravel instead of panning it. When first I saw this primitive process, the gravel was dumped in a conical heap two feet high. With their bare hands, scarred and maimed by frequent cuts, bruises, and sores, a man and a woman moved the heap forward by throwing handful after handful to the top. The finer sand was blown away during the process, and the coarser fragments rolled to the bottom of the cone, where they could be brushed away. Thus the advancing heap was gradually diminished in size, and reduced to a somewhat homogeneous mass of very fine pebbles and coarse sand. At length the miner put this in a wooden pan, and, holding it higher than his head, poured it into a cloth on the ground, thus allowing the wind to blow away part of the remaining sand and pebble. In the midst of the pouring, the young man stopped and began to whistle. "What are you whistling for?" I asked. "For the wind," was the sincere answer.

When the wind had done its work the miner spread the remaining gritty mass thinly over the cloth, and blew it away by mighty blasts from his lungs, beginning on the edge and working inward. All his partners, of both sexes and all ages, or at least as many of them as could find room, gathered around the cloth, and, lying on their stomachs, watched with the traditional gold-miner's excitement for traces of the yellow metal. A little girl pounced on a flake, but that was all. "Only ten cents worth of gold for the morning's work of ten of us," was the discouraged remark of the strong-lunged miner; and his "ten of us" meant only the men who share the mine, not the women and children who had helped.

*Excerpt from 'The Pulse of Asia.' On the accompanying map the word 'China' marks the approximate position of these deposits.

Several expeditions have been sent into southern Chile to prospect for petroleum in districts where topography and formations indicate the existence of oil. One of these expeditions recently left for Manao to explore a petroleum field covering 1600 *hectares* of land. Borings will be made in different places and a full report of the result of the investigation will be submitted in due course.

A copper smelter has been established at El Teniente, Chile, with a capacity of 20 tons of bar copper per day. The first shipment of 35 tons of bar copper has been made to Liverpool.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Flat-Bottomed Ore-Bins

The Editor:

Sir—Frequently mining journals print articles advising the use of ore-bins having inclined bottoms instead of flat bottoms, and a recent note in the *Mining and Scientific Press* for March 30, 1912, under 'Concentrates' reiterates the statement.

I believe it is very bad practice to make an ore-bin with an inclined bottom. They are more costly to construct, harder to maintain, and are a great waste of space. A flat-bottomed ore-bin will hold approximately twice as much ore as an inclined one, and where do you need storage capacity more than at the mill or reduction plant? I maintain that it is the most important point to have storage capacity. That is where the heart of the mining operations is situated, and it should be the aim of all mine managers to keep the reduction plant running continuously and without loss of time. By the time the ore has reached the mill it is in its best condition for storage, because of its reduced size. The mine manager never knows when something will happen to shut down his supply of ore from the mine; a break-down to the hoist, necessary repairs to the shaft, broken pumps and flooded stations, or serious mishaps to his levels, stopes, and chutes, and, above all, repairs to his crushers. By having a good storage bin at the mill there is always a reserve on hand and frequently the repairs at the mine of any nature can be made without loss of time to the mill. I have seen mills of from 5 to 300 stamps that had such small bin capacity that a delay of 12 hours in putting ore into the bin from the mine would cause a shut-down of all the stamps in the 5-stamp mill and up to 75 stamps in the 300-stamp mill, of from one to twelve hours.

At the Gold Bank mine, in Forbestown, Butte county, California, I had a 60-stamp mill, 40 stamps averaging 2½ tons per day, and 20 stamps averaging 3 tons per day of 24 hours, and without notice I could run the mill to full capacity for ten days, and once by making preparation, I ran the mill to full capacity for 3 weeks without putting a pound of additional ore into the bin. I consider the time gained for making repairs in the mine and hoist of the greatest value. At one time I practically reconstructed the ore-bin for 40 of the stamps without losing a minute of running time for a single stamp; that is, I put in new posts, new main sills, floor sills, floors, and siding. The method pursued was to put in temporary chutes from the track to the bin so the ore would shoot directly over the openings above the feeders. The back part of the ore-bin was uncovered, the bin having been practically emptied before beginning operations (the flat part of the ore-bin being about 16 ft. wide, as I recollect it, from front to back). Just enough ore was carried in the bin at night. Two shovelers at $2.50 were provided on both day and night shifts. When about two-thirds of the bin was completed from the back toward the front the chutes were taken out and the ore dumped upon the completed floor, and short sections in the front part were taken up one at a time, and new main sills, flooring, and siding put in. The shovelers threw the ore from the completed floor space across the space into the chutes leading from the bin down to the feed hopper; the chute and hopper held enough ore to run five stamps about an hour and a half, which enabled the carpenters to do a lot of work without interfering with the shovelers. As stated above, the work was completed without a minute delay in running the mill.

Too much stress cannot be put on the necessity for large storage capacity where it will do the most good, namely, at the reduction works, and there is no better way than by making flat bottomed ore-bins which will hold approximately twice as much as inclined-bottom ore bins, and ore is then available at any time of emergency with slight additional cost.

HARRY P. STOW.

Oakland, California, April 5.

Magmatic Origin of Ore-Forming Solutions

The Editor:

Sir—*De gustibus non est disputandum!* In your issue of March 16 C. F. Tolman takes issue with A. C. Lawson's criticism of 'Types of Ore Deposits' and develops his conception of the problem. To speak for myself: I enjoyed Mr. Lawson's article as I would enjoy a brilliant after-dinner speech, and found under the unusual surface many an instigation to reflection and a clever reminder of the fact that our ideas on ore deposition are still to a large extent speculative, even if some of our great pioneers laboriously join stone to stone for an ultimately irreprovable foundation.

I do not intend to question for a moment that Mr. Tolman's article contributes a great amount of new and valuable material, nor that his ideas are both original and convincing. But he cites a great many ore deposits to support his theories, and with some of those mentioned I am somewhat familiar, and regret that I cannot quite agree with him. For example, in the Globe district, I cannot see that it is proved beyond doubt that the diabase intrusion here has nothing to do with the ore deposition. F. L. Ransome offered some very good arguments to support his supposition, and even if there is a later acid intrusive that originated the disseminated copper deposit of the Miami district and reworked and enriched the Old Dominion vein, that does not prove that the diabase had nothing to do with the copper in this district. If Mr. Tolman would study some sections of the Old Dominion vein and some of its eastern neighbors, such as the Superior & Boston or Buckeye, he would find deposits that tally closely with Monte Catini in character. There is hardly any doubt but that here, as there, the source of the copper was an extremely basic intrusive. The ore here is marked by plentiful micaceous hematite with chalcopyrite and pyrite. Even rounded boulders of chalcopyrite in soft red gouge are reported from the bottom of the Mallory shaft. Is hematite and micaceous hematite a characteristic of salic or femic rocks? Furthermore, while it is a fact that until now the Old Dominion system of veins has been nearly the only one in the Globe district that has proved to be of economic value, that does not preclude the existence of other veins equally important that have not been proved. In fact, I have every reason to assume that mining around Globe is only in its infancy and that a number of other veins will soon rival the Old Dominion in richness and importance; veins that never received due consideration till now, partly because their outcrops are buried under overthrust masses or Gila conglomerate, and partly because nobody ever believed in them or tried them, and the stampede was going in the other direction.

In the Morenci district ore deposits are localized around two places—Morenci and Metcalf—it is true, but the rock is not more acid in these two places than in the rest of the laccolith. The fact is well recognized that the southwest part of the laccolith to the south and west of Morenci is mostly a diorite porphyry and practically devoid of copper deposits. But Metcalf is to the north of Morenci, and there are several miles of porphyry between these two places which is fully as acid as in the copper zone, and, nevertheless, no orebodies of importance have been proved there, although search has been made. My opinion is that the great east-west faults have much more to do with the mineralization than has yet been recognized. The Coronado fault antedates the mineralization, and so does, in all probability, the Concentrator fault, and perhaps also the Copper Mountain fault, even if here a later reopening would have to be assumed. The lode system at Morenci is almost a typical fracture-zone due to end-to-end pressure in a fault

block. The Coronado fault passes straight into Metcalf hill, even if it sends off some curved branches in the Santa Rosa country. There is one reason for the localization of the copper, but it is not found in the nature of the intrusive.

The deposits at Bisbee, Mr. Tolman characterizes as "lenses in limestone, unaccompanied by intergrowth of contact minerals and at some distance from the intrusive." I do not believe that Mr. Tolman could prove very many orebodies in Bisbee "away from the intrusive." The Shattuck is a mineralized porphyry dike, plain and simple. J. M. Boutwell, of whose thorough study and careful observation the Bingham report is a splendid example, advocates, as I am told, the theory that the Bisbee orebodies originated in close conjunction with porphyry dikes and sills in the limestone. I pointed out six years ago that the great kaolin masses in connection with the orebodies were altered porphyry dikes, and attempted to and (I thought) succeeded in tracing porphyritic structure from little altered porphyry to the white kaolin masses that blend into orebodies. About a year ago I sketched some observations along the same line for your journal. So much as to the concrete points upon which I do not agree with Mr. Tolman.

As to abstract reasoning—to avoid the word speculation—I believe that the magmatic origin of many deposits is unquestionable. Deposits like Cripple Creek, Braden, and Nacozari, to mention only the extreme and uncontestable ones, point plainly in that direction. Even the Globe district affords a splendid example, as against the mineralization by heated ground or surface water. I mean the gradually deepening of the Miami-Inspiration copper belt from about 200 ft. below the surface at Miami, to a covering by more than 1000 ft. of schist in the southwestern Miami field; not to mention the deep sulphide zone of the Old Dominion vein that extends now nearly 1000 ft. below the ground-water level. How many hundred feet of vein have been eroded above? And how many hundred feet higher was the ground-water at the time when the Gila conglomerate was deposited?

Mr. Tolman explains the fact that many deeply eroded granites are barren, by the assumption that their mineralized outer zone has been destroyed. Is it not much simpler to assume that they never had any? Surface lava flows are very seldom ore-bearing in themselves. Conditions for development of orebodies seem much more favorable in rocks that never reached the surface. Would that not rather point to an accumulation of metallic contents in the central part of an intrusive, where the heat remains active and segregation can work longest? Should all the metallic contents be emptied out at once? Evidence is to the contrary, and, besides, nature does not work in leaps and bounds. Therefore what was possible at the rim facies first should gradually work backward as the cooling progresses and the last contraction breaks and the last healing solution should be near the centre of the mass. In most of the copper deposits of the Morenci type there are two distinct mineralizing processes. A spontaneous one by direct exchange from the liquid or plastic magma into country rock and, as Bergeat has proved at Concepción del Oro, also from the heated country rock back into the magma; and another one, more peaceful and extended, that added silica and metallic sulphides to both the cooling or cooled magma and country rock and healed up their contraction slips and breaks. Is the first one more important, or the second? I would think the latter, as I never saw a district yet that did not prove disappointing where the second was not strongly in evidence, in spite of rich irregular masses in the contact zone. If the second process, the gradual infusion of silica and metallic sulphides from a dying volcanic centre is the cause of our important ore deposits, then why should not the feeding channels, that ought to be more and more trunk channels in depth, become richer and richer in depth? They were affected all the time while metallic sulphides as vapors or solutions passed through them; gradually receding action and partly closed upper channels should cause deposits richer and richer in metal.

To come to a concrete point, why should the pyritic horizon below the chalcocite zone denote the limit of workable ore? Why should not disseminated masses of chalcopyrite and trunk channels of the same mineral exist below the disseminated chalcocite deposits? The source of the copper in those chalcocite zones was supposed to be 'cupriferous' pyrite. The existence of such a thing has been disproved in Butte, for one place. There the fresh pyrite was barren of copper. The copper existed as chalcopyrite, invading the pyrite along joints and cracks. Did that chalcopyrite come from above or below? Did the surface waters collect the copper that did not exist in the pyrite and produce all those secondary copper sulphides? Waldemar Lindgren says that the pyrite below the chalcocite at Morenci is the primary ore, but in his discussion he names, and in his slides he shows, chalcopyrite as the primary sulphide. In Morenci there is pyrite above and pyrite and marcasite below the chalcocite. Are both primary? What became of the primary chalcopyrite? There is plenty of marcasite as well as pyrite in the Old Dominion below the chalcocite. Is marcasite considered a primary mineral? Pyrite occurs in coalbeds, pyrite incrusts fossils, is it primary there? Why is it that Nacozari and Braden, both having only a very slight chalcocite zone, extend deeper than any other disseminated deposit in workable ore, pyrite and chalcopyrite, and show no signs of quitting even at the lowest levels? Is it perhaps because here they mark a primary type?

At Nacozari a lean pyrite zone followed directly under the insignificant chalcocite zone, below was chalcopyrite and pyrite. Primary chalcopyrite might split into chalcocite and pyrite, might it not? Is, therefore, the lean pyrite-zone only the pyritic half of the chalcopyrite that furnished the chalcocite above? Is this pyrite zone thicker according to the thickness of the chalcocite zone above and lacking where it was not developed? Nacozari and Braden point that way.

Will workable chalcopyrite deposits be found below all disseminated chalcocite deposits? Millions and millions hinge on that question. Will somebody show me, convince me, that I am wrong? Till then, I believe in these buried millions.

W. L. Tovote.

Globe, Arizona, March 20.

The Mine-Owners' Liability for Accidents

The Editor:

Sir—The 'compensation' principle as applied to recompensing industrial accidents has four separate, irrefragable justifications, any one of which should prove a sufficient foundation to support the Roseberry liability and compensation law. Let us consider them in the order of their importance.

Compensation is based upon society's right to protect itself from those influences which strongly tend to cause persons to become public charges. The 'first law of nature' gives society that right and warrants it in putting forth every effort to prevent pauperism and the crowding of any portion of the people below the poverty line. This unrequited industrial injury does. It ranks third among the four great sources of poverty in the world. Only sickness and unemployment outrank it, while premature death follows immediately after. Therefore, wherever human life is valued, as it is not much in America (as our statistics of accidents in mines and homicides everywhere conclusively prove), drastic laws are made for the safeguarding of industrial life and the employer is compelled to insure against the economic consequences of such accidents as are legally unavoidable. Compensation is, therefore, founded on social justice, and social justice is the highest form of justice known in this world.

Compensation has an economic basis as rock-founded as any principle in the whole science of political economy. A little careful attention to a not at all involved process of reasoning will make this fact clear. Monopoly has ever been regarded as odious, and rightly so, inasmuch as its purpose uniformly is to extort an undue price for the

commodity furnished or service rendered. All countries have laws against monopoly, and the fight against monopoly is one of the fights of the ages, for unless resisted tooth and nail at every point, greed will practise extortion if it can.

All laws against monopoly are based upon the self-evident proposition that the ultimate consumer has a right to have his commodity furnished him at what it is reasonably worth after he shall have compensated, fairly, every person who has rendered a necessary service in the production of such commodity and its distribution to him, from the planting of the seed, or mining of the ore, until the finished product is handed over the counter to him or is delivered at his kitchen door. It is unlawful for any two or more links in this chain of production or distribution to combine for the extortion of more than a fair return for the service rendered. Who can question the correctness of this reasoning? If the foregoing is a true statement of the rights of the consumer, then it follows absolutely that such ultimate consumer has no right to leave any person, in the whole chain of production and distribution, who has rendered a necessary service, uncompensated for the service rendered. The consumer's right not to be made the victim of extortion goes hand in hand with the obligation that rests upon him to pay reasonably for all services necessarily rendered in supplying his needs.

Now, ever since feudalism gave place to free industry, one person, constituting a link in the chain of production and distribution, has been left unpaid. That person is the hurt worker, the victim of industrial accident. In Great Britain, until the law of damages for negligence gave place to the law of compensation without regard to negligence, only seven persons out of each hundred industrially injured ever received damages, and in this country the ratio has been eight to twelve out of the hundred. All the rest have had to bear the burden as best they could, and that it has been a great burden is proved by the fact, to which attention has already been called, that industrial accident ranks third among the great causes of poverty in this world. The economic basis of compensation is unshakable and the problem is to somehow enable (or compel) the ultimate consumer to pay the hurt man for his hurt as certainly as to pay him for his labor. For, after we shall have done all that we can do to prevent accidents, an irreducible minimum of pure accident will remain. The hurt man must be paid. He who has given a hand or foot, an eye or a life to industry, is as worthy of being compensated for his contribution as the man who contributes labor or capital, raw material or business ability.

A stumbling-block in many minds is the requirement of compensation that employers should be called upon to pay for injuries when they themselves were without fault, but if not in the line of fault, they are in the line of causation. Let me illustrate by example: A mine-owner visited the office of the Industrial Accident Board to learn about the law. He went away in high dudgeon, denouncing the law and the legislature that enacted it. He is the owner of a mine that barely pays him a living, but, buoyed by the hope that there are riches (for him) just beyond, he drives his way into the rock as hard as he can. He admitted that some of his men had been killed and their families thrown upon public or private charity, and that many had been injured and sent to the county hospital and cared for without cost to him. This man really felt that conditions had been, all along, just as they should be; that in order that he may live and have a chance to grow rich, he should be free to bore into the earth at whatever cost to life and limb, so long as men were willing to take the chances for 'day's pay,' casting upon society widows and orphans, crippled men and sick, as his own ends might prompt.

But society has said to the railroads, for instance: "Yes, you may run locomotives from ocean to ocean, belching fire at every turn of the wheels and dumping fire-boxes at convenient places, but if any wheat field, house, or barn takes fire from that cause, such railroad must pay for the damage done." In other words, men are to be free to harness great forces for their gain, impound waters, generate electricity and distribute it, bore into the earth after gold or coal, but if damage is inflicted as a result of this effort, that damage must be made good. Although the employer may not be morally blameworthy, he is in the *line of causation*, and, therefore, must be held responsible for the consequences which flow from the forces which he, for his own profit, sets in motion. Upon this basis rests the whole fabric of laws which require common carriers to be the virtual insurers of passengers and their baggage and of all freight committed to their care for transportation, and Congress is now in process of applying the same principle to compensation for accidents growing out of transportation. The doctrine of 'responsibility through causation' is firmly fixed in the laws of the civilized world.

We now come to the fourth and final justification for compensation. It is founded in that average justice between man and man that approaches ideal justice about as closely as any quality of justice likely to be derived from our clumsy, tardy, and uncertain system of jurisprudence. A workman is hurt. No responsible person is, let us say, blamable for the hurt. The accident just happened, and that is the whole story. The injured employee, under the compensation provisions of the Roseberry law, goes to his employer and, in effect, says: "I am hurt. It is neither your fault nor mine, or perhaps we were both of us somewhat at fault. Now I tell you what I am willing to do. You pay me 65% of what I lose in industrial time while I am getting well; I will stand 35% and I will take for my share all the pain, the disfigurement, the mutilation; this arrangement to last until I get able to go to work again, or if the injury prove permanent, then until I have drawn what I would have been able to earn in three years had I not been hurt, after which I will bear the rest of the loss myself until I sink into my 'six feet of earth'." Isn't that pretty nearly a 'fair shake' as justice is commonly meted out in this world? In most countries compensation goes on as long as the injury lasts, even if for life. The Roseberry law does not, in fact, make whole for all loss sustained. It merely tides the injured person over his period of adversity until he can get on his feet again, and, even doing only this, it constitutes one of the greatest boons to labor that has come to those who toil that others may thrive since industry was made free.

A. J. Pillsbury.

San Francisco, March 25.

Huanuni Tin-Mining District

Considerable activity has recently been shown in the Huanuni tin-mining district of Bolivia, one of the richest producers of tin in the country, according to the *Pan-American Union*. The large interests of Peny and Duncan have been transfered to another native capitalist, the consideration in the transaction being more than £500,000. The consummation of this sale settles the boundary litigation between the buyer and the sellers and makes the former the largest producer of tin in the Republic. The tendency to concentrate the large tin-mining interests of the country into the hands of Bolivian capitalists, some of whom are at present interested in the building of railways in the Republic, is regarded by the Bolivian press as a favorable step to retain at home the profits produced in the tin-mining industry and the further investment of the profits in new enterprises of the country.

Mineral exports from Broken Hill, N.S.W., during 1911 constituted a record, the net value being £3,100,109, made up as follows: Silver-lead concentrate, 276,963 tons, value £1,981,439; zinc concentrate, 420,031 tons, value £1,047,020; silver-lead crude, 27,355 tons, value £61,903; silver-lead slime, 11,761 tons, value £9747. The best previous year was 1907, when the total value of the exports was £3,081,031. It must be remembered that the 1911 export figures do not represent the actual total output of the mines along the Broken Hill line of lode, as these returns have not so far reached the Mines Department.

Special Correspondence

TORONTO, CANADA

REAL ESTATE INTEREST INJURES STOCK MARKET.—ONTARIO DEVELOPMENT NOTES.—COBALT INCREASES SHIPMENTS.

The stock market has lately shown a decidedly downward tendency, probably due to the closing down of some of the weaker Porcupine mines, and unfavorable reports from properties for which high expectations were held. The outside public is taking but little interest in mining ventures this season, the great majority of investors being attracted by the prospect of larger profits and fewer risks in real estate. There appears little likelihood of any decided change until tangible results in the shape of dividends from the Porcupine district are in evidence. Reports of the operation of the Dome mill are satisfactory, the recovery of gold being reported as over 98%. The work of the mill is regarded as having demonstrated the fact that Porcupine ores can be effectively handled by the free-milling process. There have been some stoppages for adjustments, but the mill is gradually attaining full capacity and the production is unofficially estimated at $5000 per day. The plans of the management for the season include 10,000 ft. of underground development. A shaft will be put down to the 500-ft. level and 24 drills will be worked. At the Dome Extension the drift on the 100-ft. level of No. 4 shaft is in pay-ore for 80 ft., the body consisting of banded schist and quartz, which has every appearance of being a large deposit of free-milling ore, though the gold content is unevenly distributed. A cross-cut is being run from the 200-ft. level of No. 1 shaft to tap the orebody at this depth. The Preston East Dome since giving up the Preston property has been working on the East Dome and has cut the vein sought on the 100-ft. level. The showing is regarded as sufficiently good to warrant further development, and the main shaft is being put down to the 200-ft. level. The Vipond has 5000 tons of ore on the dump in readiness for the mill, the construction of which is proceeding steadily. On the main vein there is a continuous shoot of pay-ore for 528 ft. at the 100-ft. level, and 420 ft. of good ore has been developed on the same vein at the 200-ft. level. A 3-ft. quartz vein has been cut in a cross-cut from No. 2 vein at the 100-ft. level. The McIntyre is preparing for the installation of the first unit of 20 stamps with plates and Deister tables for the concentration of the tailing, forming half of its new equipment. The other 20 stamps will be added later, which with the 10 now working will give the mill before the close of the season a total of 50 stamps, with a capacity of between 300 and 350 tons of ore per day. A large new vein was recently intersected on the 200-ft. level of No. 1 shaft. Underground work on the Rea has been discontinued, the veins which promised well on the upper levels having disappeared at 400 ft. The Pearl Lake, which has reached a depth of more than 400 ft. and has had encouraging results from diamond-drilling, has suspended operation until further funds for development can be obtained. The Standard is another company for which the outlook is unfavorable, its treasury being exhausted, and no orebodies of commercial value having been found. The directors have been authorized to raise money by issuing preferred shares or any means they think advisable. The Dome Lake will build a 10-stamp mill, but will not determine the process to be adopted until trial runs have been made with a shipment of its ore. Mr. Robins, manager of the Hollinger, hopes to have the stamp-mill in operation by May 1. Recent development on No. 2 and No. 4 veins continues to show gold content considerably in excess of the estimate of the report. Mowry Bates has resigned as manager of the Hughes and will take a few months rest. He expects to go to Mexico in the summer. Two shafts are being put down on the Miller Middleton and one on the Dixon, both properties belonging to the Timmins syndicate. Development on the 300-ft. level of the Swastika are encouraging. An adit on the extension of the main vein found in the shaft has been opened up in pay-ore for 100 ft., the vein averaging 2 ft. wide. Another good vein has been tapped by a cross-cut on the same level. The plans for a 10-stamp mill are now complete. There is but little news from the Cobalt district. Production has been well maintained since the opening of the year, with steadily increasing bullion shipments, and a consequent falling off in consignments of ore. The shutting down of the Nova Scotia mill is offset by the increase of 40 stamps at the Northern Customs mill, making 120 stamps in all, and giving it a capacity of 300 tons of ore per day. The Nipissing continues to lead as a producer; its output for the first quarter of the year being 1,179,470 oz., valued at $916,912. The most encouraging development lately has been in the northern portion of the Nipissing's property, operations in other directions having but indifferent results. On the Meyer vein the Eastern adit has been advanced farther in ore, giving a total length of 363 ft. on the lower level. A fault has now cut off the vein. Development on veins 100 and 80 between the first and second levels is yielding good ore. The Gould Consolidated has cut Nipissing's vein 146 at the 100-ft. level. The McKinley-Darragh has made a good discovery. Driving from a winze sunk 60 ft. below the 150-ft. level a vein from 2 to 3 in. wide has been cut near the Princess line. The Coniagas has declared the regular quarterly dividend of 6%, but has omitted the usual additional 3% bonus. The quarterly statement of the Temiskaming shows a total production of 562,910 oz. at a cost of 16¼c. per ounce. The cash balance on hand was $484,219, less $175,000 deferred payments for North Dome.

JOHANNESBURG, TRANSVAAL

RHODESIAN OUTLOOK NOT PROMISING.—RAND HOUSES WITHDRAWING ENGINEERS FROM RHODESIA.

Despite all that may be said regarding mining in Rhodesia the news reaching here more than confirms the unfavorable impressions previously recorded. The present is the season when there ought to be an exodus of engineers from the Rand to Rhodesia to undertake the inspection of promising properties, but instead of this taking place the very reverse is happening. Instead of engineers being despatched to Rhodesia, which in 1909 and 1910 was described as a coming mining country, most of the leading Rand houses are withdrawing their engineers from that country, owing to their inability to make important discoveries, and evidently do not regard the prospects with any degree of confidence or as justifying the incurring of further expense in the present state of Rhodesian mining affairs. Last year's gold output at £2,647,896 did not after all show much improvement on the previous year. The total number of natives employed in mining increased only from 27,824 in 1910 to 38,356 in 1911, and of these but 23,301 were employed on producing mines, the balance of 15,000 being at work on prospects. Then again, no less than 58,328 mining claims were abandoned during 1911, and at the end of the year only 101,472 claims were in existence as compared with 121,472 claims at the end of 1910, which the chairman of the Rhodesian Chamber of Mines claims has strengthened the position because so many worthless claims have disappeared. The importance of the Rhodesian goldfields may be estimated perhaps by the statement that no less than 6,280,908 tons of profitable ore is developed in the mines, which is exactly the amount considered necessary to have in reserve for the Randfontein Central mill of 600 stamps. There are nevertheless several important gold properties in Rhodesia, and these are not likely to allow the output of gold to dwindle while they have gold reserves assaying over ten million sterling in the mines, but there does not seem much scope for a large increase of output, under existing conditions, and little likelihood of the predicted boom taking place at present. There have been too many manipulations accompanied by mine saltings and exaggerated reports of tin discoveries to conduce toward confidence and take the place of solid work. There are not wanting signs that agriculture in Rhodesia is likely in the

immediate future to make more rapid progress than mining. The closing down of the smelters in Kantanga will also have a bad effect on things in general in Northern Rhodesia where so much help was looked for from this direction, while Southern Rhodesia coal mining will suffer through the prospective market for coke failing to materialize.

PIOCHE, NEVADA

HISTORY OF DISTRICT, COMMENCED LAST WEEK, RESUMED.—WOOLLEY'S RISE AND FALL.

Ernest R. Woolley, when elected president of the Nevada Mines & Smelters Corporation, first attempted to effect a consolidation of the Prince Con. M. Co., the Consolidated Pioche M. Co., and the Nevada holdings of Nevada-Utah. Every mining periodical in the United States announced that this merger had been effected. Without doubt this plan for a time seemed certain of accomplishment. Had it been successful it would have proved the greatest disaster which ever befell Pioche, as such a monopoly would have had the camp at its mercy. Fortunately it failed, and all negotiations to that end were abandoned. In the early part of 1911 the railroad was again washed out, and for four weeks service was suspended. Then traffic was

PRINCE CONSOLIDATED SHAFT.

resumed with semi-weekly service. The Day mine at once resumed shipping at a rate of about 60 tons per day, and the Mendha and other mines sent out an occasional car. Early in June Woolley's promotion activities began to show fruit. About that time there were incorporated in rapid succession the Day-Bristol Con. M. Co., the Pioche Pacific Railroad Co., and the Amalgamated Pioche Mines & Smelters corporation. The Day-Bristol was a merger of the Bristol Con. M. Co.'s property, the Day and Hillside mines of Nevada-Utah, and certain undeveloped claims. The Pioche Pacific railroad took over the 15-mile narrow-gauge railroad formerly belonging to the Nevada-Utah and used to transport the Day ore to the broad-gauge track of the Salt Lake railroad's Pioche branch at Pioche.

The Day-Bristol Con. M. Co.'s property has great possibilities. Most of its mines began producing in 1870 and 1871. While no conclusive figures of total production are obtainable, there can be no question that it has run into the millions of dollars. The crest of the Bristol range is a mile from the terminus of the Pioche Pacific railroad. The first mine on the farther side is the old Hillside, which also was a great producer. A lead smelter, a copper smelter, and a pan-amalgamation mill were all erected to treat ore on that side of the Bristol range. For several years during the eighties the thriving town of Bristol, at the foot of the Bristol range on the farther side, was headquarters for men employed in those mines and mills, and their families. These mines have all been idle for several years, having all been shut down.

The Pioche Pacific railroad was not incorporated until Woolley took it out from the Nevada Utah holdings and made it a separate institution. Each ton of ore pays a fixed charge for carriage. One of the plans of the Day-Bristol is to construct a tunnel from the Day side to the Bristol side, connecting with all mines on the farther side of the range. Now no ore can be shipped from the Bristol mines without heavy cost for wagon haul. Such a tunnel will make available hundreds of thousands of tons of low-grade ore which could not bear the wagon charge. It will facilitate the development of all the mines, obviate having heavy hoisting plants, furnish air for the mines, and provide drainage for many years of mining. At present water has not been reached on the Bristol side, but development, it is thought, will soon result in finding water and adding a pumping charge to mining operations. The Amalgamated Pioche was a merger of all properties formerly belonging to the Nevada-Utah company in Nevada (excepting those in the Day-Bristol merger and the Pioche Pacific railroad), the old Ohio-Kentucky, and all other Godbe holdings in Pioche, and of the very valuable Pioche Water Co. In order to effect the Amalgamated Pioche merger, Mr. Woolley secured from the Godbes their Ohio-Kentucky stock, for which he paid them 100,000 shares of Prince stock (taken from the treasury of Nevada-Utah), $25,000 in cash, and gave a note of the Nevada-Utah for $125,000, secured by all the stock of the Pioche Pacific railroad, and 300,000 shares of Day-Bristol stock (also taken from the treasury of Nevada-Utah).

BOSTON

SUBURBAN RAILROADS WILL NEED MUCH COPPER.—INDIANA STOCK RISES.—LAKE SITUATION.

The railroad situation in New England has special bearing on the copper industry. The Governor and the legislators have been canvassing with the New York, New Haven & Hartford officials the matter of leasing the Boston & Maine to the New Haven for a period of 25 years on a 4% basis for outstanding stock of the latter. One of the conditions of this lease is that a tunnel shall be opened and the line electrified from the North Station to the South Station. The plan also includes an ambitious system of railroad electrification. The New Haven will be required to proceed to electrify all lines of both companies within the limits included within the following named points around Boston: Swampscott, Wakefield Junction, Stoneham, Lexington, Winchester, Waltham, Needham Junction, Dedham, Readville, Mattapan, and Braintree. This system of electrification, including the tunnel, must be completed within five years from the date of the lease.

Activity among Lake coppers was recently transferred from Mayflower and Old Colony to Indiana. The first news was received here on Monday, April 15. On the previous Saturday there had not been a transaction in the stock, but Monday's news was followed by transactions of 1500 shares in 15 minutes. The news was that the cross-cut at the 600-ft. level had cut 25 ft. of rich copper ore at a distance of 28 ft. from the shaft. The news stated that large masses of copper weighing 20 to 30 lb. had been found. The news was considered significant by Stephen R. Dow, president of the company, because he claims that it proves the hypothesis on which operations have been conducted—namely, that the Indiana lode is a vertical deposit of rich copper as indicated by the No. 9 drill. The stock at first had an uneventful history on the Curb, but little attention being paid to it. It sold as low as $5.50. Suddenly, on the strength of drill news, it shot up to $9.25 in 1908 and had a most sensational run to a high price of $44.75, meantime being transferred from the Curb to the Exchange. Previous to the find made in the cross-cut of the 600-ft. level the price held around $15 per share.

It is an interesting situation, even to a layman, that exists among the companies of the Lake district. Mayflower and Old Colony are being closely watched, as well as Indiana, North Lake, South Lake, Algomah, Mass, and

Bohemia, with especial reference to what the drills determine. The deepest and the most scientific drilling ever done in Lake Superior is now under way there. Drilling is not being done altogether to find copper, but to confirm or disprove theories as to the regularity of the formation. Lake and Boston people sometimes seem to be as well satisfied when a drill-core fails to show copper as when it does. These people are studying the situation of the drill-cores in order to work out a theory of ore deposits.

Especial interest attaches to Mayflower and Old Colony because of a tradition handed down that there is what is called the 'Lost Lode' somewhere in their vicinity. This has been indicated by rich spots of ore discovered east of the Calumet & Hecla. Ever since the commercial exploitation of the Lake district there has been a persistent search for this 'Lost Lode.' The Indian, ever figurative, is said to have called it also the 'Moonlight Lode' and the 'Dark Lantern Lode.' Notwithstanding the Lake Copper Co. has done the most important development work at Lake Superior south of Portage lake, and is now on the threshold of permanent shipments, the fact remains that its formation has not yet been determined.

The activity and advance in the price of Tamarack is directly the result of 16c. copper. Tamarack loses money on 12c. copper, but can return dividends of $5 per share on 16c. copper. Tamarack is doing the deepest copper mining in the world, about a mile deep. The length of its shaft is about the same as that of the Boston subway. In connection with the advance of the price of the stock, the report was made that by a recent re-survey of the property 640 acres was found to belong to the company which heretofore had been credited to other Lake Superior interests. Tamarack has important possibilities in its Osceola lode, providing copper stays at 16c. or better. When copper drops to 14c. Tamarack begins to dwindle as a commercial undertaking. The report of the finding of what appears to be a persistent copper orebody on the 500-ft. level of the Butte Central mine created a stir in Boston.

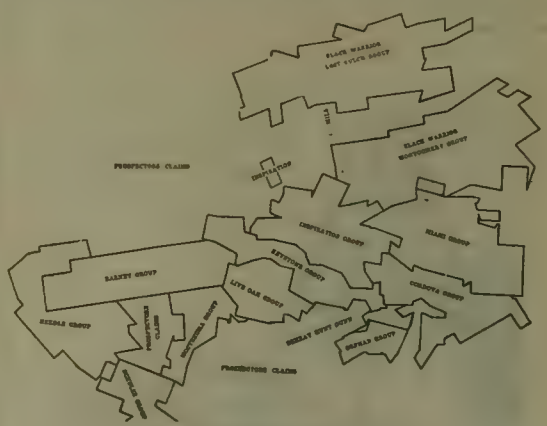
It has been expected that Charles J. Paine, Jr., president of the St. Mary's Mineral Land Co. and the Winona Copper Co., would succeed Harry F. Fay as president of the Mayflower company. This change was brought about at the first meeting of the newly elected directors on April 17. Other changes were made in accordance with the transfer of control and direction from the Fay regime to St. Mary's. The offices of the company are also to be removed to the Sears building.

GLOBE, ARIZONA

MIAMI REPORT.—DEVELOPMENT NOTES.—CARMICHAEL ON THE KINNEY BILL.

The March production of the Miami Copper Co. was about 2,900,000 lb. copper, derived from an average of 2800 tons, dry weight, of ore per day. The daily production of concentrate averaged about 125 tons, assaying about 40% copper. Concentrate is shipped to Cananea. There was 5900 ft. of development work done during the month and an average of 800 men employed. The only new construction work going on at present is that of a tower for elevating the tailing, the steelwork being now in course of erection. One of the electric locomotives on the 420-ft. or main haulage level escaped control last week and ran into the cage-compartment of the main shaft, falling to the bottom, a distance of 300 ft. It is stated that aside from the loss of the locomotive the damage was slight and operation has not been affected. F. L. Ransome, of the U. S. Geological Survey, has been staying at the mine during the past week and making an inspection of the underground workings. The work on the Inspiration Consolidated dam across Pinal creek which was delayed by the recent rains and floods, has been resumed. The diverting flume gave way and allowed the excavation and forms to fill with débris, which is now being cleaned out. The test mill at the Inspiration mine is running and the sinking of No. 2 shaft at the Live Oak mine will be resumed in a few days, the installation of the surface plant being nearly completed. Surveys are under way, but the location of the millsite has not yet been determined.

Churn-drill hole No. 2 of the Southwestern Miami Development Co. has been discontinued at a depth of 1240 ft. and while still in the chalcocite zone. Commercial ore was disclosed in this hole, but how much is not made public. Hole No. 3 is 710 ft. deep and in the chalcocite zone. Holes No. 4, 5, and 6 are 235, 200, and 75 ft. deep, respectively, and have not yet passed through the conglomerate formation. Hole No. 7 will be started in a few days. Churn-drill hole No. 2 on the Barney group is 560 ft. deep and in schist formation. Progress is very slow, the ground being soft and clayey, caving considerably and causing the drill to stick, it being possible to drill only a few feet without driving the casing. Hole No. 3 is 200 ft. deep and is in the conglomerate formation. Churn-drilling continues at the Keystone mine. Hole No. 48 is being drilled at the eastern end of the property near the Inspiration line and is 250 ft. deep, having passed through the granite-porphyry into the schist formation.



CLAIM MAP OF MIAMI DISTRICT.

At the Superior & Boston mine the local management states that shipments of ore from the upper levels to the Old Dominion smelter will begin next week. The Gibson mine, nine miles west of Miami, has just shipped to the Old Dominion smelter at Globe another carload of chalcopyrite ore which is believed to assay about 18% copper. Driving south on the Pasquale vein on the fourth and fifth levels continues. Ore is reported in the face of the drift on the fourth level. Stoping is being done above this level, where it is stated that ore has been exposed for a length of 100 ft. along the vein and of a width from a few inches to three feet. The machinery and equipment for the South Live Oak Development Co., which will explore with churn-drills the Schulze group of 16 claims adjoining the Southwestern Miami on the southwest, is expected within ten days. The road to the site of the first hole has been completed. This hole will be on the western extension of the Augustus claim in the granite-porphyry formation. Pipe-lines and water-tanks are being installed. Lessees at the Black Warrior mine, near Miami, are shipping copper silicate ore to the El Paso smelter at the rate of nearly three cars per week. It is reported that the ore assays 9 to 10% copper and is all coming from the 100-ft. level. The company is doing some repair work on the lower levels.

Norman C. Carmichael, general manager for the Arizona Copper Co. at Clifton, is making an inspection of the mines of the Globe-Miami district. Mr. Carmichael states that 200 men are working on the grading for the new smelter at Clifton and that the erection of the steel work should begin in July. He asserts that if the Kinney bill now under consideration by the State legislature at Phoenix should be passed, it would mean a shut-down of the mines in the Clifton-Morenci district. The bill as introduced

provides that it shall be unlawful to employ in mines, mills, smelters, and railroads 'any person who cannot speak and understand the English language,' and charges its enforcement to the State Mine Inspector and his deputies. The workmen of the Clifton-Morenci district are mostly Mexicans, and Mr. Carmichael says that it is impossible to get white men to work and live in the climate and conditions in the district.

GOLDFIELD, NEVADA

DEEP MINING IN THE DISTRICT.—GOLDFIELD DEEP MINES CO. PLANT.

Goldfield district has entered upon a new era, marked by deep mining, in which the Goldfield Consolidated Mines Co. has played the principal rôle. The deepest shaft in the district is still the Grizzly Bear, on the Grizzly Bear claim of the Consolidated. This is down 1300 ft. The next deepest is the Clermont, the main working shaft of the Consolidated properties. This has a depth of 1100 ft. The third deepest shaft on this group is the Laguna, about 800 ft. lateral development is being done from the bottom of the Grizzly Bear and Clermont shafts. The Hazel shaft on the Miss Jessie claim of the Laguna is also down about 800 ft. The three main shafts are all equipped with high-power machinery. The orebodies are stated to persist large and rich as deep work has progressed, and these reports naturally stimulate more operation. A recent estimate places the total yield of the Goldfield Con. properties at over $48,000,000, including the output of leases. The company has thus far paid $19,925,757 in dividends, with practically all ore contributing to this produced from above the 1000-ft. point. The Jumbo Extension company claims one of the deepest shafts in the district with its 1030-ft. Polverde shaft. This has tapped promising orebodies. A Gould pump has been installed on the 1030-ft. level and it is likely further deep work will soon be undertaken. The Florence Goldfield company has its main shaft down 1060 ft. and will continue to the 1260-ft. point. Lateral development is planned for the 1000-ft. level, and later work will be done at 1200-ft. depth. Aside from the workings described, little in the way of deep development has thus far been attempted at Goldfield, but within the past few months plans have been made so that the district will be thoroughly explored at depth.

One of the most important of the new plans is fathered by the Goldfield Deep Mines Co., controlling the Merger Mines Co. The main shaft, on the St. Ives claim, has reached a depth of 850 ft. and will be deepened to the 2000-ft. point. This work is expected to exercise a marked influence on the future of the district. The electric hoist is of the 300-hp. intermittent type, capable of operating to a depth of 2500 ft. It is the most powerful hoist in the district. The steel head-frame will be 80 ft. high. The shaft is progressing at a rate of about 150 ft. per month, with four machine-drills used. Ore has been cut at two points since sinking commenced, but no attempt will be made at lateral work until the 1200-ft. level has been opened. The shaft has dimensions of 8 by 17 ft. In addition to opening the Merger Mines estate, the St. Ives shaft will also assist in the exploration of other properties, as it was recently stated arrangements would be made when this shaft attained the 1800-ft. point, by means of which drifts would be extended to open the adjoining Atlanta claims at depth. The latter will also be explored probably by work conducted from the 1300-ft. level of the Goldfield Con. M. Co.'s Grizzly Bear shaft. It is stated that the wealthy interests lately associated with the Atlanta, plan sinking an 1800-ft. shaft on the Black Bear claim. There are two shafts on the Atlanta, the deepest being about 700 feet.

The Blue Bull company plans the sinking of a shaft on the Hat claim, to a depth of at least 1000 ft. This is designed to open the Blue Bull orebodies at depth, also to tap the veins of the Victor claim. The east half of this claim has been leased by the Blue Bull from the C. O. D. Con. M. Co. Shaft-sinking is being done at the Silver Pick, Vernal, Booth, Goldfield, Belmont, and one or two other properties, and the C. O. D. Con. company is reported to be planning to deepen the 600-ft. shaft of the Gold Bar claim. Deeper mining is planned also by the owners of the Sandstorm-Kendall group.

Besides the sinking of new shafts, considerable development of properties is being done by driving from the old workings of adjoining and more powerful companies. Thus the Combination Fraction is being explored by driving from the old Mohawk workings. Such conditions facilitate

HIGHLAND HOIST, HOMESTAKE MINE.

the opening of small mines at a minimum of development cost, and naturally assists in the exploration of the district. During the past year several small companies have been merged into one strong combination. The various consolidations have united wavering and divergent policies under one vigorous management, as well as obtained funds.

BLACK HILLS, SOUTH DAKOTA

HOMESTAKE OPERATING BY ELECTRICITY.—BLACK HILLS SMELTING CO. PLANS.—OTHER NOTES.

On April 11, the Homestake M. Co. started using power from the Spearfish hydro-electric plant. On that date the first motors were connected in the Amicus 240-stamp mill. All of the stamps which have previously been driven by steam, are now operated by electricity. For running the stamps 25-hp. back-geared motors are used, one motor for each battery of ten stamps. The power is supplied to these motors at 440 volts, 3 phase, 60 cycles, being stepped down from the transmission line voltage at a sub-station at Lead, adjacent to the Amicus mill. Into this station will also be conveyed the current generated at Englewood, amounting to about 600 hp. The next work for the electricians will be the connecting of the rock-crushers. For each crusher there will be installed a 35-hp. motor, equipped with a heavy fly-wheel. As there are something like a dozen of these motors to be put to work, the task will probably consume some little time. W. E. Walter has arrived to take the superintendency of the Black Hills Smelting Co., at Galena, and as a first step has been making a thorough examination of the mines tributary to the smelter, with a view to learning the probable amount of ore that will be shipped to the plant. He is also investigating pyrite supplies. Nothing will be announced regarding the probable date of blowing in the plant until Mr. Walter reports his findings to the officials of the company. The plant is practically complete and ready to start on short notice. The Deadwood Lead & Zinc Co. recently held its annual meeting, at which the following directors were elected: Aaron Dunn, president; P. M. Bonniwell, vice-president; George S. Jackson, secretary and treasurer; O. N. Brown, and C. S. Ruth. The company is endeavoring to find a suitable treatment for the ore, which has a high percentage of iron pyrite, about 10% zinc, 10% lead, $3 gold, and 10 oz. silver per ton. At the New Reliance the ten new stamps are now in operation, making in all thirty stamps regularly dropping. W. H. Weigand is superintendent. Charles E. Ellis, who for some time was mill superintendent for the Mogul company, on April 1 accepted a similar position with the Trojan Mining Company.

General Mining News

ALASKA

JUNEAU

The Alaska Treadwell G. M. Co. in March made a production with a 'realizable' value of $159,782. This was derived from 64,120 tons of ore, which yielded 1146 tons of concentrate valued at $77,912. The free gold production was valued at $83,485. The realizable value, however, is given as slightly below the total production of $161,396. The net profit for the month was $58,614. The yield per ton was $2.51. Development work done during the month amounted to 1072 ft., and the stock of broken ore was increased by 42,333 tons.

ARIZONA

GILA COUNTY

The report of the Miami Copper Co. for the year ended December 31 includes the following items:

Sale of 14,970,557 lb. copper at 13.03c	$1,950,669
Other income	33,273
Total income	$1,983,942
Total expense	1,396,092
Balance	$ 587,850
Interest on loans and on bonds	98,246
Surplus	$ 528,523

According to B. B. Gottsberger, general manager for the company, the preparatory stage of the mine has been passed. The first unit of the mill was started March 15, 1911, and production was increased steadily. At the close of the year five units were treating 3500 tons of ore per day.

GREENLEE COUNTY

The Arizona Copper Co. is increasing the capacity of the power-plant equipment for its mines at Clifton by the addition of new machinery, including three 2500-kva. turbo-generators and nine 417-kva. transformers from the General Electric Company.

MOHAVE COUNTY

It is reported that some of the large companies are investigating a copper ore discovery made by Lyon Kay, north of the Keystone mine, near Mineral Park. The Arizona Turquoise mines at Mineral Park will soon have a large force employed. The Ruth is sinking its shaft to the 300-ft. level. The property is in the San Francisco district. Frederick Lyon, vice-president, and A. P. Anderson, field engineer for the United States S. R. & M. Co., recently inspected the company's holdings in the county.

PINAL COUNTY

The Ray Con. Copper Co. during March produced more than 2,400,000 lb. copper, obtained from 108,700 tons of ore. The profit for the month was about $157,000. The mining cost was 88c. per ton, 10c. more than last year's average. During the larger part of the month only three units of the mill were operated, but toward the end of the month the fourth unit was used to handle the increased tonnage. The mill treated ore at a rate of 1100 to 1150 tons per unit, the extraction being about 70 per cent.

YAVAPAI COUNTY

Rich silver-gold ore has been found in the Hidden Treasure claim, near Prescott. The property is owned by Charles Bennett.

CALIFORNIA

AMADOR COUNTY

(Special Correspondence.)—Steady progress is being made in unwatering the Plymouth, the water being lowered at the rate of eight feet per day. The shaft has now been recovered to a depth of 800 ft. and in that distance only 14 sets of timbers have had to be re-set. A 500-gal. bailer is being used, with an electric hoist, and work is continuous through three shifts, though shaft repairs interfere somewhat with bailing on the day shift. The mine is to be unwatered to the bottom at 1700 feet.

Jackson, April 24.

(Special Correspondence.)—The shaft at the Keystone has been unwatered and repaired to the 1400-ft. level and a pump placed to drain the 1500-ft. level. It is planned to resume sinking. The property lies near Amador City and is operated by the New Keystone M. Co., for which C. R. Downs is superintendent. The foot-wall ore on the 500-ft. level of the South Amador shows a width of 45 ft. at the point intersected by cross-cuts. The new headframe at the South Jackson is in course of erection. The Bunker Hill company declared its regular monthly dividend of 7½c. on April 15, marking the seventieth consecutive disbursement. The 1950-ft. shaft of the Lincoln Consolidated has been cleared of water, and from the bottom level a drift is being extended to tap the Wildman-Mahoney orebodies. It is stated the strong vein recently opened on the 2700-ft. level of the Central Eureka has been intersected on the 2800-ft. level. It is believed to be the continuation of the west vein of the South Eureka mine. J. E. Davis is superintendent of the Central Eureka. The Poundstone mine, near Sutter Creek, has been re-named the East Eureka. Machinery at the mine and equipment for the 20-stamp mill are being erected. The shaft of the Plymouth Consolidated has been unwatered to the 700-ft. level and will be cleared to the 1700-ft. level. From this point it is planned to sink the shaft an additional 500 ft. The property is being developed by the California Exploration Co., composed of London capitalists. The Kennedy continues to operate 100 stamps, with a production of about $80,000 per month. A large percentage of ore is coming from below the 3000-ft. level. Webb Smith is superintendent.

Jackson, April 21.

KERN COUNTY

It is reported that a compromise has been effected adjusting all claims against the Skidoo Mines Co. Charles H. Churchill and Edward Teagle of Randsburg have located several potash claims in the Johannesburg district.

In a preliminary report, Bulletin No. 471-A-5 of the U. S. Geological Survey, on the geology and possible oil resources of the south end of the San Joaquin valley, Robert Anderson states that the stores of petroleum along the foothills of the Temblor range on the southwest side of the valley and in the foothills of the Sierra Nevada near Bakersfield on the northeast side suggest the possibility of finding oil in the foothill belt along the south end of the valley, between the two districts named. He, however, reaches the conclusion that a continuous productive area is by no means to be expected, but that two or more areas situated near the border of the foothills at the south end of the valley offer favorable conditions for the accumulation of oil. Across the level San Joaquin valley from Bakersfield to Buena Vista lake, to the San Emigdio region and to the Tejon region, any oil-bearing rocks probably are too deep to be accessible by present-day drilling.

PLUMAS COUNTY

It is reported that arrangements are being made for building a mill at the Altona mine, in the Greenville district. The property has been bonded to J. W. Dailey.

Grill & McCauly, lessees at the Old Harry claim, ten miles from Quincy, report that 41 tons of ore milled from their last run averaged $65, says the *Plumas Independent*.

COLORADO

CLEAR CREEK COUNTY

The Anglo-Saxon Mines Co. has started development on its property on Saxon mountain. The mine formerly belonged to the late Henry C. Parker. John Bowen is manager of the property, which is in the Georgetown district. The Mineral Chief mill will be started May 1 by Stephens Bros. & Old, lessees on the Linn Con. M. Co. property. The mill during the summer will be run on the dump material.

GILPIN COUNTY

Ore assaying as high as 25 oz. gold and 6000 oz. silver

per ton, according to newspaper reports, was found in the Coaley mine. The streak from which the ore was taken is 2 to 8 in. wide. The Castle Rock shaft will be sunk an additional 200 ft. Joseph Tuckfield, superintendent of the property, has completed the new foundation for the hoist. Richard Fraser and James Flynn recently shipped from the War Dance property six tons of ore that brought them $500 per ton, and six tons valued at $111 per ton.

Ouray County

It is rumored that Robert J. Lucas may resume operation of his Mineral Farm mine. Development will be started soon at the Molly mine, Red Mountain district, after a shut-down of twenty years. A. E. Ackerson recently bought the property from Blanchard & Buskirk.

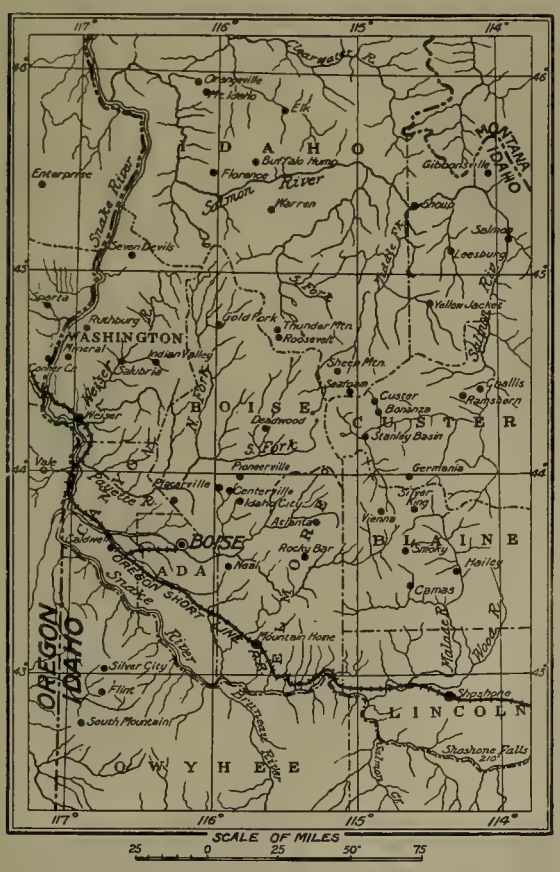
Teller County (Cripple Creek)

Kenneth McKenzie, who bought the title to the St. Thomas G. M. Co., has proposed to the stockholders a reorganization of the company under the name of the Peoria G. M. Co. The property, which McKenzie acquired at a tax sale, is under lease to the 101 M. Co., for which Charles Crowder is general manager. John B. Neville, president and general manager for the Free Coinage G. M. Co., has bought the Delmonico claim. The Portland estate has withdrawn the Colorado City claim from the property to be leased.

IDAHO

Idaho County

The Revenue M. & M. Co., recently organized in Spokane by Harlow H. Dean and associates, has taken over the old



IDAHO.

California mine, near the junction of the American and Red rivers, in the Elk City district. The mine was worked as placer ground in the early days, but was later located as a quartz claim by W. C. Smith, who ran a 600-ft. adit on the main lode, which opened an orebody of promise. G. J. Calvert will be superintendent. The officers of the company are: president, H. H. Dean; vice-president, S. S. Bassett; secretary-treasurer, Walker Guthrie; directors, E. F. Cartier Van Dissel, and Thomas Olsen.

Shoshone County

The Bunker Hill & Sullivan M. & C. Co.'s mill, costing $375,000, placed in commission at Kellogg, a few days ago, is said to be the largest silver lead concentrating plant in the world. Its capacity is 35,000 tons per month. The mill is operated by electricity, 750 hp. being required. Construction work was started in 1907, the first unit with ore-house and conveyor being completed in December 1910. The mill is equipped with ore-bins of 3000 tons. Concrete and native timber were used in the buildings.

Sinking will be resumed at the Bullion, of which J. H. Taylor is manager. Ore from the property is said to assay over 12% copper, and to have fluxing properties which make it valuable to smelters.

At the Marsh mine, near Burke, it is reported that a 4-ft. vein of high-grade galena, assaying as high as $80 per ton, was cut at a depth of 456 ft. below the No. 2 adit. The company has just signed a five-year contract with the International S. & R. Co. to treat its ore. In a drift west, 12 ft. from the point in the cross-cut where the ore was discovered, the vein has widened to 6½ ft. Of this, 30 in. is high-grade shipping ore.

The Hecla M. Co.'s April dividend of $20,000, at the rate of 2 cents per share, places the disbursements at $80,000 for the first four months of 1912, or $2,430,000 to date.

MONTANA

Musselshell County

C. W. Scott and C. C. Shultze are planning to develop the former's coal property near Roundup. The coal of the district is bituminous. The land is crossed by the Billings & Northern railroad.

Silverbow County

(Special Correspondence.)—The Davis-Daly company expects to be in a position to increase shipments next month from the Colorado mine. The orebody on the 1700-ft. level is improving, some of the ore showing 10% copper. Some ore is being mined on the 1400-ft. level. Some time ago the shaft of the Raven mine was unwatered and now prospecting is in progress on the lower levels, but up to the present with little success. It was contended that with the water removed a rich orebody would be found on the 1300-ft. level, but none of real value has yet been discovered. The Butte-Ballaklava company has commenced shipping ore from the 1400-ft. level, which it is claimed is in ground which is not in dispute with the Anaconda company. For the present a carload every other day will be sent to the East Butte smelter, and C. W. Newton, the superintendent, hopes to be in a position in a short time to increase the shipments to a carload per day. The ore being shipped is taken from stopes. It is stated that as the stoping proceeds the ore is showing improvement.

Butte, April 22.

The North Butte M. Co., says the annual report recently issued, in the year ended December 31 produced 24,816,669 lb. copper, 1,134,300 oz. silver, and 1281 oz. gold. The ore reserve on January 1 amounted to 710,920 tons, with an average assay value of 4½% copper and 4.25 oz. silver per ton. The profit of the company for the past four years has been tabulated as follows by the *Boston Commercial.*

Year. Dec. 31.	Gross receipts.	Net profits.	Per share.
1908	$4,701,829	$1,863,282	$4.66
1909	4,083,284	1,036,305	2.59
1910	3,790,991	560,888	1.40
1911	3,752,160	641,858	1.56

Lateral development was confined chiefly to the Croesus and Snowball veins. Development for the year amounted to 17,700 ft. Decrease in the ore reserve, as noted in the quarterly reports, is attributed by James Hoatson, president of the company, to the fact that the Edith May and Jessie veins above the 2400-ft. level had been largely explored, and to the sinking of the Speculator shaft, which precluded much work below the 2200-ft. level. Since the

last report was issued, the company has purchased an additional three-tenths interest in the Charlie and Protection claims.

NEVADA

Clark County

Paul Barlock is planning to prospect his Missoula group of three claims near Searchlight. The property has a 35-ft. shaft equipped with a 9-hp. Fairbanks-Morse gasoline hoist. Work is to be resumed soon at the Searchlight-Parallel property. Walter R. Fales, of Los Angeles, will be in charge of the mine.

Esmeralda County

(Special Correspondence.)—A reorganization has been announced of the Lone Star M. Co. under the name of the Lone Star Con. M. Co. It is reported that the financial condition of the new company is good, and that extensive development work will be done. The company's property is close to Consolidated Mines and Jumbo Extension. The Lone Star Consolidated company is capitalized at $2,500,000, and stock in it will be exchanged for stock in the old company on payment of 2c. per share. It is believed this provision will make unnecessary any assessment within a year. The stock must be exchanged within three months.

Goldfield, April 20.

The 7 by 18-ft. shaft of the Goldfield Merger Mines Co. was 900 ft. deep on April 18, and the sinking is progressing at a rate of about 140 ft. per month, say Goldfield advices. The ground penetrated so far is firm. No lateral development will be started until a depth of 1400 ft. has been reached. Three shifts are employed.

Lander County

(Special Correspondence.)—The Maricopa Mines Co. has resumed operation in the True Blue adit and workings in New York canyon. The vein in the stope is said to be five feet wide, with the ore mined running 20 oz. silver per ton. The second vein is smaller, but is said to be richer. It is planned to place the mill in commission early in June. The Salt Lake interests recently taking over the Austin Central properties on a long-term lease is driving an adit along the dike paralleling the Jack Pot veins. Renewed activity is reported by the Bullion Mountain company in the Bullion district. A shaft has been started and an adit is under way to prospect the porphyry dike. The Georgia Nevada M. Co. reports that at an inclined depth of 150 ft. a small vein of high-grade silver and gold ore has been cut. At another point a 5-ft. vein is being opened. This is said to assay about $39, principally silver. W. D. Scott is president.

Austin, April 20.

Lincoln County

The Prince Con. M. Co. has issued a statement for the quarter ended March 31 which shows the company in that time received $103,760.

Lyon County

The Mason Valley smelter recently established a new record, according to newspaper reports, by treating 710 tons of ore in 24 hours.

Press reports state that much interest has been aroused by the discovery of copper sulphide ore on the 200-ft. level of the Copper King, owned by the Queen Regent Merger Mines Co., near Schurz.

Nye County

(Special Correspondence.)—The Big Four company has taken charge of the Big Four mine, and arrangements are practically completed for sinking the main shaft to the 500-ft. level. Between the 300 and 400-ft. levels the vein shows a width of about 60 ft. L. K. Koontz, president, states that thousands of tons of milling ore is available for treatment in the upper workings, and that a modern milling plant will be built immediately. The Poak-Steen-Cicala lease has completed its run at the Priest mill, and from the final clean-up 455 oz. of bullion valued at $6850 was produced. During about 20 months of operation this lease produced over $300,000. It is understood the members of the leasing company plan to take over other holdings in the district. The 10-stamp Associated mill is crushing the first shipment of 1000 tons of ore from the Steffner lease, on Manhattan Con. propery. The contract with the mill calls for an initial treatment of 2000 tons from Steffner's lease. The next handled will be 1000 tons from the White Caps mine. The Dexter-Union is arranging for work on company account. Work will be carried on from the Rose-Nash shaft on the Union No. 4 claim. A good vein of milling ore has been exposed by lessees. S. C. Durkee has been chosen superintendent. The Swanson lease on the Earl reports opening two strong shoots on the 250-ft. level. The orebodies run about four feet wide and average around $12 per ton. The vein recently cut in the Mushet-Wittenberg lease on Manhattan Con. land is said to be four feet wide. It was found at the 125-ft. level and is said to assay over $150 per ton. The lease adjoins the Steffner workings.

Manhattan, April 20.

In the Manhattan district, ore from the Mineral Hill Consolidated adit assayed as high as $128 per ton. Previous assays from the same orebody were $29 and $33, and the management hopes to cut a rich ore-shoot. In the Kendall-Douglas lease of the Silver Pick claim of the Manhattan Consolidated, a 7-ft. vein assaying about $75 was cut recently, according to press reports.

The Tonopah Belmont Development Co.'s report for the year ended February 29 shows that the net earnings of the company amounted to $1,802,081, as against $1,502,381 for the preceding year. A résumé of the report will be given in next week's issue of the *Mining and Scientific Press*.

The production of the Tonopah district for the quarter ended March 31 is summarized as follows by the *Tonopah Miner:*

Company.	Jan.	Feb.	Mar.	Total.
Tonopah Mining	14,943	14,326	14,706	43,975
Belmont	10,363	9,813	8,609	28,785
Montana	4,724	4,092	4,748	13,564
Tonopah Extension	3,775	3,822	4,618	12,215
West End Con.	2,798	3,288	3,170	9,256
MacNamara	317	1,595	1,700	3,612
Midway	180	.....	.....	180
Totals	37,100	36,936	37,551	111,587

Estimated gross value, $2,890,810. The falling off in the production of the Belmont mine is due solely to the cessation of shipments to smelters during the retimbering of the main shaft. The West End shipments for March include 113 tons of high-grade ore sent to the smelter.

Storey County

In connection with the usual development, the Union Con. mine produced 191 tons of ore averaging about $20 and shipped 389 tons of second-class ore to the Kinkead mill. The Mexican mill, running 66% of the week, crushed 402 tons of ore which averaged $24.28, with an apparent extraction of 92%. Repairs were made to the Chilean mill, tube-mills, and agitators. Twelve bars of bullion were shipped to the Selby S. & L. Co. The customary development work was done on the other Comstock properties. The Nevada Deep Mines Co. has ordered a 70-ton mill from the Union Iron Works. It is to be running in about three months. The property is at Como.

White Pine County

(Special Correspondence).—The Giroux shaft has been unwatered to the bottom, 1445 ft., and has been thoroughly cleaned. The water at a depth of 1400 ft. flows wholly toward the Alpha, and pumping has been started to keep the water from flooding the 1200-ft. level, and preventing prospecting above that level. It is not probable that work will be resumed there until ore shipped from the Morris shaft will pay for it. It is a question whether the Zack shaft of the Ely Consolidated has much ore. The discovery of a small body of sulphide ore, however, has been widely advertised.

Ely, April 20.

Reports from Ely state that geologists for the Tonopah M. Co. have completed a preliminary examination of the Argus and Montor mines and several claims at Taylor. The properties are under option to the Tonopah company.

The Smokey Development Co., owning 175 acres near Lane, is planning to start driving an adit within two weeks, according to H. P. Eastwood, one of the organizers of the company. The property is between the Federal Ely and Chainman Consolidated properties.

NEW MEXICO

Socorro County

(Special Correspondence.)—The Ernestine M. Co., produced bullion in the last 10 days of March amounting to 8850 oz., concentrate for the period was 12,000 lb. The total output for the month was 22,640 oz. bullion, and 16½ tons concentrate, from an ore treatment of 3200 tons. The tonnage last week was 660. The Deadwood Mines plant is in operation, the upper workings furnish the mill with ore. A fair tonnage of custom ore is handled.

The Treasure M. & R. Co. is delivering 60 tons per day to the mill on Whitewater creek. Work on the Johnson mine, a patented property, has disclosed gold and silver ore, and the extent of the orebody is being determined. The Mogollon Gold & Copper Co., has let a new working lease on the Little Charlie mine to Los Angeles capitalists. It is probable the other holdings of this company will be handled by the same people. Lessees on the Pacific mine are taking out a good tonnage of mill ore, largely from development, amounting to a total of 40 ft. of work during the week.

Mogollon, April 12.

OKLAHOMA

Ottawa County

(Special Correspondence.)—The Baxter-Quapaw district, idle for many months save for occasional spasmodic operations, is showing signs of activity, and a big centrifugal pump has been erected at the Omaha-Petersburg mine. The ground is so saturated with water, as a result of the continuous rains and snows of the late winter and early spring, that drainage is a serious problem. Many mines have suffered heavily from surface floods, but the chief source of annoyance has been the increased underground seepage. A last effort has been made to work the Hackett mine, which is equipped with one of the most costly plants in the district. It was built at a cost of $80,000 and operated first with one type of jig and then another. New York people have taken over the Hackett and have drained the ground. The best mill recovery was barely in excess of 2%, but the present operators believe they can handle this low-grade ore at a profit at the present high price of zinc. Employment is now given to 13,000 men throughout the district, embracing mines in the adjoining corners of the three states of Missouri, Kansas, and Oklahoma. Eight hundred companies are operating. The output of zinc-blende is close to 6000 tons per week, calamine 500 tons, and lead 1000. Only American labor is employed, all efforts to introduce foreign workmen having failed. Many of the workmen are now members of the union, and efforts at unionizing the entire district are meeting with more or less success.

Quapaw, April 19.

UTAH

Juab County

(Special Correspondence.)—Utah mining men are greatly disturbed over a recent decision of the general land office in the case of the East Tintic Con. M. Co. which upsets all previous practice as to securing patent for mining claims. The decision is interpreted as meaning that hereafter the mineral claimant must actually develop a valuable mine before he can secure patent, no matter how favorable the mineral indications are. The decision says:

"It is evident from the record that the deposits alleged to have been exposed on these claims are regarded by the applicant as possessing practically no economic value, but that, on the other hand, title to the claims is sought essentially on account of the possible value for certain unexposed deposits supposed to exist at considerable depth below the surface, and having no connection, so far as shown, with any deposits appearing on the surface.

"The exposure, however, of substantially worthless deposits on the surface of a claim; the finding of mere surface indications of mineral within its limits; the discovery of valuable mineral deposits outside the claim, or deductions from established geological facts relating to it; one or all of which matters may reasonably give rise to a hope or belief, however strong it may be, that a valuable mineral deposit exists within the claim, will neither suffice as a discovery thereon, nor be entitled to be accepted as the equivalent thereof.

"To constitute a valid discovery upon a claim for which patent is sought there must be actually and physically exposed within the limits thereof a vein or lode of mineral-bearing rock in place, possessing in and of itself a present or prospective value for mining purposes; and before patent can properly be issued or entry allowed thereon, that fact must be shown in the manner above stated."

Eureka, April 22.

The new machinery for the Iron Blossom No. 3 shaft has been delivered at Tintic. According to reports from the property, the Dragon mine, which is operated through the Iron Blossom company's shaft, is producing ore which assays 2 oz. gold, 20 to 40 oz. silver, and 2% copper per ton. According to an estimate by Walter Fitch, manager for the company, the Chief Consolidated in March produced about $56,000. Erick Levin has taken a lease on part of the dump at the Eureka Hill mine, other lessees being William Clark and Elijah Bowden.

Salt Lake County

(Special Correspondence.)—D. C. Jackling, general manager for the Utah Copper Co., is authority for the statement that the company will increase its tonnage steadily until the maximum is reached. The ninth unit of the Arthur mill is now in commission and the milling capacity of the company is now 18,000 tons per day.

Salt Lake City, April 22.

Strikers caused a temporary shut-down of underground work at Bingham, and the mills are supplied with ore from only the steam-shovels. The supply thus cut off furnished about 15% of the total tonnage. The machine men 'demanded' a raise from $3 to $3.50 per day, according to a report. The Utah Copper Co. invited them to send a spokesman to discuss the matter, but no one appeared. The strikers resumed work in a few days.

Summit County

(Special Correspondence.)—The Daly-Judge has begun marketing its zinc product, which was being held for a time pending the negotiation of a favorable contract. A deal was recently made with the United States Smelting, Refining & Mining Co., and now the tonnage of the Daly-Judge is being rapidly increased. The zinc product is going to the Midvale plant of the United States company, where separation is made by the Huff electrostatic process.

Park City, April 23.

Stockholders in the Diamond-Nimrod company have received a letter stating that on March 26 the holders of $48,915 notes against the company and of 101,337 shares of the stock had sold their interest to Harry Joseph of Salt Lake City for $75,000, with the stipulation that he should pay 10c. per share for the rest of the capital stock. The provision states that the certificates for such shares, properly endorsed, must be deposited with the Chicago Title & Trust Co., of Chicago, on or before June 25, and that Joseph is to deposit with the same company $13,867.80 as security. It is rumored that the Daly West company is interested in the deal. H. G. McMillan, manager for the Daly West company, recently stated that the mill will be in operation about May 1. The present shut-down, due to the failure of Silver lake to thaw, is the longest in years. No quarterly report will be issued for the first three months of 1912.

UTAH COUNTY

The Opohongo M. Co. has declared a dividend of 1c. per share, payable April 30 to stockholders of record April 25. The dividend will require $8950, and will bring the total amount disbursed to stockholders to $26,850.

WASHINGTON

SPOKANE COUNTY

Legislative needs of the Pacific coast and intermountain states will be discussed at a Western welfare conference, called by the Spokane Mining Men's club to meet in a city, to be agreed upon, before the national political conventions. L. K. Armstrong, president of the organization, has forwarded invitations to the governors of California, Oregon, Nevada, New Mexico, Arizona, Utah, Washington, Idaho, Wyoming, Colorado, Montana, North Dakota, and South Dakota and representative citizens of the thirteen states to select a place of meeting and fix the dates.

CANADA

ONTARIO

Special Correspondence.)—Construction work on the Elk Lake branch of the Temiskaming & Northern Ontario railway has begun and it is expected that the line will be completed by November 1. The prospect of railway facilities has revived interest in the Elk Lake and Gowganda mining industry, and some formerly promising properties are being re-opened and new prospects developed. A good many mining men are going in from Porcupine. A recent shipment of 15 tons of high-grade ore from the Mann property, Gowganda, has realized over $38,000, or a profit of $32,000 after deducting mining and marketing expenses.

Toronto, April 17.

The fourth gold brick from the McIntyre mill was shipped April 17. It weighed 180 oz. and was valued at $3000.

In 1911 the La Rose Consolidated Mines Co. produced 3,691,797 oz. silver, at a total cost of 19.2c. per ounce. Shipments for the year amounted to 4,092,709 oz. silver. The net profit was $1,269,086. This was 64% of the production.

YUKON

The Canadian Klondike M. Co. and the Treadgold interests in the Klondike basin have been merged, according to an announcement by Charles Boyle, Jr., resident manager for the Canadian Klondike company. The telegram from J. W. Boyle, president of the company, telling of the consolidation, also stated that a third dredge has been ordered, of the same size as the dredge *Canadian*, now being operated. Last month it was announced that the second, a duplicate of the present dredge, said to be the largest in the world, had been ordered from the Marion company. The consolidated properties will be under one management, with J. W. Boyle in charge, and under the present name of the company. Among the Treadgold properties absorbed are the Granville Power Co. and the Bonanza Basin Company.

MEXICO

SONORA

The action of the United States Government in not allowing explosives to cross into Mexico is causing several of the small companies to cease operations. It is understood that there are quite a number of companies which at present have but a small amount of explosives on hand, and if the embargo is not raised in the near future they, too, will be compelled to cease operations until such time that conditions allow. The Cananea Con. Copper Co. has a sufficient supply on hand to last them eight or nine weeks, and it is thought by that time conditions will be such that powder will be allowed to enter Mexico. It is understood that the matter has been taken up with the United States Government, so that arrangements can be made to import powder, the Federal Government to see to its delivery. Without powder thousands of men will be thrown out of employment in Sonora, and it is to be hoped that this condition will not present itself.—*Mexican Herald.*

Among the Copper Mines

The EAGLE & BLUE BELL shaft, Tintic district, is expected to cut the main orebody on the 1400-ft. level by July 1.

NEVADA-UTAH stockholders in Boston who followed Lawson held a meeting recently and endorsed the plans of the shareholders' protective committee.

The BUTTE & SUPERIOR COPPER CO. has decided to issue 30,000 shares at $27.50 per share. The entire issue has been underwritten by a Boston banking house.

The SHANNON COPPER CO. has found it necessary to blow in an additional small furnace, as its large furnace has been overtaxed. It is believed that April will be a record-breaking month for the company from the point of view of costs and earnings.

The NORTH BUTTE M. Co. last year made a net profit of $1.56 per share, as against $1.40 per share in 1910, $2.59 in 1909, and $4.66 per share in 1908. Gross receipts last year amounted to $3,752,160, as against $3,790,991 in 1910. The total net profit was $641,858, as against $560,888 in the preceding year.

L. VOGELSTEIN & Co. give the following figures of German consumption of foreign copper for the months of January-February, 1912:

	Tons.
Imports of copper	33,787
Exports of copper	1,713
Consumption of copper	32,074

as compared with consumption in 1911 of 28,138 tons. Of this quantity 29,293 tons came from the United States.

The CALUMET & ARIZONA COMPANY has made one of the most important ore finds in its history. The ore was found in a cross-cut 522 ft. from the Briggs shaft on the thirteenth level. The ore is sulphide and assays made on several days averaged 35%. They have averaged by days, 31.8, 40, 22, 24, 27, and 41%. This find follows several recent finds on the twelfth and thirteenth levels of the Briggs shaft averaging 7 to 10% copper and $3 per ton in gold, which are holding out. It only takes 1250 tons of 40% ore to produce 100,000 lb. copper.—*News Letter.*

UTAH CONSOLIDATED stock having declined almost $8 per share on the announcement that its developed ore reserves decreased 105,565 tons in 1911, a comparison of the more important features of its operations last year, as shown in its annual report, with those of the North Butte M. Co. will be interesting.

	Utah Con.	North Butte.
Number feet of new development openings	18,799	17,700
Tons of ore mined and treated	172,839	410,694
Tons of ore developed at the end of the year	275,435	710,920
Decrease during year in tons of developed ore	105,565	247,760
Tons new ore developed during the year	67,274	162,934
Gross operating expense per ton of ore treated	$5.87	$7.44
Profit per ton ore mined and treated	$2.53	$1.56
Net earnings per share of stock outstanding	$1.46	$1.56
Number shares of stock issued	300,000	410,000
Present market price of shares	$15	$33
Stock market valuation of issued capital	$4,500,000	$13,530,000
Value of net quick cash assets in treasury	$1,249,134	$485,793
Cash and quick assets behind each share	$4.61	$1.18

—*Boston Commercial.*

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

E. Gybbon Spilsbury is in Texas.

Edmund B. Kirby is in New York.

D. W. Brunton was in New York recently.

M. R. Hydliff has been visiting San Francisco.

Frederick Lyon was in San Francisco Thursday.

F. M. Simonds is in Cuba on professional business.

J. Parke Channing was at the Miami mine recently.

H. S. Denny was in New York on his way to London.

H. C. Callahan left for Panama on the *Sonoma*, Thursday.

J. V. N. Dorr is spending two weeks in southern California.

John Weir and H. R. Rood were among those lost on the *Titanic*.

F. O. Jasmer has gone to Santiago Papasquiario for six months.

Henry H. Armstead, of Guanajuato, is in New York for a month.

A. Chester Beatty sailed from New York for London on April 23.

T. A. Rickard sailed from New York for England on the *Cedric*, April 18.

Howard D. Smith has returned from a professional trip to the California oilfields.

Stuart H. Ingram, from La Cumbre, was in San Francisco, and has gone to Nevada.

Charles Janin is returning from France and will go to Alaska to examine placer ground.

Rensselaer H. Toll is examining mines in the San Juan district and will be at Ouray until May 15.

T. H. Jenks has returned to Denver, after a four-months professional trip to Mexico, Arizona, and New Mexico.

Willis Lawrence is general superintendent for the Chosen Mining Co. at Ko Sung mines, Yeng Byen, Korea.

Charles W. Guttzeit has resigned from the general managership of the Titan Steel Casting Co. of Newark, New Jersey.

Robert H. Richards is in Denver on professional business and will visit Rolla, Missouri, and Houghton, Michigan, on his way East.

J. H. Loring, of Cobalt, Ontario, who was a passenger on the *Titanic*, was not, as reported, a relative of W. J. Loring, none of whose family were on the steamer.

J. B. Tyrrell will be the leader of the Ontario government expedition to locate the ten-mile strip at the mouth of the Nelson river and the five-mile strip along Hudson's Bay, which Ontario has been granted by the Dominion.

Obituary

Horace J. Stevens, best known because of his 'Copper Handbook,' died from heart failure at Houghton, Michigan, on April 22. Mr. Stevens was born at Conewango, New York, in 1866 and received his education in the schools and academies of the vicinity as well as during service as a country school teacher. Removing to Michigan in 1883 he served in a variety of capacities at the Beaufort mine, eventually becoming a reporter on the *Marquette Mining Journal*. After five years of this experience he started the Peninsular News Bureau, which prospered under his management and led to the publication in 1901 of the first volume of 'The Copper Handbook,' which quickly established a place for itself, and is the work for which he was known to mining engineers, though in Michigan he was one of the best known newspaper men of the upper peninsula.

Market Reports

LOCAL METAL PRICES

San Francisco April 25.

Antimony	11—11½c	Quicksilver (flask)	41.50
Electrolytic Copper	16½—16¾c	Tin	47—48¼c
Pig Lead	4.45—5.40c	Spelter	7¼—7¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, April 25.—Trading in metals has been quiet in New York the past week, especially in the case of lead. Prices for copper and spelter, none the less, are firm. Average daily prices in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
April 18	15.80	4.20	6.70	59½
" 19	15.75	4.20	6.70	59⅜
" 20	15.75	4.20	6.70	59⅜
" 21	Sunday.		No market.	
" 22	15.73	4.20	6.72	59⅜
" 23	15.73	4.20	6.72	59⅜
" 24	15.75	4.20	6.72	60¼

LONDON QUOTATIONS

(By cable, through the courtesty of C. S. Burton & Co., New York.)

	April 25.
Camp Bird Ltd	$ 7⅛
El Oro	4
Esperanza	8⅛
Oroville Dredging	1¼s
Santa Gertrudis	7¼
Tomboy	5⅛

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, April 25.		Closing Prices April 25.
Adventure	$ 9⅜	Mohawk	$ 65
Allouez	46	North Butte	31⅜
Calumet & Arizona	73½	Old Dominion	55
Calumet & Hecla	492	Osceola	117½
Centennial	26½	Quincy	91½
Copper Range	63½	Shannon	14½
Daly West	6⅜	Superior & Boston	2⅜
Franklin	14½	Tamarack	45
Granby	57½	Trinity	8
Greene Cananea, ctf.	9	Utah Con	14
Isle-Royale	27¾	Victoria	4⅜
La Salle	7	Winona	6⅛
Mass Copper	7¾	Wolverine	111

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, April 25.

Atlanta	$ .28	Mayflower	$ .03
Belcher	.78	Mexican	3.47
Belmont	10.20	Midway	.38
B. & B.	.17	Montana-Tonopah	3 25
Booth	.12	Nevada Hills	2.20
Chollar	.10	Ophir	1.40
Combination Fraction	.16	Pittsburg Silver Peak	1.40
Con. Virgina	.80	Round Mountain	.50
Florence	.80	Savage	.17
Goldfield Con.	4.20	Tonopah Extension	2.12
Gould & Curry	.09	Tonopah of Nevada	8.00
Jim Butler	.67	Union	1.00
Jumbo Extension	.50	Vernal	.17
MacNamara	.24	West End	2.07

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. April 25.		Closing Prices. April 25
Amalgamated Copper	$ 83⅜	Miami Copper	$ 25
A. S. & R. Co	85¼	Mines Co. of America	3
Braden Copper	5⅜	Nevada Con	18
B. C. Copper Co	5¼	Nipissing	7⅞
Chino	30	Ohio Copper	1¼
First National	3¼	Ray Con	19⅜
Giroux	5¼	Tenn. Copper	41⅝
Goldfield Con.	4½	Tonopah Belmont	10½
Greene-Cananea	9	Tonopah Ex	2¼
Hollinger	11⅝	Tonopah Mining	7
Inspiration	19⅜	Trinity	8½
Kerr Lake	2⅛	Tuolumne Copper	3½
La Rose	3⅝	Utah Copper	63¾
Mason Valley	12¼	West End	2¼
McKinley-Darragh	1⅝	Yukon Gold	3

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

TERNE-PLATE is an inferior variety of tin-plate, made from tin alloyed with a large percentage of lead. It is chiefly used for roofing purposes and for lining packing cases for ocean shipment.

DIAMONDS, according to O. A. Derby, may have resulted from the segregation of a portion of the C of CO_2, a gas which is always present in kimberlite, the rock with which diamonds are associated.

LIME can be burned with almost any fuel. The use of wood is common throughout the West, while in the Eastern United States coal is ordinarily employed. At Allentown, Pennsylvania, coke is employed for this purpose.

MACHINE-DRILL air-hose is wrapped with flat wire to protect the hose from damage while in use, but this protection has its limits. Few, if any, brands of hose will stand having machines thrown down on them, or withstand blasting.

NOILS have nothing to do with nails, being the short pieces and knots taken from the long staple of wool in the process of combing. They are used for felting purposes, or made into inferior yarns which are put into cloth to increase its thickness.

OREBODIES often change in character in depth. Some of the mines at Bingham, Utah, were originally worked for gold, later for copper, and are now yielding lead. At Leadville gold was first sought for, then the district became famous for its silver-lead production and now is an important producer of zinc.

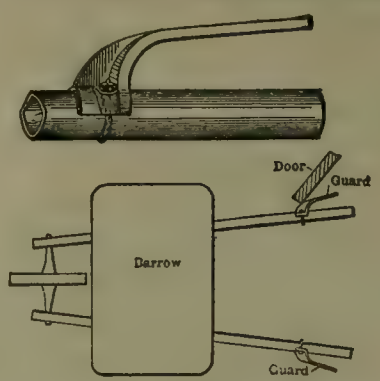
NUMBER of men employed in the world's mines and quarries exceeded 6,000,000 for the year 1909, according to a recent report of the British chief inspector of mines. The total number was probably nearer 8,000,000; since the English figures include for the United States only the coal miners and some of the metal miners. A few countries such as Bolivia with its tin mines, Brazil with its gem fields, China with its coal, iron, and tin mines, Turkey, and Persia are unrepresented in the statistics.

SMOKE is absolutely necessary in steel metallurgy. Any operation that removes the carbon will produce poor steel. If a smokeless flame is used, all the carbon is burned out and the surface of the steel is made rotten. English magistrates realize that smoke is essential to the manufacture of good steel and exempt metallurgical furnaces, but the question of mixed stacks is continually coming up to the annoyance of manufacturers. So far as health is concerned, the most mischief is caused by household smoke, yet it is usually ignored by the smoke inspectors. Strange as it may seem, some medical men have recently taken to recommending the smoky parts of Sheffield, England, for sufferers from asthma.

CO-OWNERS can be eliminated from a claim when they refuse to share the expense of development, but in 'advertising out' a co-owner, the demand can only be made for the co-owner's share of the work at the rate of $100 per claim. If more than $100 per claim was spent, the co-owner's refusal to contribute on a basis of more than $100 cannot be used, under the statute, to work a forfeiture of his rights in the claim. It appears that if a certain co-owner or co-owners have the work performed, any forfeited ownerships will inure to them solely, instead of being also apportioned among the other co-owners who may subsequently offer to pay their share toward the forfeited portions. If the demand is made by personal notice in writing, the delinquent has ninety days within which to respond and pay his portion. If the demand is made by publication for ninety days in the newspaper published nearest the claim, as should always be done if the delinquent cannot be readily found or reached, the delinquent has ninety days from expiration of period of publication within which to respond.

MONZONITE is a kind of eruptive rock that displays considerable mineralogical variation, but is usually considered a variety of augite-syenite. Brögger has applied the name to a transitional group of rocks between the granite-syenite series and the diorites. The true monzonites have both alkali feldspar and lime-soda feldspar in approximately equal amounts, or at least both richly. Numerous varieties, such as quartz-monzonite, are distinguished. The rock monzonite should not be confused with the mineral monazite, which is a phosphate of cerium, lanthanum, and didymium, but contains a number of other alkaline-earth elements, of which thorium is the most important, and from which it derives its value for the manufacture of mantles for incandescent gas burners.

DOORWAYS are sometimes narrow, with the result that the knuckles and back of a barrow wheeler's hands are forced against the door post. With a swinging door or one drawn shut by a weight, the blow against the exposed hand



comes with greater impact. This can be obviated by a knuckle guard, as shown in the accompanying figure taken from the *Journal of Industrial Safety*, that serves to receive the blow and protect the hand.

WHITE PIGMENTS which have zinc for a base, either in whole or in part, are four in number; namely, zinc oxide, leaded zinc oxide, zinc-lead oxide, and lithopone. All of these may be, and in the United States the first three usually are, made directly from ore. Zinc oxide is the most important of these pigments. In European practice the oxide is made from spelter, though in France zinc oxide is made from ore in the electrothermic furnace invented by Côte and Pierron. In the United States the oxide is generally made from ore, but in 1909, of the total production, 3255 tons was made from spelter. The production of zinc oxide made a large gain in 1909, being 68,974 short tons, as compared with 57,237 tons in 1908, an increase of over 20%, but not quite equaling the production of 1906 and 1907. The imports of zinc oxide in 1909 were 3327 short tons, and the exports for the same period were 14,846 tons. Leaded zinc oxide and zinc-lead oxide are produced from ore, both in some cases at the same plant, the zinc-lead containing somewhat the larger percentage of lead. The combined production of these two pigments in 1909 was 7655 short tons, as compared with 8430 tons in 1908. Lithopone is an intimate mixture by chemical precipitation of zinc sulphide and barium sulphate. It may be manufactured from spelter or zinc oxide, but in the United States it is now generally made from zinc skimmings, ashes, and scrap. The zinc content of the various zinc pigments made in the United States in 1909 from ore, both domestic and foreign, was 54,139 short tons, as compared with 48,004 tons zinc content in 1908 and 56,391 tons in 1907.

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EDITORIAL

ALASKA trails are opening unusually early this season. It is announced that river boats to Dawson from White Horse are to start May 10.

DEFEAT of the rebels at Tepic helps the Mexican situation a trifle. A few good battles would clear the air amazingly. The trouble is that the great majority of the Mexicans, while peaceable, are not like the Hoosier who would have peace "if he had to fight for it."

GROUND is being cleared at Observatory inlet in British Columbia for the power-house and smelter to be built this year by the Granby Consolidated Mining, Smelting & Power Company, Ltd., which by a fortunate purchase on the coast bids fair to renew its youth.

CLOSING of the Mammoth smelter at Kennett, California, is threatened by the farmers. The suit is of especial interest, since it raises the question of how far the bag-house solves smelter-fume troubles. If the farmers are able to show substantial damage under existing conditions, it means that metallurgists must frankly face the problem of neutralizing SO_2 fumes as well as giving protection against SO_3 and dust.

ACCORDING to the quarterly report of the Nevada Consolidated Copper Company, the production in January, February, and March amounted to 6,309,228, 4,888,790, and 6,380,432 pounds, respectively, making a total of 17,578,450 pounds of copper in three months. The ore milled amounted to 728,592 tons, averaging 1.85 per cent copper. These figures may be compared with interest with those for 1911, as given by Mr. Pope Yeatman.

TONOPAH is enjoying well deserved prosperity. The report of the Tonopah Belmont Mining & Development Company, summarized on another page, is a cheerful record of good work done and good prospects for the future. Reports of the Tonopah Mining Company and others of the companies operating in the district are equally satisfactory. Improvements in technology and the rise in the price of silver have helped the Tonopah companies, but back of these is the fact that the district is one of great and rich orebodies and, despite the unusual amount of faulting to which these have been subjected, the capable men in charge have learned how to find the ore economically.

SELLING of roofing plate by weight instead of by area is an improvement in trade practice which is to be commended. Under the former system unscrupulous sellers found it easy to substitute sheets of a lighter gauge than specified and escape detection, but where the weight is specified such a subterfuge is impossible. Changes in the metal industry are likely to result from the introduction of 'lohmannizing,' a process whereby lead is deposited on sheets and tubes of iron after a manner similar to sherardizing with zinc. The process is too new for all its excellences and defects to be known as yet, but it seems more likely to develop new uses for the new product rather than to restrict the market for tinplate.

MECHANICAL handling of ore at smelters is important and economical, not only because of the saving in labor, but because it permits accurate sampling and mixing—and the first essential to good furnace work is a regular feed. At Cananea mechanical devices have been introduced to an unusual extent, despite the fact that Mexico is one of the so-called cheap labor countries, and the plant has amply justified its designers and builders. To the original plant built by the Robins Conveying Belt Company for handling ore, has recently been added an extensive one, built by the Stephens-Adamson Manufacturing Company, for handling the concentrate from the Miami mill, now smelted at Cananea. We print this week an account of the whole system by Mr. M. J. Elsing, with views of the new part of the plant, furnished by Mr. Colby N. Avery. While the climate at Cananea permits out-of-door handling of material and thereby cheapens construction, the essential features of the system are widely applicable.

A FAVORABLE report has been made by the House Committee on Mines and Mining on the amended Raker bill for the establishment of a mining experiment station at Auburn, California. The bill has been changed so as to avoid the conflict with private ore-testing plants possible under the bill as first drawn. It is now proposed that the station shall be under charge of the Bureau of Mines and shall be empowered to do only those things which it is proposed the Bureau shall hereafter do. We believe it would be better to let the Bureau work where and when needed and not to tie up money in a local station with the inevitable demand for other local stations and the development of a pork-cutting contest—which indeed has already begun and received approval in the favorable report of the House Committee on the Taylor bill proposing a similar station at Silverton, Colorado. We are in favor of the proposed work, but the most effective argument for centring it at Auburn seems to be that Mr. Raker is the only Democratic congressman from California, and it would be better to postpone expansion of the investigations than to have them become the football of partisan politics.

GEOLOGY in its relation to ore deposits has received much attention in recent years, and since Emmons mapped the faults at Leadville, the value of the study of the structural geology of a district has been generally recognized. On another page Mr. C. A. Stewart draws from practice, instructive examples of the value of other phases of geological study. In a day when 'secondary enrichment' has become the stock word of the mining promoter, it is worth while to emphasize the limitations as well as the possibilities of the application of geological knowledge, and we join Mr. Stewart in urging that this is a field where a little knowledge may lead one far astray. Mining companies too often make the mistake of employing poorly trained men at first. When the deposit shows only as a prospect, while plans are being formulated that must control development of the whole property, then is the time when the most expert of assistance is needed. When the mine is developed and the vagaries of the particular deposit have been learned, a less able man can keep things going. Spend money freely as well as carefully at first, that you may save money from useless development. In a faulted region careful study by a trained geologist should prevent many mistakes in underground work, and neither drills nor drifts should be employed till the surface has been mapped; it affords the one complete ground plan that will ever be open to observation. In too many cases little or no use is made of this opportunity.

Prospectors and Buyers

Many claim-holders wonder why they are unable to interest buyers in their properties, and resent the fact that their proposals are rejected by engineers who have never been on the property, just as young authors stick a few pages of manuscript together to catch the editor who rejects without reading. As a matter of fact, engineers are amply justified in refusing to incur for themselves or clients the expense of an examination when the prospectus furnished by the prospector himself shows that the man who writes it does not know what he is talking about. We quote below a few paragraphs from a letter sent by an American prospector to an English financial house, whose name he had seen in a paper. He doubtless wonders why their consulting engineer refused to make a trip to the property despite his 'reasonable' terms. As to what he says: "I have no fancy price on it; if I retain an interest I will take $150,000, and will let you pay me out of the ores if I have a little to go on till sale." The district is one in which there are no profitable mines and in which repeated attempts to find ore have failed. The owner has merely undeveloped claims and in suggesting an 'interest' and $150,000 he shows himself entirely unfamiliar with mine valuation. He describes several veins. What he writes about two of them is sufficient to show that he knows as little about sampling as about valuing mines.

"No. 1," he says, "is gold and copper, being 300 to 600 ft. wide. Its course is N.E. to S.W. as all the other leads are; its surface is much leached and its values precipitated downward like most all large copper bodies are. Some quartz runs as high as 2½ oz. in gold and 84% in copper at, or near, the surface, still the erosion is so great it can be shoveled like ashes. It has all the colors of the rainbow—it cuts into about the middle of a large porphyry and lime mountain—the yellow porphyry is about a mile wide on the side of the mountain and pans gold—the top is capped with lime and great iron columns protrude through the porphyry and lime—at the base in the vein there is over 100 ft. solid red oxide of copper in width—the vein seems to be about 600 ft. wide. My lowest tunnel will cut this mountain about 500 ft. deep and follow the vein all the way and have pay quartz from the start; also have 6000 horse water power at the mouth of the tunnel, and this lead is continuous through the entire range and comes out on the opposite side in the vicinity of great coal fields and where water is abundant, making it a water and railroad proposition as well as mineral, having less than 2% grade to the tunnel, said tunnel being about 30 miles from the valley, and a railroad could follow the river all the way. There has been some grading for a railway line in that direction. Timber is abundant of all sizes, red and white spruce predominating. There are two tunnels each 40 ft. in length." Continuing, he says of No. 6 that it "is my last find, in September last—it is also a remarkable demonstration of nature, being to the best of my knowledge about 500 ft. wide where it outcrops about half way up the mountain which it cuts about the middle. At the base is iron quartz of immense bodies, and at the top of this porphyry and lime mountain are high needles like protruding out through the formation, several hundred feet high. Some of the quartz runs as high as $486 per ton, but much of it will be lower grade I expect. No work done except surface work—a tunnel at the base will cut 2000 to 3000 ft. deep on it."

This prospectus was referred to a busy and capable engineer, who is hardly likely to use his clients' money in searching for a lead 600 ft. wide and containing "100 ft. solid red oxide of copper." In other words, the writer

uses terms so carelessly as to make it clear that his observations are valueless. To sell a claim, a prospector must first have something of real value, and, second, present it in such terms that the buyer can see that his observations and statements are accurate.

Chinese Finance

It is natural that public opinion should regard the work of governmental reform in China as having been completed with the announcement of the establishment of a republic and the election of a president, but the real labor of the institution of a representative form of government has only just begun. With nations as with men, the problem of securing funds to meet obligations and finance undertakings is an urgent one; one, indeed, that is of critical importance to the infant Chinese republic. Much of China's trouble has grown out of a bad monetary, banking, and revenue system, which persists in spite of its defects because it is so difficult to change. Of the monetary system we shall say nothing; much space would be required to do justice to its faults, and banking may be similarly passed over, concentrating our attention on the revenue and liabilities of China. The revenue has heretofore been derived from a land tax, tribute, customs receipts, both native and foreign, salt gabelle, likin or transit tax, and miscellaneous taxes. Of this the foreign customs yield over one-third of the total, the land tax one-fourth, and the salt gabelle and the likin about one-eighth each. The expenditures are chiefly for payments on foreign loans and indemnities, one-third of the total; grants for provincial administration, one-fourth; army, navy, and fortifications, one-fifth; miscellaneous items serving to make up a total which usually exceeded the total revenue by nearly one-third, thus making necessary further foreign loans. The foreign debt of China in 1906 amounted to over $675,000,000, over one-half of which represented indemnities, while only $60,000,000 was in the form of railway loans. Since that time other railway loans have been incurred, as well as the Manchurian loan of $50,000,000, so that the new six-power loan of $300,000,000 will put the foreign debt of China well above the $1,000,000,000 mark. The interest charge upon this will approximate $45,000,000 (the loans bear differing rates of interest) and, following the former custom, will presumably be secured by the receipt of the foreign customs. These amount to less than $25,000,000 and represent over one-third of the national revenue. Since the army and navy and the administration of the provinces have heretofore absorbed about $36,000,000, and miscellaneous expenditures have required half as much more, it would seem as though China requires a business manager more urgently than a president.

The annual revenue of the United States is eight-tenths of its total debt; of Russia, more than one-fourth, and of Great Britain, one-fifth. China's present revenue amounts to only one-twentieth of its foreign debt, the bonds of the other countries named being largely held by their own citizens. How much the revenue of China can be increased is a difficult problem. The dues now imposed on foreign trade amount to 5 per cent *ad valorem*, and this can be increased somewhat, as provided in the treaties existing between China and the principal commercial nations, but not to any great extent, as the interested powers can scarcely be expected to look with favor upon taxing their trade to provide funds to meet the interest upon their loans. The likin, or transit tax, should be abolished, rather than increased; it is and always has been a clog upon the wheels of trade, offering infinite opportunity for oppression of the small merchant and for peculation by the tax gatherers. The salt gabelle is an economic anachronism; many countries have imposed such a tax in the primitive stages of their development, but have abolished them in the course of national progress. The people of China are, on the average, on almost the lowest level of poverty, and in addition large areas are now in the grip of famine, and it is scarcely possible that land and other internal taxes can be increased without plunging them deeper into the mire from which the national leaders are hoping to draw them. It is clear, then, that the nation's financial salvation must come from the increased receipts from the Government-owned enterprises, such as railways, telegraphs, and mines, supplemented by increased taxation upon foreign trade and the increased national prosperity which is expected to result from the development of the national resources. The courageous inception of the new form of government in China must be looked upon as the biggest politico-financial undertaking in all history. What its outcome will be it is impossible to prophesy. To successfully develop a new form of government under such a financial load is surely a super-task, calling for super-men. Has China super-men?

Denzaburo Fujita

Osaka advices report the death, March 30 at his home, of Baron Denzaburo Fujita, head of the Fujitagumi, one of the largest private companies in Japan. To mining men he is known especially for his connection with the Kosaka mine. This great property, as has been true of so many copper mines, was long worked in a small way for silver only, the oxidized ore being treated by the Augustin process. Below was a large body of copper ore containing 12 to 30 per cent barite and peculiarly difficult to treat. One of the younger engineers connected with the company, Mr. K. Takeda, became convinced that this ore could be smelted, and with the approval of Baron Fujita, came to America and studied smelting methods. On his return a pyrite smelting plant was erected and put in blast in 1897, and from that date progress at the mine has been rapid. A 60-foot furnace was built, and at the time it was the largest in the world. Open-cut methods of mining followed, and for some years the Kosaka was the largest copper mine in the Far East. Baron Fujita was born of poor parents under the old regime. He founded his house in 1869, and his remarkable success testifies not only to the opportunities of the last generation in Japan, but to the open-mindedness of the men who have led. It required courage of a high order to back Mr. Takeda in building furnaces to treat an ore that had baffled many experimenters. Another side of his character was shown when he gave an option on the Kosaka mine, his best property, in order to raise money for investment in government bonds at the time of the Japanese-Russian war. The bonds paid relatively small interest and the mine paid well, but the country needed the money. The mine, which was priced at $8,000,000, was examined by Messrs. N. B. Knox and John B. Farish and a deal was nearly concluded. Differences of opinion developed with the option holder as to his commission and the sale was not made. Fortunately for the owner, copper rose to such a price that he was able to hold the mine and still buy the bonds, and for his services in that connection the Emperor conferred the Second Class Order of the Rising Sun. On the occasion of the recent visit of American Mining Engineers to Osaka, Baron Fujita tendered them an elaborate luncheon and extended many individual courtesies. One of the first to rally to the defense of the Emperor in his contest with the shogun, he became one of the leaders of New Japan, and his death will be felt as a loss abroad as well as at home.

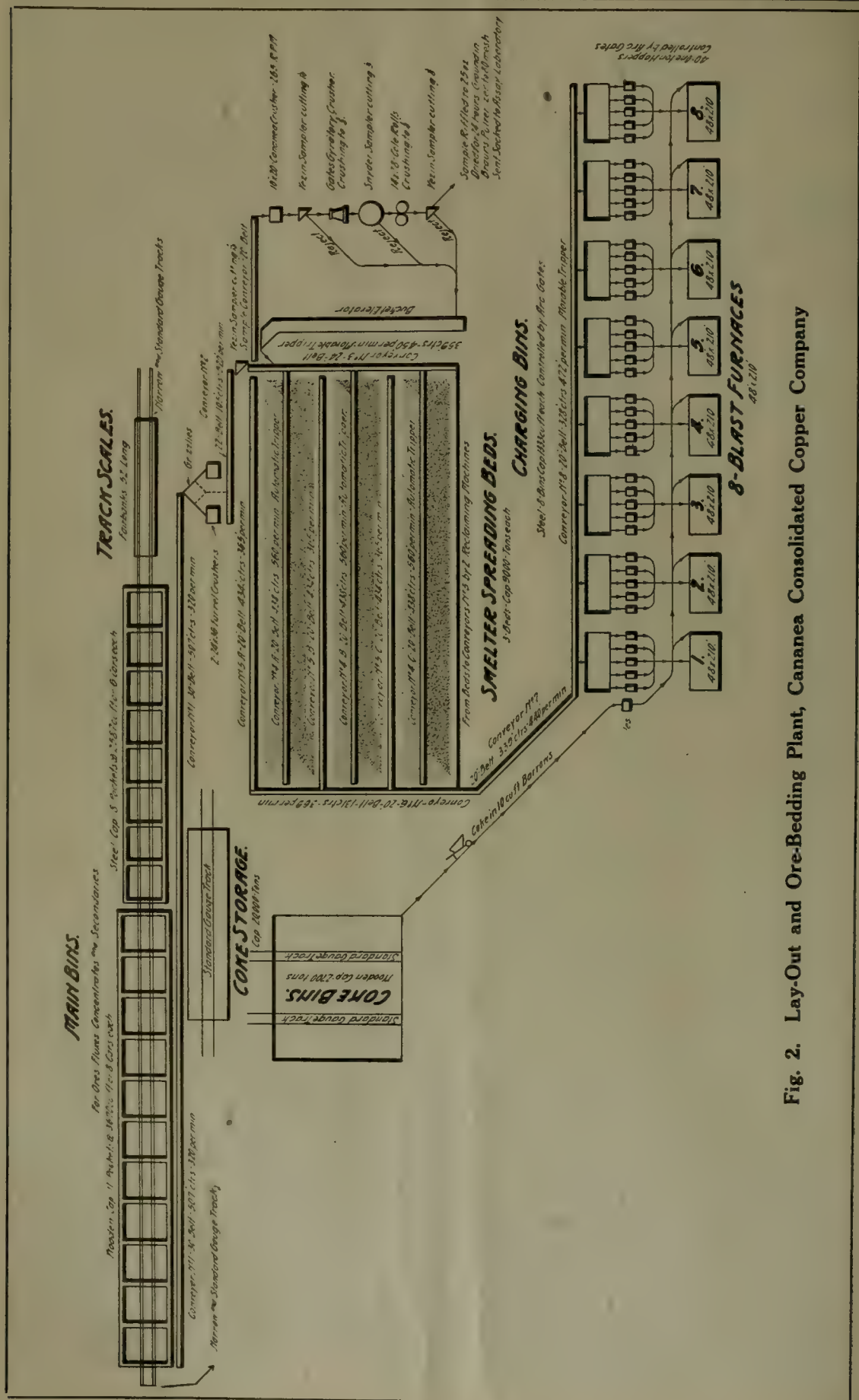


Fig. 2. Lay-Out and Ore-Bedding Plant, Cananea Consolidated Copper Company

Handling Furnace Charges at Cananea

By Morris Jesup Elsing

The methods of handling furnace charges at the smelting plant of the Greene-Cananea Copper Co., Cananea, Sonora, Mexico, involves many unique features. Under the management of Arthur S. Dwight, with the assistance of E. H. Messiter, consulting engineer for the Robins Conveying Belt Co., there are a series of belt conveyors and mechanical devices designed and constructed for mixing the blast-furnace charge and delivering it to the furnace. Several parts of the original construction have been replaced because of difficulty found in operating, and the installation is now working with great success. A diagrammatic 'flow-sheet' shown on the opposite page illustrates the following description, and shows details of the bins through a steel chute which is provided with an arc gate. In order to assist the steady feeding of this wet material, an attendant is stationed at the chute with a compressed-air barring device. This device consists of a piece of 1-in. pipe about 6 ft. long to which is attached a short piece of tapered pipe with a $\frac{1}{4}$-in. opening in the end. A compressed-air hose and valve is attached to the other end of the 6-ft. length. When compressed air is turned on, this device becomes a very sufficient means of barring down material that otherwise 'hangs up.' The different classes of ores, such as heavy sulphide ore, limestone ore, and the silicious ores are kept in separate bins as well as the by-products that are smelted in the blast-furnace.

Fig. 1. General view of smelting plant, Greene-Cananea Copper Co.

capacity. The 'flow-sheet' of the sampling works is also included.

In outline the plant as it stands today consists of a series of eleven receiving bins, constructed of wood, for ore and secondaries, and eight steel bins for concentrate and picked ore. These bins are filled by trains from the mines and concentrator, after each car has been weighed on a Fairbanks scale. The bins are equipped with automatic feeding devices that feed into a hopper and to a belt conveyor, which transports the material to the sampling works, where it is automatically sampled.

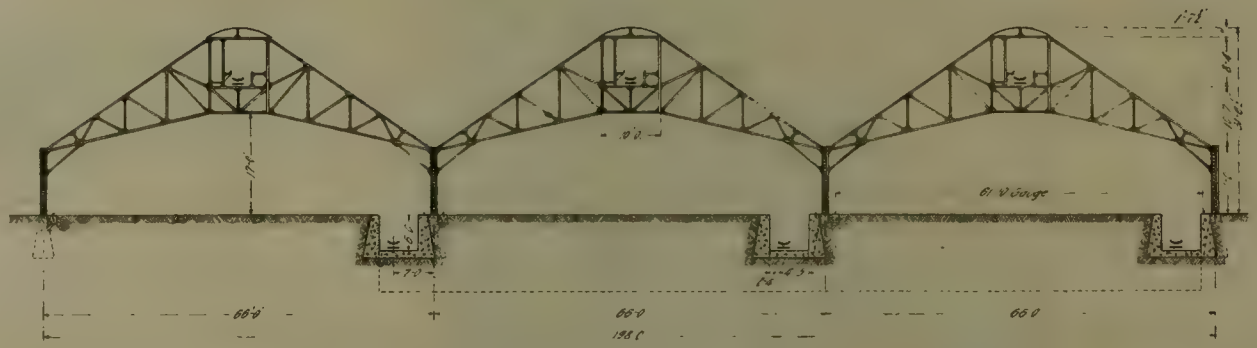
The feeding device attached to the wooden bins consists of a steel table suspended by four rods at the bottom of the bins. This steel table is given a reciprocating movement by a connecting-rod attached to an eccentric placed at the back of the bins. This eccentric is attached to a shafting, which runs the entire length of the wooden bins. Each of these bins has four of these feeding devices. The ore feeds into a movable steel hopper, which breaks its fall upon the belt. The picked ore from the steel bins is fed upon the belt by a shaker feed-car, which is a hopper mounted on a carriage astride of the conveyor. This hopper has a table below its discharge opening, which is given a reciprocating motion feeding the material on the belt at the desired rate, which is controlled by certain adjustments.

The concentrate is fed upon the belt from the bottom of

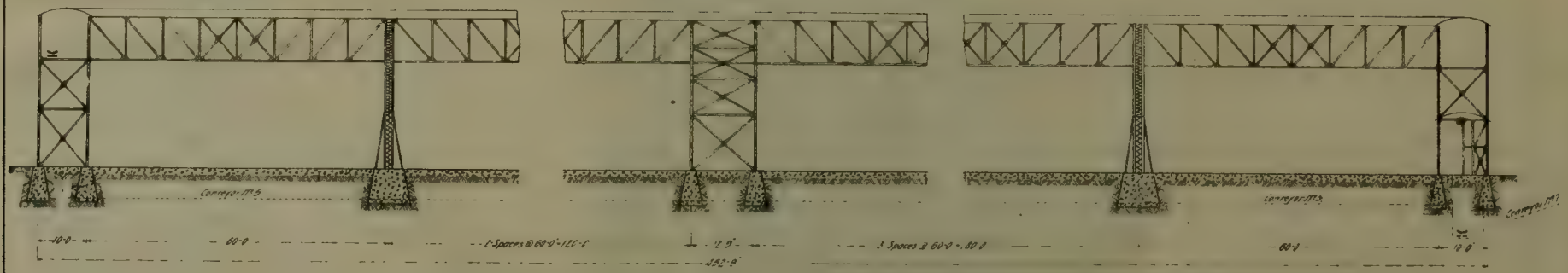
From the sampling works the material is conveyed to one of three parallel belts, which are supported on steel bridges about 20 ft. above a concrete floor (see Fig. 3). By means of Robins Conveying Belt Co.'s automatic trippers, a long narrow pile or bed is built up in successive layers. The tripper is a carriage astride of the conveyor belt, through which the belt passes. The direction of travel is determined by certain fixed brakes and traction wheels, which are reversed on reaching the end of the conveyor. In this way a continuous stream of ore is spread on the floor below the traveling tripper. The receiving bins containing known tonnages of material, whose approximate analysis is already known, are in turn emptied on the bed. From the sample taken as the ore passes through the mill, the exact amount of each constituent of the charge is determined, and as the bed nears completion, such materials are added to make it the self-fluxing mixture that is desired.

Reclamation

The reclamation of this bed of self-fluxing material is accomplished by a device known as the reclaimer, which was especially designed for this work. It consists of a traveling steel bridge or framework, which spans the entire width of the bed, and is mounted on car wheels and rides on rails. Under the forward side of the bridge is suspended a scraper conveyor, operating on a nearly horizontal steel



Section of Ore-Bedding Plant



Side Elevation of Ore-Bedding Plant, Cananea Consolidated Copper Company

Fig. 3

bottom plate. The flights are inclined to the axis of the conveyor, and are provided with plough-shaped extensions, which draw on to the bottom plate all material within reach, and carry it along to a conveyor paralleling the bed, and placed in a trench a little below the elevation of the floor of the bed (see Fig. 4). A triangular harrow covering the entire cross-section of the bed, and given an inclination of approximately the angle of repose of the material, is mounted on the front of the machine. The harrow is given a reciprocating motion cross-wise to a pile, which dislodges the material in a continuous manner from all parts of the face of the bed, and causes it to roll down to the conveyor below, by which it is carried away as described.

An electric motor operates the harrow and scraper conveyor while a smaller motor advances the machine into the

two fold and may be divided into mechanical cost and metallurgical cost. The mechanical cost has been reduced by the elimination, so far as possible, of manual labor, and its replacement by the use of the mechanical devices described. The metallurgical reduction is due to the uniformity in the chemical composition and the physical character of the charge, and to advance information on these subjects.

It is evident that a given amount of ore will not often make an even number of layers on the bed, and, therefore, there will be an overlapping of layers. When the bed is completed it contains about 9000 tons or about 40,000 lb. per linear foot. With each overlap, roughly 50 lb. per foot has been added, and the result is that any particular foot may receive 1 800 more or less of a certain flux or ore than some other foot. This overlap will not constantly occur

CONVEYOR LEADING TO BEDDING CONVEYOR.
STACKING AND RECLAIMING CONVEYORS.

BEDDING TRIPPER.
RECLAIMING SYSTEM, CONVEYOR No. 7 AT THE LEFT.

FIG. 4. MECHANICAL PLANT FOR HANDLING CONCENTRATE (Stephens-Adamson construction).

pile at any desired rate, or runs it back to the end of the bed, where it is transferred to the next bed by a transfer car. The thoroughly mixed charge then passes to the other belt conveyors, being elevated and finally discharged directly into narrow steel storage bins of 75 tons capacity above each blast-furnace. These bins feed steel pockets containing about one ton each, which are partly emptied into the furnace, and partly on the feeding floor by the simple operation of a chute and deflecting gate. The coke is brought to the furnace is wheelbarrows. The whole system of conveying and reclaiming is controlled by a series of signals so that each operator of any part is notified when to commence operations or of any stopping or over-load, thus unifying the whole system.

ADVANTAGES

Among the advantages due to this method of mixing and delivering the furnace charge the reduction of the cost of smelting is the most important. This reduction of cost is

at any one place in the bed, but it will be compensating. It will apply to all of the different materials added to the bed and the final outcome will be only infinitesimal variation in the analysis of any transverse section of the bed. The thorough mixing of the charge by the reclaiming machine is self-evident. Its advance into the bed is approximately an inch per minute, so that only a small quantity is being taken from every part of the cross-section. The inclination of the harrow being adjustable, makes it possible to set it at an angle so that material being agitated by it will roll down from every part of the pile and be combined on the bottom plate.

Due to the elimination of the variation in the composition of the charge, it is possible to operate the furnace with a lower factor of safety. In nearly every other method of charging there is a constant variation in conditions; that is, at one time the slag being produced is more acid, and at another more basic than desired. Due to this constant change, it becomes necessary not only to add fluxes to counteract

these differences and restore equilibrium, but to use an excessive amount of coke, and the outcome is that costs increase. With this careful mixture of charge, however, the analyses of the slags obtained can be predicted with extreme accuracy. With a given mixture they will show little variation from day to day, and the costs are brought down to a minimum. Other conditions being equal, accretions can in part be traced more or less directly to variation in the composition of the charge.

To summarize, with an exact knowledge of the composition and physical character of the furnace charge it has been possible to increase the speed of smelting, to reduce excessive accretions in the furnace, to reduce the amount of costly fluxes, coke, and air-blast required, and it has been possible also to increase the percentage of fine in the charge.

Roaster Bedding Plant

A system somewhat similar to that in use for the blast-furnace charge has recently been installed by the Stephens-Adamson Manufacturing Co. for handling the concentrate that is roasted, and then sent to the reverberatory furnaces. The concentrate is emptied from the standard railroad cars that come from the mill into especially designed bins. From the bins it is transported by belt conveyors to a bridge below which a bed is formed by a traveling tripper. The reclamation of the bedded concentrate is accomplished by means of a transverse belt conveyor, mounted upon a movable carriage. The roaster charge is then shoveled upon this transverse belt, which discharges into a longitudinal belt, and is conveyed to the roaster bins where it is fed to the roasters as required.

Geology in the Examination of Prospects

By C. A. Stewart

That accurate knowledge of the geology of an ore deposit is essential to proper mining and development, is generally recognized. Many of the large mining companies now employ a force of geologists to keep careful records of the underground geology, and smaller companies, that do not require the services of specialists the year around, are accustomed to have geological examinations of their properties made from time to time as new developments show the need. In most cases, however, this work is done only by companies that have producing mines. It is the purpose of this article to point out ways in which geological work can be of value even when the property is little more than a prospect. As a matter of fact, examination of prospects is in large part geology. Engineering training is necessary to determine whether or not the ore can be mined, and its metals extracted at a profit, for such a determination requires a knowledge of mining and metallurgical methods and their costs. But the possibilities of the extent of the orebody, its probable changes in shape and mineral character in depth, are matters of geology and matters involving detailed study and not the rule-of-thumb methods often used.

Classification of the Deposit

It is often entirely possible, even from surface showings, to refer an ore deposit to one of several classes based upon origin, and from this classification to tell much of its probable shape and relationship to the country rocks. It would require a whole treatise on economic geology to discuss all known classes of ore deposits, but for purposes of illustration four types may be considered that are most often met in the West, namely, fissure veins, contact-metamorphic deposits, irregular replacements not contact-metamorphic, and impregnations.

Fissure Veins.—Deposits of this type are widespread and easily recognized, and there is no need of defining them or of pointing out their usual characteristics in depth. Because true fissure veins are so common many orebodies are put in this class that do not belong there, and I have seen many instances of adits and cross-cuts driven to intersect the 'vein' in depth which never met the ore—not because it was 'faulted out', but because it was not a vein. In true vein deposits it is important to distinguish between those which are the result of filling open fissures and those which are the result of replacement of the wall-rocks along narrow cracks which themselves would not be wide enough to furnish workable orebodies. The changes which may be expected when a vein of the first type (open-fissure filling) passes from one rock formation to another are those dependent upon the kind of resistance the different rocks offer to forces of fissuring. Homogeneous rocks, like the igneous rocks and massively-bedded sediments, are likely to give wide, well defined fissures; shaly and schistose rocks, on the other hand, often cause the fissure to split up into small cracks so that an orebody that is a sharply defined vein in a granite or a sandstone may change to a mass of small stringers on passing into a shale, schist, or slate, and the reverse. Veins of the second class (replacement veins) generally vary in width with the solubility of the wall-rock. Such veins may be mere stringers in granite or quartzite and widen out into rich bonanzas where they cut more soluble rocks, such as limestone. Igneous rocks with an abundance of the dark silicates (hornblende, augite, and biotite) are more favorable to replacement than the light-colored granites. The two processes of vein formation may have been at work in different parts of the same vein, while in other cases no replacement may be shown, and the vein may be a true fissure filling throughout, and its value depend entirely upon the size of the original crevice. For this reason, no man, no matter how expert a geologist, can absolutely predict the action of veins with depth. A geologist can never be a substitute for the prospecting shaft, but he can ascertain the nature of the underlying rocks from the geology of the surrounding country, point out the probabilities, and thus prevent the building of too elaborate 'air castles' or the premature abandoning of a good possibility. Moreover, when prospecting has once revealed a change in vein character, he can see its significance and make important predictions from it.

Contact-Metamorphic Deposits.—Ore deposits of this class are found at the contact of igneous and sedimentary rocks, and have as gangue minerals garnet, epidote, pyroxene, wollastonite, and rarer contact-metamorphic silicates. Their position and characteristic gangue minerals make them easily recognizable, but because their outcrops are sometimes linear in extent, they may be mistaken for veins, and serious mistakes in exploration thus result. Contact-metamorphic ores are most often irregular in shape—bunches, pockets, and lens-shaped masses from a few feet to many hundreds of feet in dimensions. They usually hold close to the contact, and follow its numerous windings. Limestone is the most favorable country rock, although ores in other rocks are known. A careful study of deposits of this class makes necessary a subdivision into two classes, which act differently.[1] Thorough exploration of these ores must be based upon a geological map that will show the igneous-sedimentary contact, and the position of the several sediments. To make such a map is often a difficult matter, for excessive metamorphism in the district may produce rocks that are hard to classify. I have in mind a district in which the contact character of the ore was recognized, and an attempt made to direct prospecting along the contact. The engineers were misled, however, into taking a puzzling metamorphic rock for a porphyry, and drove hundreds of feet along it until a man better versed in geology pointed out their mistake.

Irregular Replacements Not Contact-Metamorphic.—Under this head are included orebodies not apparently related to fissures or to igneous contacts, and formed by replacement of the wall rocks. The deposits of Leadville are among the most famous of this class. The ores may show all the irregularities of the contact-metamorphic ores and present greater difficulties to exploration because there is no contact line to serve as a guide. Their shape and

[1] C. A. Stewart, *Eng. and Min. Jour.*, Sept. 10, 1910.

location is, however, usually dependent upon some geologic structure that a careful study will make clear. A detailed study of these factors has recently been published,[2] so a brief reference to the more important is sufficient. Replacement bodies are often found along lines of fracture that because of insignificant size and lack of ore pass unnoticed. When such a condition is recognized, it is possible to locate these lines of fracture, and to conduct underground exploration along them with good results. At other times the replacement occurs along the contact of the ore-bearing formation and an impervious rock, which has dammed up the ore solutions and thus caused them to deposit their minerals. In general, limestones are the rocks most often containing replacement deposits, but certain beds, either because of greater porosity or greater purity, may be more favorable than others of the same formation. The recognition of the factors of importance in any one district is a matter for geological investigation. Even when these factors are recognized, the work is not completed, for careful mapping of fissure systems, impervious strata, or favorable limestone beds is necessary to furnish a guide for exploration.

Impregnations.—By impregnations or disseminated deposits are meant those in which ore occurs in minute quantities scattered throughout great masses of rock. In this class are the 'porphyry coppers' that have attracted such great attention at Bingham, Utah; Ely, Nevada; in Arizona; and New Mexico. These ores are usually of value only when secondary enrichment has taken place. In the case of the copper ores at the surface, a capping of leached and more or less decomposed rock is found that may extend from fifty to several hundred feet in depth. Underneath this is a zone of secondary enriched ore that gives place to very poor, usually unworkable, sulphides. Even the richest part of these ores is usually so lean that it must be worked on a large scale, and extensive blocking out of the deposit by drilling or underground work must precede mining. The function of the geologist in these cases is to look for zones of fissuring that may have influenced the concentration of the ore, or that may affect mining, and to keep track of changes in depth and shape of the secondary zone, and to predict from these what may reasonably be expected in the future.

Among other types of ore that act in characteristic ways are magmatic segregations, bedded deposits, and lenticular deposits in schists and gneisses.

Secondary Enrichment

It was not many years ago that miners rejoiced in the optimistic belief that every 'true fissure vein' grew richer in depth. This has given place to the modern conception of secondary enrichment which teaches that an orebody typically shows three zones, an upper or oxidized zone, followed by a rich zone of secondary sulphides, which gives place to leaner primary sulphides in depth. Many prophecies as to change of ores with depth are based upon the false assumption that this simple rule holds for all deposits. As a matter of fact, so many exceptions enter into the question that only careful study of every deposit will give a clue to what is actually the case. W. H. Emmons has recently shown that gold deposits act in different ways in regard to secondary enrichment, depending upon the presence or absence of manganese.[3] D. C. Bard has called attention to the fact that veins with calcite gangue often show high content in the oxide zone and have no secondary sulphides.[4] Even this last generalization has exceptions that make it dangerous to apply it blindly to all deposits.

In general, the extent in depth and the richness of secondary sulphides are dependent upon the amount of ore leached from the oxidized zone. It is therefore important to know how much of the oxidized zone may have been eroded in any particular case. I have heard of an engineer boldly prophesying that the secondary sulphide zone of a certain property could not be of appreciable extent, because there was above it only a comparatively few feet of leached vein from which secondary ore could have been derived. He neglected entirely the possibility of hundreds of feet of leached vein-matter having been eroded.

Sulphide ores are sometimes found at or near the surface. It is then important to know to what extent they are primary ores, for the primary ores are likely to hold unchanged for much greater depths than secondary deposits. The methods of recognizing secondary enrichment have been best summarized by F. L. Ransome.[5] Probably the most satisfactory method of investigation of this point is microscopic study of polished specimens of the ores, which often enables us to distinguish between primary sulphides and those formed by secondary deposition. There is an instance of a European mining company which was in doubt as to the advisability of proceeding with deep development on its sulphide ores. If the sulphides were secondary, the extent in depth was unlikely to warrant further work in such an inaccessible district; if they were primary, they probably represented such reserves in depth that a profitable mine was assured. The question was settled by sending specimens of the ore to an American geologist, who found by microscopic study that there was no sign of secondary deposition of sulphides.

In general it may be said that nowhere is the truth of the danger of a 'little learning' better shown than in the mistaken prophecies made by men who have only a superficial knowledge of secondary enrichment. This process, like all others involved in ore deposition, varies in its nature with local conditions. The texture and mineral content of the ore and wall rocks, the nature of the fissuring, and the geologic and physiographic history of the whole region are involved. The great importance of knowing whether the upper portion of an ore deposit is poorer or richer than the lower makes it well worth while to give considerable attention to local geology during the early stages of mining.

Miscellaneous Considerations

Geological work may be of value in a variety of ways not mentioned above, and often in ways that the wisest engineer cannot foresee. An understanding of the relative age of the ore deposits and the igneous rocks is sometimes of importance, and may be deduced in an indirect way, as is illustrated by the following case.

In the case supposed the ore veins occur in a series of sediments that are cut by dikes and sheets of diabase, and also by stocks of granite. The question at once arises as to chance of the veins extending through the diabase. Comparison with neighboring districts shows that the mineralization is most probably the result of the granite intrusion, and examination of the district itself establishes the fact that the diabase cuts the granite and is distinctly younger than it. The diabase intrusions, therefore, may be expected to cut the veins, and not be cut by them, and claims underlain by great masses of diabase are less promising than those in which sediments predominate. The above conclusion is not as theoretical as it may seem, for economic geology has succeeded in establishing the ore-forming importance of certain intrusions and the barren character of others. In Arizona, for instance, most of the important copper deposits are connected with post-Paleozoic granites, and it is therefore reasonable to expect all formations younger than these granites to be found to be barren.

The value of geology in solving fault problems when the ore is cut off is well known, but it is customary to wait until the fault is intersected in the underground workings before paying any attention to it. In many cases a few days study of the surface geology will show the existence of faults, which from their strike and dip are likely to intersect and displace the orebody. With this in mind, the exploratory work can often be more wisely directed, and the discouragement of finding the ore unexpectedly cut off avoided.

[2] J. D. Irving, *Econ. Geol.*, V, pp. 527-562, 619-669, 1912; 'Types of Ore Deposits,' pp. 220-298.

[3] *Mining and Scientific Press*, XCIX, pp. 782-787, 1909.

[4] *Econ. Geol.*, V, pp. 56-60, 1910.

[5] *Econ. Geol.*, V, pp. 205-220, 1910.

Report of the Tonopah Belmont Development Company

The results of operations in the mines of this company, which is capitalized for $1,500,000 in shares of $1 each, for the fiscal year ended February 29, 1912, are shown by the following financial and statistical statements from the report of the president, Clyde A. Heller.

The net earnings of both mine and mill during the fiscal year were $1,802,080.85, as compared with $1,502,381.36. The operating expenses of the mine for the fiscal year, compared with the previous three years, were as follows:

	1912.	1911.	1910.	1909.
Mining expenses	$377,585.25	$322,766.41	$177,784.93	$174,761.34
Depreciation of mining equipment	15,028.44	15,028.44	15,028.44	15,028.44
Development work	167,832.37	160,369.60	94,672.30	107,427.93
Totals	$560,446.00	$498,164.45	$287,485.67	$297,217.71
Dry tons of ore mined	115,563	81,066	36,930	37,994
Cost per ton, including depreciation and development	$4.85	$6.14½	$7.78 4/10	$7.81½
Tons of ore and waste mined	188,988	97,304	69,160	77,234

	1911 March	April	May	June	July	August	September	October	November	December	January	February	Totals	Per Ton
DEVELOPMENT DIRECT														
Miners	$4,271 10	$4,169 70	$3,915 77	$3,578 26	$3,940 41	$4,015 94	$4,391 49	$6,232 37	$5,005 27	$5,835 16	$6,883 34	$5,300 58	$54,739 38	.474
Muckers and Trammers	1,167 95	1,857 53	1,576 30	1,979 47	2,317 74	1,746 23	1,414 54	2,409 66	2,078 29	2,307 42	3,372 05	3,435 50	25,663 01	222
Timbermen and Helpers	538 69	811 77	881 88	1,005 41	724 86	549 38	749 60	569 69	1,611 51	826 18	800 47	680 31	9,737.77	084
STOPING DIRECT														
Miners	[illegible]	4,056 02	3,883 40	3,903 42	3,576 68	4,822 90	4,991 03	3,690 32	5,244 63	4,852 12	3,774 07	4,136 13	51,450 69	445
Shovelers	3,410 05	2,451 04	3,094 15	2,772 45	3,543 74	4,012,94	2,970 61	3,549 76	3,603 91	3,721 77	2,776 95	3,110 81	39,175 17	339
Trammers	2,424 47	1,577 01	[illegible]	2,841 59	2,444 45	1,647 59	1,217 40	1,029 64	1,013 54	1,046 48	1,201 12	1,190 54	22,196 61.	192
Timbermen and Helpers	[illegible]	[illegible]	[illegible]	9,004 69	11,053 83	9,756 73	9,295 97	9,316 95	8,635 21	7,789 68	8,235 82	7,841 89	112,994 39	978
Filling			186 01	189 00	439 27	419 49	516 77	511 11	577 74	802 66	704 77	518 70	4,895 52	042
Piston Drills—Reprs & Maint	182 58	259 51	[illegible]	707 99	325 56	180 11	289 81	207 29	641 49	1,891 11	311 07	356 17	5,809 69	030
Stoping " "	316 73	872 21	168 54	165 53	126 86	104 73	238 09	213 08	210 59	202 68	175 67	[illegible]	3,389 78	029
Steel and Sharpening	561 40	[illegible]	621 23	430 70	674 56	511 23	609 45	747 41	662 15	722 18	680 07	682 65	8,158 35	071
Explosives	1,917 16	[illegible]	[illegible]	2,429 71	3,260 45	3,030 65	2,958 20	3,347 48	2,915 40	3,168 21	3,232 00	3,064 86	33,096 33	286
Hoisting to Surface	3,020 40	2,502 33	3,456.35	2,643.96	2,861 02	2,440 64	2,644 58	3,259 07	2,486 96	2,807 84	3,614 49	3,311 85	35,711 59	309
Auxiliary Hoisting	892 51	1,028 08	2,211 26	1,112 01	567 07	226.23	392 74	630 35	937 42	943 81	925 94	958 27	10,847 99	094
Ore Sorting and Loading	2,449 04	2,503 11	2,662 68	2,887 42	2,019 96	2,699 01	3,238 42	3,047 04	2,299 23	2,571 70	2,446 40	2,167 81	31,592 00	273
Sampling and Assaying	211 00	482 12	356 80	621 91	575 57	577 05	321 93	385 30	421 79	501.17	414 71	388 24	5,457 98	.047
Surveying	465 81	562 71	672 89	500 07	570 03	524 74	472 08	528 40	516 54	514 85	539 73	554 02	6,481 87	056
Superintendent and Shift Bosses	[illegible]	[illegible]	1,225 00	1,250 63	[illegible]	1,415.00	1,625 00	1,437 85	1,325 35	1,247 75	1,298 15	1,244 95	15,801 66	137
Mine Office	[illegible]	1,515 16	1,136 78	1,189 08	1,223 15	1,247 48	1,222 13	1,139 90	1,319 15	1,227 72	1,307 05	1,158 57	14,926 56	.129
Surface and Plant	1,708 71	1,888 71	1,900 17	1,338 09	1,242 07	2,128 57	1,249 36	1,670 44	1,595 24	1,321 05	1,602 19	1,087 38	18,731 07	162
Lighting	645 26	[illegible]	369 15	224.51	[illegible]	409 02	316 86	403 45	482 83	582 82	424 53	442 99	5,313 64	.046
Heating	908 42	412 55	426 61	139 25	153.61	[illegible]	[illegible]	126 06	506 23	801 01	591 46	531 86	4,609 16	041
Drayage	489 75	511 22	760 75	599 40	638 32	967 52	687 39	564 15	542 23	413 43	553 23	207 58	6,956 97	.061
Maint & Reprs of Buildings	452 60	191 73	316 47	111 51	232 82	381 22	58 89	98 56	246 40	385 66	271 31	242 45	2,909 62	.025
" Mach & Mach Tools	4 26	400 75	613 86	217 57	165 64	258.41	200 07	152 96	181 06	207 14	110.40	122 15	2,624 27	023
" Pipe Lines & Tanks	298 26	184 69	220 13	94 02	116.87	9 88	60 70	151 78	206 74	252 06	171 76	135 61	1,902 40	.016
" Railroad Spurs	134 58	332 08	133 58	51 97	218 59		38 69	28 04					937 53	.008
" Pole Lines		16 74	23 96	166 25				4.85	11 98	14 17	1 82	2 22	241 99	002
Pumping			4.70	95 81		381 60	833 36	1,042 48	1,294 78	994 41	1,105 98	1,224,87	7,068.30	.062
Ventilation							442 96	465 88	288 13	335 90	187 38	275 07	1,095 32	017
TOTAL COST DIRECT MINING	$42,914.95	$45,636 11	$46,794 97	$42,309 00	$45,210 22	$43,878 69	$44,004 22	$46,901 41	$46,864 79	$49,308 14	$47,802 83	$44,772 20	$545,417 62	4 720
Administration	$767 92	$708 95	$702 43	$802 15	$544 52	$586 86	$820 89	$584 19	$582 61	$929 85	$115 85	$721 34	$7,867 56	068
Taxes and Insurance	572 32	647 91	578 85	616 43	654 16	567 20	588 13	609 19	1,382 53	1,415 00	1,493 96	1,210,64	10,336 32	.089
Legal and Traveling Expense	25 00	800 00	258 00	775 72	200 00	283 90	421 90	321 60	275 00	294 10	322 80	495 10	4,458 12	.039
Bullion Tax	2,500 00	4,600 00	4,000 00	3,244 24	3,138 73	3,598 46	2,547 98	5,321 49	4,042 70	800 54	3,012 19	4,548 35	40,954 68	354
Depreciation	1,252 37	1,252 37	1,252 37	1,252 37	1,252 37	1,252 37	1,252 37	1,252 37	1,252 37	1,252 37	1,252 37	1,252 37	15,028.44	130
Rescue	2,800 15	985 10				332 52	362 31	6 75					4,487 03	.039
TOTAL COST INDIRECT MINING	$7,917 76	$7,094 11	$6,771 65	$6,690 91	$5,789 78	$6,621 31	$5,995 78	$8,008 59	$8,135 21	$4,691 86	$6,197 17	$8,227 80	$83,132.15	719
TOTAL OPERATING	$50,832 71	$53,650 44	$53,566.62	$49,000 00	$51,000 00	$50,500 00	$50,000 00	$55,000 00	$55,000 00	$54,000 00	$54,000 00	$53,000 00	$628,549.77	5 439

DETAILED MONTHLY COSTS OF MINING, TONOPAH BELMONT.

The average actual extraction at the mill during the past year was 92.54% of the gross content, as compared with 89.4% in 1911, 89.9% in 1910, and 86.2% in 1909. The average value of the ore produced during the year, as compared with the previous two years, is as follows:

	1912.	1911.	1910.
Tons shipped to mill	87,952	59,159	29,898
Average gross value per ton	$20.84	$27.58	$14.40
Tons shipped to smelters	27,611	21,907	7,032
Average gross value per ton	$61.35	$54.76	$34.89
Total production (dry tons)	115,563	81,066	36,930
Average gross value per ton	$30.51	$34.93	$17.99

The sales of ore, bullion, concentrate, etc., for the year were divided as follows:

Gold, 45,069 oz., sold for $19.68 per oz.	$ 886,971.47
Silver, 4,535,762 oz., sold for 52½c. per oz.	2,381,542.54
	$3,268,514.01
Less treatment charges, assaying, freight, and express	387,337.26
Total receipts	$2,881,176.75

The operating expenses of the Belmont mill, including indirect expenses (but not depreciation) for the fiscal year were $293,840.13, as compared with $239,568.95 for the previous year. The cost per dry ton milled, including indirect expenses (but not depreciation), compared with the previous three years was as follows:

	Dry Tons of Ore Milled.	Cost per Dry Ton Milled.
1912	87,349	$3.36 4/10
1911 (10 months)	58,624	4.08 6/10
1910 (8 months)	37,166*	4.05 7/10
1909	61,929	4.37 9/10

*Includes custom ore.

During the year the capital stock of the company was reduced from 2,000,000 shares to 1,500,000 shares, par value $1 per share, and the 500,000 shares of the stock of the company in the hands of a trustee for the benefit of the treasury were canceled. The company's investment in stock of the Southern Nevada Abstract Co. was sold at a profit of $1200. The increase in administration expenses over the previous year was caused principally by the increase in taxes paid during last year (which increase alone amounted to $13,166.49), most of which is due to the United States internal revenue excise tax.

The project of a new cyanide mill at the mine, to take the place of the old mill at Millers, was authorized in June 1911, when it had become evident that the ore reserves fully warranted this large item of new construction. Ground for the new plant was broken in July, and by the end of that month the work of excavating was well under way. At the present writing the construction work, as described by Frederick Bradshaw, general superintendent, is progressing according to schedule, and, without interruption by bad weather, unforeseen accidents or delays, the plant should be in operation by June 15. The cyanidation of ores has been improved wonderfully in the five years since the construction of the mill at Millers, and an extended experience with Belmont ores at the old mill has shown the best metallurgical practice to be fol-

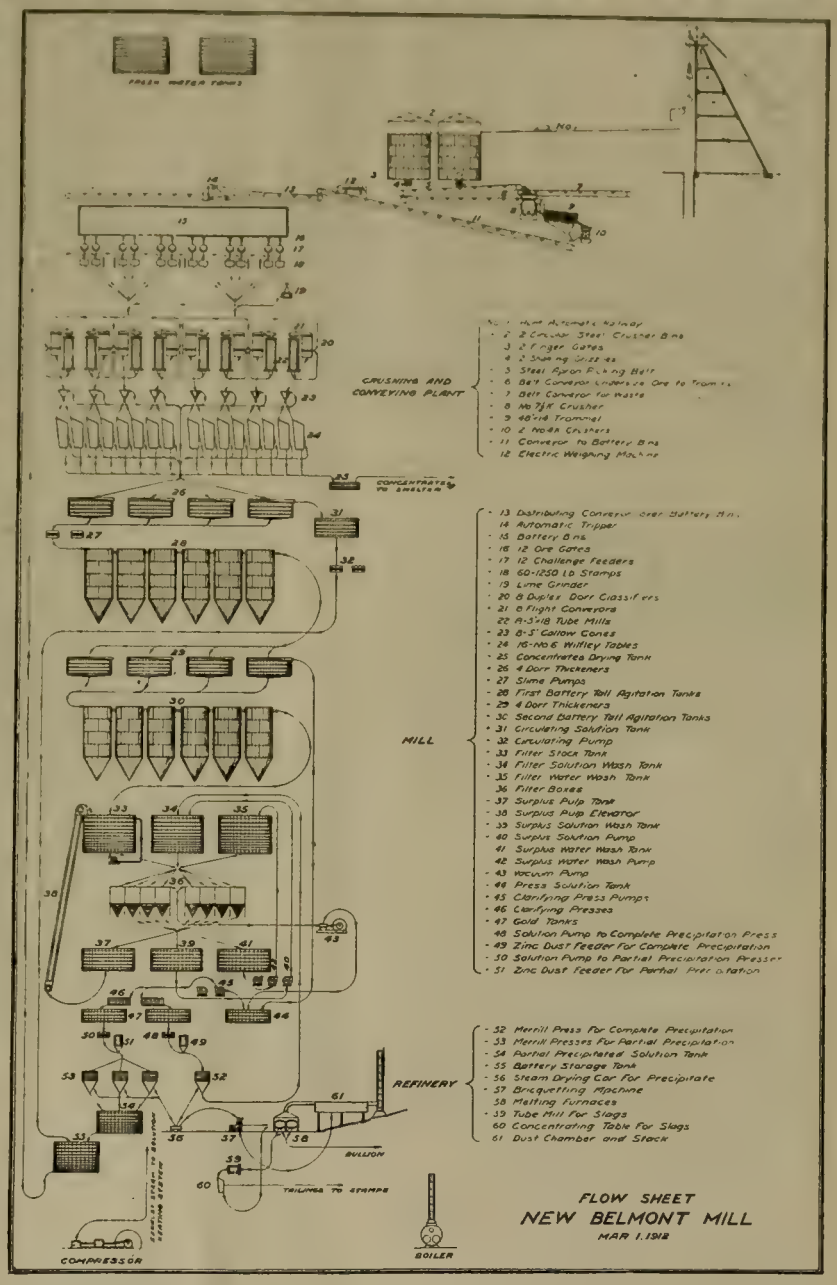
lowed in a new plant. Much painstaking thought and effort has been devoted to the metallurgical and mechanical construction of the new mill, and upon its completion it will be one of the finest cyanide mills in the country.

Briefly, the new milling plant will consist of a crushing department, the mill proper, a separate refinery, transformer house, boiler-house, store-room, and assay office, with other small auxiliary buildings and tanks, as shown by the accompanying flow-sheet. Resultant economies in transportation and reduction with the new plant in operation, as compared with similar items for the previous year, will be at least $2.50 per ton, while the capacity of the plant will be, at the lowest estimate, 165,000 tons per annum. The new mill will obviate entirely the shipment of ore to the smelters, and will also allow the extraction and reduction of ores of a grade lower than are under present conditions profitable. The capital outlay for the plant should be returned, in the form of reduced costs, in a year and a half or less of operation, after which a large net saving should accrue. While the freight and treatment on mill ore to the Millers plant averages at present but $4.619 ($3.879 treatment plus 70c. freight, plus 4c. toll over Montana spur) on $20 ore, it is to be considered that on all ore shipped to mill and smelter the freight and treatment charge (average for year) is greatly higher, $6.449 per ton. The new mill should save, on a tonnage of ore equal to that shipped during the past year (114,960 tons), $287,400, and should save during its first year (on say 165,000 tons treated), $412,500. The estimated cost of this mill is $435,000, of which $292,304.17 has been expended up to and including February 29, 1912. The capital outlay will almost be returned during the first twelve months of operation. Efforts are being made to obtain a sufficient tonnage of custom ore from other mines to justify the operation of the old mill after the new mill shall have been completed; but as nothing definite has yet been obtained the management deemed it prudent to write down the value of the old mill as carried on the books by over one-half, or $232,500. Of this amount, $82,500 has been taken from 'Reserve for Depreciation' and the balance $150,000, from 'Special Reserve.' During the coming year, if it is found impossible to keep the old mill in operation, its value will be written down to the actual scrap value.

The amount paid during the fiscal year on account of the mine fire of February 23, 1911, is $48,633.12, which pays in full all claims of relatives of those who lost their lives in the fire (without recourse to the courts) except in three cases. In these three cases the amounts have been agreed upon, although, on account of legal formalities incident to obtaining proper releases, and signing of papers, actual payment has not yet been made.

There has been no change in the acreage of the property, which consists of 11 claims, a total of 116.55 acres.

An admirable feature of this report is the detailed monthly statements of mining and milling costs, given herewith. The combined income account of the mine and mill for the year ended February 29, 1912, is as follows:



Administration expenses	$	40,555.93
Losses and expenses incidental to fire in mine		48,633.12
Surveying and other preliminary expenses for mill-site		4,040.81
Adjustments of prior years' accounts		745.90
Dividends paid to shareholders:		
No. 7, Feb. 27, 1911, 25%	$375,000.00	
No. 8, May 11, 1911, 25%	375,000.00	
No. 9, Aug. 28, 1911, 25%	375,000.00	
No. 10, Nov. 27, 1911, 25%	375,000.00	
		1,500,000.00
Balance of net income, available for the payment of dividends or otherwise		1,487,948.15
		$3,081,923.91

DETAILED MILLING COSTS, TONOPAH BELMONT M. & D. Co.

	1911 March	April	May	June	July	August	September	October	November	December	1912 January	February	Totals March 1, 1911, to February 29, 1912
Crushing & Conv'g	$583.14	$549.82	$826.16	[illegible]	$387.97	$502.38	$468.26	$435 33	$412.91	$456 69	$504.14	$800.48	$6,743.67
Stamping	3,368.98	3,222.17	3,892.31	3,687 33	3,906.54	3,541.17	3,747.13	3,960 73	4,142.35	3,683 38	4,328.28	3,925.39	45,405.76
Tube Milling	1,431.14	1,443.15	1,682.95	1,687.97	1,966.31	1,394.81	1,614.16	1,055.80	2,001.78	1,446.88	1,476.48	1,335.45	18,536.88
Concentrating	793.48	754.47	775.01	723.37	707.62	849 61	795.87	918 95	811.99	756.51	835.46	778.25	9,502 59
Elevating and Separating	562 56	249.51	311.54	215.07	211.89	188.92	182 67	200 34	209 82	289.49	285 14	[illegible]	3,153.37
Leaching Sands	2,545.06	3,061.00	2,839 99	2,392.94	2,439.26	2,664 34	2,803.75	3,489 66	2,815 82	2,460 16	2,850.71	2,056.83	32,419.52
Conv'g and Disch'g Sand	588.92	782.03	531 02	631 66	598.95	916.50	435.70	611.27	437.66	736.53	465 49	820.16	7,555 89
Agitating Slimes	5,627.35	6,480 16	6,694 24	5,912.62	5,615 95	6,022.44	6,689.00	7,901.58	7,713.79	8,178 16	8,800.11	7,613.41	83,248.81
Filt'g and Disch'g Slimes	992 09	1,219.49	1,141.07	1,277.36	1,364.63	1,777.02	1,662 11	1,603.68	1,877.35	1,732 96	1,302.66	1,530.32	17,500.94
Precipitating	1,560 02	1,781.61	1,500 41	1,710.44	1,429.71	1,547.12	1,636.53	2,008.29	1,494.61	1,574.68	1,980.03	1,813.36	20,036.81
Assaying	387.92	500 19	410 11	438.58	422 87	410.68	452.86	533.25	544.20	391.61	456 27	426.96	5,375 61
Refining	1,135.62	1,203 19	1,064.07	934.70	1,046.07	920 10	1,135 06	1,304.50	1,259.60	1,007.29	1,328.24	1,350.52	13,688.96
Lighting	33 89	114 80	128 12	127.68	105 94	108 87	115.88	122.31	114.77	125.71	125.54	122.61	1,346.12
Shift Bosses	300 00	310 00	[illegible]	300.00	300.00	450.00	450.00	450.00	450.00	450 00	450 00	450 00	4,660.00
Watchmen	124 00	[illegible]	124 00	120.00	124.00	124.00	120.00	124.00	120 00	124 00	124.00	116.00	1,464.00
Surface and Plant	182.17	274.07	271.16	257.91	[illegible]	199.74	253.44	431.46	164.36	287.35	152.07	155.77	2,766.36
TOTAL DIRECT COST	20,218.34	22,065 66	22,492 16	21,225.92	20,764.57	21,617.70	22,562.42	25,151.15	24,570.40	23,721 40	25,464.62	23,550.95	273,405 29
Administration	800 00	806 45	800 00	800 00	800.00	800.00	[illegible]	875.00	875.00	875.00	875 00	875.00	9,981.45
Office and Storehouse	246 78	253.47	228.32	244.40	230.81	245.66	208.75	225.59	211.96	215.90	225.90	286.98	2,824 52
Taxes and Insurance	561.79	566.13	568 27	565.24	574 43	576.29	576.04	530 15	528.87	527.23	544.24	543.91	6,662 59
Legal and Traveling					200 00				200.00				
Depreciation	3,750.00	3,750.00	3,750.00	3,750.00	3,750 00	3,750.00	3,750.00	3,750.00	3,750.00	3,750.00	3,750.00	3,750.00	45,000 00
General Expense					35.32	51.51	152 09	595.19	22.34	65.76	23.39	20.68	966 28
TOTAL INDIRECT COST	$5,358 57	$5,376 05	$5,346 59	$5,359.64	$5,590.56	$6,423.46	$5,486.88	$5,975.93	$5,188.17	$5,433.89	$5,418.53	$5,476.57	$65,434.84
TOTAL MILLING COST	$25,576 91	$27,441 71	$27,838 75	$26,585.56	$26,355.13	$27,041.16	$28,049.30	$31,127.08	$29,758 57	$29,155.29	$30,883.15	$29,027.52	$338,840.13
Dry Tons Milled	5,614	7,100	7,425	6,810	6,500	7,200	7,664	8,384	7,700	7,490	7,820	7,642	87,349
Average Stamps	48.0	59.3	58.9	56.0	52.0	56.6	58.0	58.0	57.0	58.0	57.3	59.0	56.6
Tons Per Stamp	3.80	3.99	4.07	4.05	4.19	4.09	4.40	4.66	4.50	4.27	4.40	4.41	4.24
											* Total direct cost for year 1910-1911		$217,642.08 3.713
											Amount shown above		216,807.09 3.699
											Difference		$834.99 .014

is amount of Storehouse expense included in Office and Storehouse for the purpose of comparison.

Balance of undivided net income on February 28, 1911, as per last report		$1,185,867.30
Net earnings of the mine	$1,213,870.86	
Net earnings of the mill	643,830.24	
		1,857,701.10
Dividends received from:		
Esmeralda Power Co.	$11,250.00	
Southern Nevada Abstract Co.	300.00	
		11,550.00
Interest received		25,605.51
Profit on sale of Southern Nevada Abstract Co. stock		1,200.00
		$3,081,923.91

Mining at Jarbidge

By AN OCCASIONAL CONTRIBUTOR

In the past year Jarbidge has developed somewhat, but far from the extent expected. At the present time it may be said to have passed into a state of innocuous desuetude, from which cataleptic condition it may revive in two months or it may take two years. For the present there is no money in the district, very little work going on, no chance to make any money, and little prospect of collecting any bills. Many people are leaving.

The trouble with Jarbidge has not been with the mines so much as with the owners, who have displayed so much stupid ignorance and greediness, or have attempted too much work on no funds. Bad checks seem to have been the regular working capital of most of the companies, which has left the district in a very bad state financially. Besides the many small outfits which have paid off their laborers with checks drawn against a bank with little or no money to their account, the two big companies, with their all but useless mills, suddenly suspended a short time ago, each of them having an unpaid labor account of $7000 or $8000 which is still unpaid.

But perhaps the worst setback is the greed of the property owners who want to get a fortune for a fair prospect and who thus prevent any solid mining men from securing a foothold. They think because they find a few pieces of high-grade ore in a prospect-hole that they have a bonanza mine, and immediately want a mine price for it. There have been some good people in Jarbidge who were favorably impressed with the prospects and were willing to take hold on any reasonable basis, but who refused to invest when they were asked such unreasonable prices as $125,000 for one 10-ft. hole, $250,000 for a three-fourths interest in three 10-ft. cuts, $150,000 for an eight-tenths interest in two 10-ft. holes, and similar equally impossible prices.

George Wingfield did take hold of two of the good-showing properties, even at these high prices, one of them running up to over half a million. But then it is to be presumed that he counted on his previous acquaintance with the owners to get the mines later at a price compatible with the development. After spending nearly $50,000 in development on the two properties and opening only about $150,000 worth of ore of a fair milling grade, he wished to have the price brought down to a reasonable one, and, meeting with refusal, he decamped. And it is fair to predict that all other moneyed men will stay out and wait until prices come down to somewhere near the probable value of the properties. This will also necessitate that the owners come to a realization of the fact that the veins are only of moderate size and that the ore is of a $12 milling grade, rather than a $200 bonanza quality, as they have thought.

The best-showing prospect in Jarbidge today is the Flaxie, which on the 85-ft. shaft level has a drift over 225 ft. long in a continuous ore-shoot, with a width of 3 to 5 ft., which assays from a few dollars to over $50 per ton, with a probable average about $17 per ton. This is the longest and most regular ore-shoot yet opened in the camp. This is now under bond for $60,000, which is the most reasonable price set on any of the properties upon which good ore has been found. Work is still continued on the Jarbidge Gold, adjoining the Flaxie, but as yet it has not reached the vein in the solid formation. On the Alpha considerable work is being done in several places, and two or three feet of good ore is being opened up.

The double-track development adit on the Log Cabin is going ahead. As soon as the roads are in condition for heavy freighting, machine-drills will be employed there and the work pushed.

There is talk of a small custom mill in the canyon near town. This seems to me to be the best possible thing—a small mill turning out bullion at a profit. There is plenty of $20 to $40 ore that can be packed down from the Bourne and Flaxie to keep a mill busy; besides, there are numerous other properties which could use such a mill for a trial run to establish the value of their ore. This sums up the present condition of a sometime-in-the-future producer.

Work of the Nevada Consolidated Copper Company

By Pope Yeatman

*This report covers the fifteen months ended December 31, 1911, representing the third year's operations of the Nevada Consolidated Copper Co.; the additional three months being due to a change in the fiscal year, previously ending September 30.

Property. No addition to the area of the mining property has been made during the past year except in the way of certain claims to be utilized solely for the purposes of disposing of overburden from the section to be mined by steam-shovels. While the company had sufficient ground for the disposition of this material, the purchase of additional area was thought advisable on account of it being possible to dispose of the stripping at a lower cost. The claims consist of the Stillwater No. 2, 3, 4, and 5, amounting to 60.5 acres, and allow for the disposition of 3,750,000 cu. yd. of waste. In addition dumping privileges have been obtained on claims belonging to the Coppermines Co., covering an area of 15.3 acres, and providing for the dumping of 1,265,000 cu. yd. of waste, measured in place.

Prospecting.—Considerable work has been done with churn-drills in order to determine the limits of the orebodies, both laterally and in depth. While these limits were already fairly well known, there were still a few gaps for which more complete data were required to enable the company to fill out the boundaries more accurately. Fifty-one holes were drilled, amounting to 17,185 ft. In this footage, however, is not included drilling in the steam-shovel pits for blasting purposes. The total number of holes to date, including the Cumberland Ely holes, is 258, amounting to 78,872 ft. Prospect drilling in the last year was carried out on Ruth, Eureka, Hecla, and Liberty areas.

As a matter of special interest, hole No. 76 was drilled in the Eureka pit to a total depth of 680 ft. below the original surface, far into the primary ore, to determine if the low-grade material, less than 0.4% copper, was local or if the real primary ore had been finally penetrated. The latter is believed to be the case.

Ore Reserves.—During the past year the ore reserves have been added to, but these additions were proportionately not so large as during the previous year. The ore now developed and its estimated assay value is as follows:

	Tons.	Average % Cu.
Total developed ore, to Jan. 1, 1912	49,410,087	1.705
Unprofitable account slopes	1,419,300	1.212
Total profitable ore developed	47,990,787	1.716
Ore milled to Jan. 1, 1912	7,137,416	2.041
Profitable ore remaining in reserve, January 1, 1912	40,853,371	1.662

Mining.—As in other years, all mining has been done by means of steam-shovels, and this work continues to be carried on most satisfactorily. Much the larger portion of the ore mined has been from the Copper Flat or Eureka pit. During the last few months a considerable tonnage has been extracted from the Liberty pit. The deepest point reached in the Eureka pit is about 115 ft. below the main tracks, or approximately 137 ft. below the capping. This point is well below the water-level, but the amount of water has been too small to give any trouble.

In December, after having been idle for over two years, the Veteran mine of the Cumberland Ely was re-started and a small amount of ore was mined underground. During the fifteen months period the following dry tons of sulphide ore was mined and shipped to the concentrator:

	Tons.	Average % Cu.
Eureka pit	3,261,482	1.790
Liberty pit	62,956	1.768
Veteran mine	5,584	3.050
Total	3,330,022	1.791

The ore mined was of lower grade than for the year preceding, due to the fact that more ore was taken from the fringes of the deposit, from greater depth, and from sections which had previously been considered as waste, but with the reduced cost of concentration, was found to be profitable. During the year silicious carbonate ore amounting to $205,795 dry tons, averaging 2.91% copper, was mined, of which 39,235 tons was crushed and delivered to the smelter, and 166,560 tons was put into mine storage. As was the case the previous year, this ore was mined faster than the requirements at the smelter demanded, but it was necessary to take it out in the course of removing the overburden. It has been stored to supply the future needs of the reverberatories and converters.

Stripping.—The overburden removed during the year has been taken from three sections, namely, the Copper Flat or Eureka, the Liberty, and the Hecla, in the following amounts: Eureka, 1,734,313 cu. yd. overburden, 50,158 cu. yd. approaches, total 1,784,471 cu. yd.; Liberty, 1,347,927 cu. yd. overburden, 5000 cu. yd. approaches, total 1,352,927 cu. yd.; Hecla, 111,742 cu. yd. overburden; grand total, 3,249,140 cubic yards.

Including waste material to be taken out in the stopes, the following is the estimate of cubic yards of stripping remaining to be removed: Eureka, 837,900; Liberty, 6,760,600; Hecla, 5,050,500; total, 12,649,000. There has been removed a total of 6,038,683 cu. yd. of stripping to January 1, 1912. At the Eureka or Copper Flat pit the capping directly above the ore has been entirely removed and also a large portion of the waste material in the slopes. Stripping of overburden on the Hecla was started during the fiscal year, but sufficient capping has not been removed to reach the ore itself. Stripping is sufficiently advanced on all three sections to allow an extraction of sufficient ore to meet the requirements of the concentrator. There are now in operation in the pits eight steam-shovels, of which one is held in reserve and the others used either on the extraction of ore or removal of overburden.

The three working places show a variable thickness of profitable ore and thickness of capping as follows:

Place.	Av. thickness of profitable ore, ft.	Av. thickness of direct capping, ft.
Eureka	190.0	87.1
Hecla	280.3	101.4
Liberty	193.3	154.7
Average	217.9	102.5

Costs.—Including charges of every description, such as labor, supplies, repairs, management, taxes, proportion of general and New York expenses, etc., the mining costs have averaged 15.7c. per dry ton. An additional charge of 15c. per ton of ore has been made to cover stripping redemption on the Eureka orebody and 22c. per ton on the Liberty orebody. These charges are based not only on the cost of removing the overburden directly overlying the ore to be mined, but also such waste as will have to be removed to allow for safe working in the bottom of the orebody. In other words, to allow for proper slopes in the shovel pit. Stripping costs have been reduced to 36.3c. per cubic yard. The cost for mining carbonate ore has been 74.40c. per wet ton, the increase being largely due to more care being necessary in sorting.

*From a report made to the Directors of the Nevada Consolidated Copper Co., February 14, 1912.

General.—Improvements during the year have been the acquiring of one new locomotive and one 95-ton steam-shovel, construction of numerous tracks to connect the steam-shovel pit with different dumping areas, building additional quarters for married men, schoolhouse, locomotive and car repair-shops, carpenter-shop and bunkhouses, ten Italian quarters, staff-house, hospital, two powder-houses, eight Greek dwellings, etc. The 18-yd. dump-cars and three new locomotives mentioned in the last report were delivered during the year and have been put into service.

Transportation.—Transportation of ore from the mine to the Steptoe Valley plant, has been most satisfactory, and owing to the increased equipment, there has been no delay even during the severe winter months.

Steptoe Valley Smelting & Mining Co.—The plant has worked very successfully during the past year and has shown considerable increase in capacity. Greater efficiency and a decrease in the cost of operating has resulted. A great reduction has been made in the cost of concentration, amounting to 15.9c. or 25.72%. This is due, in the main, to treating a larger tonnage of ore per section. Power costs were also reduced, and in fact there was an improvement in the way of costs in all departments.

Concentrator.—As will be seen from the table, extraction was lower than during the previous year, due first, to a reduction in the grade of ore treated; and second, to perhaps crowding through more ore than would have been the case had the grade been higher. The reduced costs, however, much more than make up for the decreased percentage of extraction. A most interesting test was made during the months of May, June, and July, which proved in working with large tonnages that ore of a very low grade, much lower than had been believed, could be treated at a profit. The test was made on a tonnage of 256,000. The following table shows, by months, tonnages treated, assay of ore, percentage saved, and ratio of concentration:

	1910			1911			
	Oct.	Nov.	Dec.	Jan.	Feb.	March	April
Tons of ore treated (dry)	204,329	190,431	184,268	209,040	229,392	223,655	205,089
Average Copper assay	1.83	2.00	2.20	1.89	1.75	1.88	1.99
Percentage saved	68.66	69.41	68.55	68.08	65.12	69.49	66.17
Ozs. Gold per ton	.015	.014	.015	.015	.015	.014	.013
Ozs. Silver per ton	.080	.095	.090	.075	.095	.090	.085
Ratio of Concentration	11.19	11.01	11.03	11.17	9.69	9.58	11.64
% Copper in Concentrates	14.03	15.30	16.60	14.37	11.04	12.54	16.36

	1911							
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Tons of ore treated (dry)	258,649	294,793	271.254	247,284	206,067	196,460	219,552	197,979
Average Copper assay	1.54	1.36	1.49	1.69	1.98	2.16	1.79	1.917
Percentage saved	68.62	66.31	66.05	65.97	67.21	67.80	69.65	66.99
Ozs. Gold per ton	.012	.009	.010	.010	.010	.015	.015	.017
Ozs. Silver per ton	.083	.071	.080	.078	.050	.080	.065	.065
Ratio of Concentration	12.30	12.87	12.12	10.37	12.14	12.61	12.08	11.09
% Copper in Concentrates	13.03	11.59	11.92	11.58	16.11	18.45	15.02	14.18

The results for the fiscal period (15 months) were as follows:

Tons of ore treated (dry)	3,338,242
Average copper assay, per cent	1.80
Per cent Cu extraction	67.59
Ratio of concentration	11.34
Assay value in gold, oz.	0.013
Assay value in silver, oz.	0.079
Per cent gold extraction	57.72
Per cent silver extraction	45.92
Average Au and Ag recovered per ton ore, cents	17.35
Average per cent copper in concentrate	13.80

A good deal of experimenting has been done during the year in the direction of greater efficiency and extraction. During the month of November a complete concentration test was made, under the direction of Allen H. Rogers, who reported fully concerning the work done by several different methods, and it is hoped that much good will result from this. The main changes made in the plant have been in the direction of increased settling devices to allow the utilization of a greater amount of return water. One section of the concentrator was altered so as to allow for treatment on the lines of the Utah Copper Co.'s flow-sheet.

Roasting Plant.—No additions have been made to this plant, but there have been some improvements made in the operations of the furnaces, and the cost of roasting has been reduced 8.3c. or 12.71% per ton of concentrate.

Reverberatories.—During the year 1911 very important changes have been made in the reverberatory operations, and the capacity of the furnaces has been greatly increased and costs considerably reduced. This improvement has been due to the change of fuel from coal to Coalinga oil. The charge per furnace-day has been increased from an average of 223.53 tons per day in 1910 to 359 tons per day for the month of December 1911, and the costs shown for the year 1910 have been, for the month of December 1911, lowered by 63c. per ton charge, or 24.31%. The whole 15 months is not included for the reason that the change to oil burning was not made until some time in 1911.

Converting Plant.—Improvements have also been made in the converting plant, principally by the change from acid-lined converters to those lined with basic brick, and also to the introduction of the Pierce-Smith converter. Greater capacity is obtained and a reduction in cost; but not having finished the entire installation of the Pierce-Smith converters, the full benefit of the improvement has not been determined.

Power-House.—Improved efficiency has resulted in considerably lowering the cost of producing power. No changes have been made during the year other than equipping some of the boilers with oil-firing devices.

Water.—Work has been continued at Duck creek in order to conserve a greater amount of water, and this has resulted in a somewhat increased flow for the Steptoe plant.

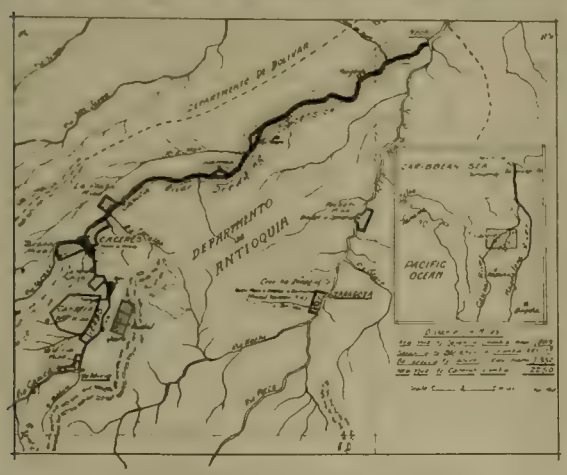
General Improvements.—These included a new warehouse and a new Nordberg return-water pumping engine of 5000 gal. per minute capacity, at the concentrator, installation of a fuel-oil system with 25,000-bbl. tank, several extra quarters, and a new clubhouse for the employees, dormitory for teachers, and increases in the fire lines and general water service. The property has been added to during the year by the purchase of the Payne ranch and water rights on Duck creek consisting of 320 acres.

Production and Costs.—The yield from all ore mined and treated, and from silicious carbonate ore delivered to the smelter, has amounted for the 15 months to 78,541,270 lb. of copper. The total cost per pound of copper has been 7.17c.; and deducting miscellaneous earnings, but including fund to cover improvements and depreciation, this is reduced to 6.97c. These costs include all possible charges, such as costs in Nevada, shipping, refining, marketing, legal expenses, taxes, and New York expenses.

Conclusion. The period under consideration has been a most successful one and has resulted in very material reductions in the cost of operating and of production per pound of copper—even on a lower grade ore than during the previous periods. The most important features have been the reduction in milling costs and increased capacity of the concentrator, installation of oil firing for the reverberatories resulting in reduced cost, and improvements in the converting due to the introduction of basic lined converters. I wish to commend C. B. Lakenan, the general manager, and his staff for their continued display of progressiveness and efficiency, and for the loyal work on behalf of the company.

Dredging at Pato, Colombia

The Pato Mines, Ltd., owns a concession of 22,000 acres on the west bank of the Nechi river, Colombia, six miles from Zaragoza in Antoquia. Of the 560,028 shares of £1 each which have been issued, three-quarters are held by the Oroville Dredging Co., Ltd., which has loaned to the Pato company $534,129 on 8% income notes for equipping



MAP OF THE PATO DISTRICT, COLOMBIA.

the property. At the annual meeting of the Oroville company held in London on March 30, F. W. Baker, chairman of the board of directors, said: "I think, gentlemen, it has been made clear to you that as soon as these advances, against which 8% income notes have been issued by the Pato Mines (Colombia), Limited, are paid off out of the profits of the Pato company, the funds so set free in this way will be available for distribution by the American company to its shareholders to the extent of the surplus earnings of that company, and that we shall be in a position to draw upon these surplus earnings for the first dividend of the new series by the spring of next year, with every prospect of maintaining dividends uninterruptedly thereafter. I would like to draw your attention to a paragraph in the directors' report to the English company dealing with an aspect of our Pato enterprise, which, in my opinion, is of great importance. I refer to the reference on page 5 of the report dealing with the portion of that property susceptible to hydraulic methods, known as the 'California Hill.' I do not think I can do better than read that portion of the directors' report, because it deals very clearly with two interests that we have outside of the 300 acres of what we call proved land, which may develop into something of considerable importance in our interests in the future. We have thereabout an additional 400 acres of dredgable ground, which our management on the spot have told us they think will prove to be good ground. We have not yet tested it thoroughly, and for that reason we are not prepared to say much about it, but it certainly holds out the hope that when we have exhausted the 300 acres, which we propose to work out as soon as our equipment is completed, we may have still another 400 acres of ground which our management think will prove to be good dredgable ground. One of the reasons that the equipment down there is being made as complete and as strong as it is, is because the management feel that we have got other assets which will not be exhausted within the seven years that it will take to work out these 300 acres, and they are really providing for the future in that way. Further, we have another asset down there which may be exceedingly interesting—how interesting, nobody can say. We have on the property what is known as the California Hill, forming a portion of the 400 acres I have just referred to. This is a big block containing probably millions of tons of gravel. A trial run of 9000 odd yards of this gravel was made, taken from different points on this California Hill, so as to try to arrive at what might be considered, even in that small way, a fair sample of the gravel. We got a result of 34.7c. from the washing of 9000 yards. That is a very high figure for a hydraulicking proposition, because that is what this would become if we found it had any merit in it at all. A 10c. ground in California has always been considered good pay-dirt, and unless we are up against conditions here which would make the operation and working of that property impossible, or so costly that it could not be carried out at a profit, we may find that we have got in that hydraulicking proposition, apart from our dredging interest, something of considerable value. Unfortunately, the 300 acres lie immediately at the foot of this California Hill, so that we could not even temporarily get a head of water in and find a method of disposing of our tailing. We could not start immediately, because the probabilities are that the tailing would go over this rich gravel ground which we propose to dredge. It is our intention to send out an expert to have this hydraulicking proposition thoroughly considered. If we get a satisfactory report, we may have to delay working it until we have cleared away enough ground for our dredge to make a dumping ground for the tailing in the hydraulicking portion. Anyhow, I think we can make up our minds that in the Pato property our resources are not absolutely limited to the 300 acres which have been proved and tested, and which we will work with this dredge that we have now put on the ground. That, in my judgment, adds a speculative value to our proposition, which time and development may prove to be a reality."

Keeping Gold Out of Concentrate

By George A. James

A generally accepted theory of mill practice is that it is of minor importance in which part of the metallurgical process gold is recovered, if the amount does not vary, and apparent costs remain the same. The outward evidence of this belief is the elimination of amalgamating plates and amalgamation in general. It is assumed that gold that should be amalgamated will be obtained by concentration or subsequent leaching. Although this assumption can seldom be admitted, it is my purpose to show a surprising loss in net returns, even though the gold recovery does not vary in quantity. An argument advanced against amalgamation is the loss of crushing capacity owing to delays for clean-ups and dressing plates. It is my belief that amalgamators exist that overcome this objection, but if such is not the case, an extra amalgamating unit could be provided to carry the load while clean-ups are made. Admitting that both of these methods are impossible, and 10% is enough to allow for decreased crushing capacity, this would seldom add 5c. per ton to the cost of ore treatment.

I shall first indicate the advantage of amalgamation where concentration is employed and the concentrate is shipped to ore purchasers. Let us assume ore worth $20 per ton and that 10 tons have been concentrated into 1. The ton of concentrate would contain $200. The percentages usually deducted would be 8.2 (5% of assay value and gold at $20 per ounce), or $16.10 per ton of con-

centrate, equal to $1.61 per ton of original ore. In addition to this, there are various charges not so apparent, but which amount to considerable importance; such as leakage from sacks in shipment and portions adhering to emptied sacks. Such leakage will certainly come to an average of 3 lb. per sack. Allowing 15 sacks to ship the ton of concentrate, 451 lb. would thus be lost, which at 9c. per pound would represent a loss of $3.95. In grinding samples in disk pulverizers (as the custom is to reduce to 100-mesh or finer), ½% or more of iron enters the sample, which, of course, deducts that much from the assay value. The commercial assay is usually ½% below corrected assays, and in determining moisture the buyer always 'plays safe.'

Considering these details, it will be seen that the ton of concentrate has returned $178.60, not including freight and treatment charges, or 89.3% per ton of original ore, equal to a treatment cost of $2.14. Let us assume that 50% of the gold could be recovered by amalgamation and that the extra cost of treatment is offset by factors not included in estimating the expense of shipping the concentrate to the reduction works. Under this head might be mentioned extra control assays, increased freight charges (which are usually regulated according to the value of ore shipped), interest on money locked up in settlements. The expense charge is about 5c. per ton for refining of gold and expressage. The account under these circumstances would then stand:

Amalgamated gold, net	$ 99.50
Gold shipped	89.30
Total	$188.30

Or $1.02 per ton in favor of this manner of handling. Against this should be charged the interest on investment required to obtain equal capacities.

An example of cyanide or chlorination treatment with the same ore would be approximately as follows. It is not too much to assert that the gold most easily amalgamated is least susceptible to leaching methods (as it consists of the coarser particles), and where 50% could be amalgamated, total extraction would be reduced, at least 2%, and the time of treatment necessarily increased. Such being the case, the comparison would then be:

By leaching:

50%, with 97% extraction	$ 97
50%, with 90% extraction	90
Total net return	$187

By amalgamation*:

50%, with 100% extraction	$100
50%, with 97% extraction	97
Total net return	$197

Thus showing a profit of $1 per ton of original ore treated. This article is merely intended to attract attention to the principle involved, and to a common source of error.

Gold is found in the alluvial sands in many districts of Siam, and is washed out in small quantities by the natives. The Kabin gold mine, in eastern Siam, was taken over by an English company some years ago, but, although the mines were worked to their full extent under the supervision of Cornish miners and Scotch engineers, no results were obtained and the company failed. Up to the present, the working for gold in Siam by Europeans has not been successful, and the native gold-mining industry is of little importance.

Tin is one of the minerals workable deposits of which are lacking in the United States. The production in 1910 was valued at only $23,447, according to the U. S. Geological Survey, while imports were worth $33,913,255.

*It is assumed that refining and express costs remain the same in case of gold recovered by both amalgamation and leaching, although it is usually in favor of amalgamation.

Goldfield Consolidated Report

The total production of the Goldfield Consolidated Mines Co. during March 1912 was 30,132 tons, containing $734,655.98, or an average of $24.38 per ton, according to the report of J. F. Thorn, general superintendent. This was milled with an average extraction of $22.92 per ton, or 93.99%. The total net realization was $491,337.30, or $16.31 per ton.

During the month 2719 ft. of development work was performed. The total cost of mining, development, milling, office, and general expense was $6.66 per ton, distributed as follows:

Mining:		
Development	$0.80	
Stoping	2.55	
		$3.35
Transportation		0.08
Milling		2.11
Marketing		0.11
General expenses		0.49
Bullion tax		0.19
Construction		0.33
Total cost of operation		$6.66
Miscellaneous earnings		0.05
Net cost per ton		$6.61

The sill of the 428-stope between the third and fourth levels of the Clermont was again extended and produced 53 tons of ore averaging $26.45 per ton. The 604-raise from the 1000-ft. level going up to the 534 on the 900-ft. level, and the stope being opened from the raise, produced 916 tons, averaging $56.34 per ton. The 700-M stope being opened between the 1000-ft. level and the 1200-ft. level from the 700-D winze produced 63 tons, averaging $45.47 per ton. The 111-M sill of the Mohawk produced 524 tons, of an average value of $13 per ton. The 212-X cross-cut on the 350-ft. level near the 260-stope produced 53 tons, averaging $69.52 per ton. The 208-X intermediate being driven under the 111-sill at the south end near the old Truitt shaft produced 30 tons, averaging $48.60 per ton. The 354-sill was extended and produced 198 tons of an average value of $74.40 per ton. The 491-sill cut out of the 415-X between the third and fourth levels, and under the old Mohawk-Jumbo lease workings, produced 436 tons, averaging $17 per ton.

The 353-intermediate between the second and third levels of the Red Top was again extended in ore and produced 151 tons, averaging $32.50 per ton. The 216-N raise from the second level just north of the shaft produced 130 tons of an average of $63 per ton. The vertical raise from the 750-ft. level of the Hazel has holed the bottom of the Laguna shaft, and is being squared out and the shaft timbered down to the bottom. The Hazel shaft surface plant will then be dismantled, and all deeper development in this territory carried on through the Laguna shaft. In the Combination mine rather an important discovery has been made between the fourth and fifth levels, in the Riley vein, about 300 ft. southeast of the shaft. The 311-P raise from the fifth to the fourth level produced 140 tons of ore, averaging $86.60 per ton. The upward extension of this orebody was cut in an intermediate between the second and third levels, where two hanging-wall cross-cuts 60 ft. apart exposed 7 ft. of ore which averaged $250 per ton. The 292-O sill was extended and produced 69 tons averaging $25.60 per ton. The 328-sill produced 41 tons averaging $20 per ton.

The gold production of Bendigo for the week ended February 24, 1912, amounted to 2496 oz. 9 dwt. The principal contributors were South New Moon, 320 oz. 12 dwt.; Hercules and Energetic, 197 oz. 16 dwt.; Ironbark, 167 oz. 3 dwt.; Central Red, White, and Blue, 142 oz. Central Red, White, and Blue announced a 2s. dividend, amounting to £3200, their total profits to date being £76,800.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Is 'Cheap' Labor Economical?

The Editor:

Sir—The important point in regard to native labor is the cost. If an ordinary development adit can be driven for as many pesos per foot, in Mexico, as it costs dollars in the United States, why is Mexican 'cheap' labor not satisfactory? I have often seen this done in Mexico, using Mexican labor entirely, only the one 'white man' in charge. It is the man in charge and how he handles his labor that counts. Many make the mistake of trying to make the Mexican do everything as directed, not realizing that for 300 years the average Mexican miners' ancestors have been miners, and they will often accomplish more if the foreman is not too arbitrary with them. When a pair of them will drill 12 ft. for a shift's work in a hard Gunnison county granite, in a 75-ft. raise, where the air is so bad that 10 and 12 candles per shift are necessary, a day's wages of ₱2.25 each ought to be satisfactory.

I have known a Mexican miner to make better than wages on a contract, at ₱3.50 per foot, driving an adit in a tough diorite, tools being furnished him, he buying his powder and doing his own 'mucking.' He and helper would go in after a round of shots, with an 8-lb. hammer and a 'bar punta' (a 6-ft. piece of drill-steel, sharpened to a round point at both ends) and break down more rock than one would believe possible, until he had seen it done. Rock broken by a good *puntisto* is the cheapest broken in a mine; it is always profitable to use one where possible. My observation and experience has been that you do not want to 'cuss,' damn, or kick the Mexican laborer when his work is not satisfactory; give him his time—life is too short to quarrel. The chances are that in two weeks you can hire him again and he will prove a good man.

Any foreman who is continually showing his men how to work, whether a 'white man' or Mexican, should get his time, as every man in sight or hearing will be idle watching him, and they will find excuses to get him to show off. If he can't tell by going to the face of a drift twice a day whether a day's work has been done or not, it is better to get one that can. Whenever it is possible, work the Mexican by task work, pay him for what he does, per foot of drilling, or per car, wheelbarrow, or *zuron* carried on his back up a chicken-foot ladder; he will do more work, cheaper, and be far better satisfied. At Batopilas, a number of years ago, when machine-drills were first introduced, several American miners were brought in to run them. The Mexican helpers soon became very efficient, have given the best satisfaction, and are by far cheaper. The Mexican learns quickly by observation. There often are 500 to 600 men underground in the mines at Batopilas; for a number of years the only foreigner has been the mine superintendent.

It is absolutely necessary that the 'white man' in charge shall speak the language well; it is not sufficient that "I can make myself understood," as it is possible, sometimes, to understand a tenderfoot by the sign language; the foreman must be sufficiently proficient so that he knows he is always understood. The workmen invariably lead you to think they understand; later, to your cost, you find that they did not. I believe, on the average, that ordinary mining operations can be carried on in Mexico for one-half the cost in the United States. Not that this is always or even generally done, but it can be done by proper handling of the labor, and good management. I have seen $1000 per month expended on management, superintendence, and office expenses when only working eight or ten pairs of miners; but that is not legitimate mining.

Ely, Nevada, April 15. G. L. SHELDON.

Protection of Investors

The Editor:

Sir—Your editorial in the number of March 16, entitled 'The 'Blue Sky' Law,' merits the approbation of all, and it would be, as you say, a desirable condition if each of these United States had upon its statute books a law similar to that of Kansas. There would be, however, one or two practical difficulties in carrying out this program literally. For example, it would be difficult to comply with the requirement by the state that the company seeking subscriptions pay the expenses of a thorough examination. In the case of any large industrial undertaking, such an examination is costly, and were each state to require an independent examination, the total cost to any company would be prohibitive. An easier way to secure the maximum degree of safety to the subscriber would be, it seems to me, to require issues, that may be offered for subscription to more than a certain limited number of persons, to be underwritten by parties satisfactory to the bank commissioner's office. The effect of this would be to guarantee a proper investigation, because no party satisfactory to the commissioner would underwrite the issues of a company with the risk of having to purchase them, who had not satisfied himself that the value was behind them. In this way, the promoters would have the expense of but one examination to pay in order to enter any number of states. The Kansas law, if enacted by many states, would, without doubt, prohibit the promotion of many meritorious enterprises.

Another difficulty in a multiplicity of such laws would be the regulations as to bookkeeping. This, of course, would not be a difficulty where all the states adopt the same regulations, but that is almost certain not to be the case, at any rate, as to form. The filing of the statement of the company's affairs down to the minutest details is, of course, an admirable feature, and, among other things which should be specified, ought to show clearly the promotion profits and all payments, whether of cash or securities, for property, patents, good will, etc., after the manner of the English law. The foregoing applies, of course, to the flotation of a stock company for any sort of operation. It applies to the formation of a company for working a mining property whether this be a mere prospect or a developed mine. But there are certain aspects of mine company promotion which will bear elucidation and discussion, some points bearing on fraudulent promotions which, I believe, have never been brought out.

The principal reason why the Government made so poor a case against Rice and Scheftels was that a large part of the representations of these promotors was opinion. Now, with respect to a prospect—that is, a property which shows no value, but promises to be of value—two different men hold two very different opinions as to its worth, and each may be thoroughly honest in his opinion. As long as this is the case, no promotion of a company to work a mining property can be proved fraudulent, for the only promise of success must be based on someone's opinion, and it is impossible to prove that such an opinion is not honest. The fact that certain production and profits are promised but not realized cannot be alleged as evidence of ill-faith, even though a competent judge of such matters could have said from the start that they were impossible of realization. The guarantee which the intending subscriber must demand under present conditions is that the opinion on which the promises are made be that of an engineer whose record shows that his opinions are of value.

Mining promotions may be divided broadly into two classes—one where the property is but little, if any, developed, and hence a 'prospect,' the other where the mine is sufficiently developed to assure a successful operation. In the latter case, the object is, generally, to provide capital for plant, etc., and is, of course, a simple business proposition, depending only on the valuation which is put upon it. Such promotions are often underwritten, and the underwriters are guided by good engineering advice. The engineer in his report gives facts and figures showing profits, so that the subscriber can figure for himself the value of

his investment. The only question in this proposition is as to the honesty of the engineer and his ability to estimate correctly the amount of ore, the cost of working, and the future of the mine. As these questions vitally concern the underwriting, the underwriters are, naturally, much concerned in satisfying themselves as to these qualities of the engineer, so that, with responsible underwriters acting, so to speak, as the agents of the subscribers, the latter can generally accept such underwriting as a guarantee of safety and good faith. The profits to the subscriber to this sort of flotation may be only small, but the risk is small, also.

In the other class of promotions, namely, the prospect, absolutely no guarantee can be given. The basis for the undertaking must be the opinion of somebody that the property, when developed, will contain a valuable body of ore. And that is as far as anyone competent to express such an opinion can go, for it is manifestly absurd to predict what tonnage of ore will be opened when no means exist for determining the dimensions, what the value will be when no samples can be taken, and what the profits will be when no knowledge exists of the character of the ore, of its amenability to treatment, or of the ground in which it occurs. So that, it may be safely assumed, when the promotors of this class of enterprise make the statement that certain profits are assured, that they belong to either one of the two classes that are, perhaps, more the bane of mining than of any other industry—honest fools or knaves. It is little satisfaction to lose money with either.

But it is an unfortunate fact that where large profits are possible, mankind often does not stop to count the chances against their realization. The promotor who is knave enough to promise, or fool enough to believe, that large profits will result from subscribing for the stock of the Easy Mark Mining Co., owner of 1000 acres of promising mining property in Eldorado, and publishes his promise or belief, sounds a note that draws the interested attention of the great majority of that large class with a small surplus to invest. Were the prospectus to state simply that the prospect, in the opinion of some engineer or geologist, promised to disclose a valuable body of ore, but that no one could say what it would be worth, no attention would be given to it. A really fair presentation of a prospect in a prospectus is futile, both because it would fail to secure subscriptions, and because such a presentation would make any price that would be attractive to the promotor manifestly too high. Therefore, the knave, in his presentation, promises the most he can think of, knowing that the people he aims to reach will not check him up, while in the case of trouble, he takes refuge in the allegation that his promises were based on an honest opinion; the fool does not have to *allege* an honest opinion, he really believed all the things he promised.

The fact of the matter is that promotion of companies by public subscription for the development of prospects ought to be prohibited. And yet there is no way in which this can be directly specified, because a prospect is hard to define. But if the law required that all issues offered to the public be underwritten, no such enterprise would ever appear, because no concern satisfactory to the bank commissioner would ever underwrite an issue based on some acreage showing a few iron stains.

The objection that will be raised, no doubt, to this proposal is that mining prospects must be developed or we shall have no mines. This is perfectly true, but let them be developed by people who understand the chances in the business, by small syndicates or mining firms, the members of whom, by close contact with the engineers in charge, can be made to understand the conditions, if they do not already do so. There are plenty of such, and I will venture the opinion that the exclusion from the mining field of the prospect companies fathered by knaves or fools will result in benefit to the industry as a whole, because the money now going into purely chimerical or half-baked schemes will find satisfactory investment in established mining enterprises.

ALLEN H. ROGERS.

Boston, Massachusetts, March 27.

Shaft-Sinking Costs at Pioche

The Editor:

Sir—The record of the costs for sinking the Virginia Louise double-compartment shaft, at Pioche, Nevada, to the depth of one hundred feet, may be of service to your readers. This work was done by four men in 54 days, during which the total number of actual shifts worked was 214. In this district the rate of wages paid by contractors for hand work in sinking dry shafts is $4 per shift, which is the union scale. Powder in small quantities costs 18c. per pound: Hay costs $20 per ton, mining timber costs $42.50 per M, and other supplies in the same proportion. Itemized at these rates the cost of the work is given below:

Labor, 214 shifts at $4	$856.00
Explosives (300 lb. powder, caps, fuse, thawing)	64.70
Expense for horses (hay, shoeing, etc.)	54.43
Tools (cable, harness, small tools, etc.)	39.80
One case candles (one-half case left)	4.25
Hauling tools to the shaft	6.00
Sundry expense	2.75
	$1,027.93

To this cost must be added the price of the timbers and hanging rods, for which I have not the actual figures, but which I know to be less than $4.75 per foot, which makes the total cost of the completed shaft $15 per foot. This figure, it must be borne in mind, is the contract cost, and not the contract price, which was an entirely different figure.

While this is a low cost and, when compared to the cost of other shafts of the same size, a very good showing, it is not described as illustrating any particularly rapid work. Were the same men to sink this same shaft a second time, working with the better judgment they gained, together with the added experience in working in this rock, they would reduce the cost a quarter, perhaps more. And, again, at $15 per foot it might compare unfavorably with the work done at another shaft, of the same size, costing $50 per foot; and as a matter of fact it would compare unfavorably if the $50 cost represented the best possible effort under the governing conditions, since the $15 cost is admittedly too high under the local conditions.

The shaft is well timbered with 8 by 8 Oregon pine (Douglas spruce) for the first 25 ft., after which depth the size of the timbers was reduced to 6 by 8 and continued to the 100-ft. mark with this smaller size. There are two compartments, each 4 by 4½ ft. in the clear, one of which is used as a manway, being fitted up with platforms and inclined ladders. The hoisting compartment is lined with 1-in. boards, no cross-head being required to this depth. The opening in the rock required for the timbers was 6½ by 10½ ft., and each foot of shaft produced 5½ tons of broken rock. The formation through which the shaft was sunk was, for the first 30 ft., a cemented gravel, which was followed by a firm but soft shale in which the work continued to the end of the contract. In the 'cement' the ground was broken by driving 'bulldozers,' a simple bar of steel sharpened to a point, in very much the same shape as a lead pencil, and ranging in length from 2 to 4 ft. The holes made by these points were loaded and fired exactly as a drill-hole. After the shale was reached all the drilling was done with churn-drills, except for an occasional plug, which would be put in with a hammer and hand steel.

Hoisting for the first 20 ft. was done with a windlass, after which a 'whip' was used, which for shallow depths is one of the simplest systems of hoisting that can be employed. In this a horse is harnessed and hitched to a cable which, passing over suitable sheaves, is attached to the bucket in the shaft. To hoist the bucket the horse is driven away from the shaft until the bucket reaches the surface; the horse is turned while the bucket is being dumped, and walking back, the bucket is lowered. Knowing that a horse will pull one-tenth of his weight at the rate of 220 ft. per minute easily, it is a simple matter to show that it is impossible for two men to keep him busy until the shaft

reaches a depth of at least 60 ft. It is, however, entirely too dangerous a method of hoisting to use without taking all the precautions which are needed. In framing the timbers all the material was cut with a big 7-ft. cross cut saw. This saw was also used for all the framing cuts after the timbers were marked. In putting the timbers in the shaft a platform was hung on the last set, and on this platform the men would work. All timbers, tools, and anything heavy was lowered in a bucket attached to a rope which, passing through a block in the tripod, was fastened to a windlass.

TOM MCCORMAC.

Pioche, Nevada, April 13.

The Mine-Owners' Liability for Accidents

The Editor:

Sir—Having duly elected to do business under the compensation provisions of the Roseberry law, rather than under the liability in damages provisions based on negligence, what then becomes the status of the mine-owner? What are his duties under the law and his liabilities toward his employees? These questions arise in every inquiring mind and are entitled to specific answer.

The employer has the first say as to which law he will work under. All employees hired after the election of compensation by the employer are presumed to have accepted compensation if they do not then and there give their employer notice in writing that they do not wish to work under compensation. With the employees who were already under a contract of hire at the time of such election of such employer the case is different. Section 7 of the Roseberry law, which governs this relation, is defective. By decision of the Industrial Accident Board, as a majority of that board understands that section, it provides no way whereby the old employee can elect to come under compensation except to continue to work on for thirty days under the law of liability for negligence without giving notice that he does not elect to be under compensation. At the expiration of thirty days he is under compensation and will so remain. If an employee elect not to be under compensation when the employer has elected to be under it, then the difference must be settled between them as other disagreements are adjusted. The employer can operate under both laws if he wishes to, but is not likely to wish to do so.

When both employer and employee are under the compensation provisions of the Roseberry law, and an accident takes place, when, at the time of the accident the injured workman was performing a service "growing out of and incidental to his employment," and while he was "acting in the line of his duty," if the injury was caused by accident and was not the result of a crime and was not caused by the "wilful misconduct" of the employee, then the employer is liable without regard to who was to blame or whether or not anyone was to blame for the accident. First, he will be liable for medical services and surgical appliances up to $100. He may select the physician who is to attend the injured workman. If the employee is injured so severely as to require the services of a professional nurse he must pay the full wages of the injured man so long as his own physician says that a nurse is needed, and no longer. If the injured person is totally incapacitated for work, but only temporarily so, then he must pay him 65% of his wages, weekly, beginning the eighth day after the injury, until he is able to go to work again. If he is permanently injured, but not totally incapacitated, then the employer must pay him 65% of the difference between what he was able to earn before he was hurt and what, with due diligence, he will probably be able to earn after the injury. If the employee is permanently injured, and so badly hurt as not to be able to work at all any more, then his employer must pay him weekly, the 65% of his wages already referred to until he had drawn what he would have earned had he kept on at work at the wages he had been commanding during the previous year for three years to come, provided that such wages cannot be taken as less than $1000 nor more than $5000. This will last him 230 or 231 weeks. In the event of the accident resulting in the death of the injured workman the employer must pay the three years' wages to his dependents weekly, as wages were paid; that is, the full amount of the wages instead of 65%. If the dead man left no dependents then the employer has only to provide for a funeral at a cost not to exceed $100.

After an accident has taken place the employer and his injured employee are at liberty to settle compensation claims in any way mutually agreeable to themselves, either by a lump sum payment or in 'chips and whetstones,' but it is anticipated that employers who avail themselves of the limited liability of compensation will carry out the provisions of compensation in good faith with their injured employees and not seek from that vantage ground to drive the hard bargains with them that have so outraged the public sense of justice under ordinary liability insurance as to have driven that form of accident insurance out of continental Europe. Such settlements should not be made without the consent of the Industrial Accident Board, to the end that the interests of society at large may be protected against injured persons becoming public charges through sacrificing rights which, if preserved, would have kept them above the poverty line.

Common experience the world over has shown that controversies seldom grow out of compensation issues. In Great Britain scarcely one claim in 200 has to be heard and determined in any formal manner. The law is so plain and the benefits so certain that, once both parties understand their rights under the law, settlements are easily effected by agreement, wherever both parties want to do what is right. Where they do not there is always trouble. But if a difference does unhappily arise, any party in interest may apply to the Industrial Accident Board to investigate, hear, and determine the rights of the parties, and this it will proceed to do as expeditiously and as inexpensively as possible. This board is not a court. It is a board of inquiry and arbitration, all of the members of whom are chosen by the state, and when an employer and his employees elect compensation, in that very act they mutually agree to leave to the Industrial Accident Board the adjustment of all issues in dispute between them regarding such compensation benefits and obligations. The findings of the board as to facts are final, but if it makes a mistake in law, or an award is procured by fraud, or its award is inconsistent with its own findings of fact, the proceedings of the board may be reviewed and set aside by a superior court. If a superior court errs, an appeal will lie from there to the Supreme Court, but it is not expected that there will be much litigation once the law is judicially construed. All statutes have to run that gauntlet.

Wherever compensation for industrial injuries has taken the place of the law of liability in damages for negligence, it has been found necessary to effect settlements of disputes without appealing to the courts for the reason that the expense of conducting court procedures and the delay amounts, in the case of an injured person flat on his back and with little or no money in the house, to a denial of justice. On an average, in California, since 1905, it has required 4 years, 9 and 7/12 months to get a personal injury case through the courts to final judgment, by which time the injured man and his family have suffered all that they could have suffered, whether they received any recompense at all or not for the injury sustained. Even in those countries where such controversies are heard by judges, it is while they sit as arbitrators and not as courts. The main advantages of compensation to the employer are that it safeguards him against heavy verdicts in damages, and he may pay the compensations in weekly instalments, whereas damage judgments have to be paid in lump sums. Also, he is not required to fight his own men at the instance of liability insurance companies that have insured him against the consequences of lawsuits, not accidents. The advantages of compensation to the workmen mainly are that they get their help when it is needed and rarely have to fight for it. It tides them over their period of greatest adversity, and their title to their compensation is untainted by charity.

Their right to it is as good as their right to wages; as good as the right of a soldier to a pension from his country if he left an arm or a leg on a battlefield.

San Francisco, March 25. A. J. PILLSBURY.

Interest in Mining

The Editor:

Sir—What is the reason for the general public's lessened interest in mining?

While probably many factors enter into it, it appears that the attitude of the Government in making it more difficult for all mining interests to conform to its arbitrary rulings has been one of the main causes. While the laws governing prospecting and locating of mineral claims on forest reserves are specific and sufficient, they, as often construed by some $75 per month ranger, discourage the average prospector. Again, it is becoming more and more difficult for the prospector to interest capital after he has found something. The Land Office construction of the laws is such that in many instances it is difficult to comply and obtain patent. The Government appears to take the position these days that every locator, whether of an agricultural, coal, or mineral land, is trying to steal something which 100 or 1000 years from now may be worth a million or more to the general public—this without regard to the execution of the laws as now found and construed for many years. This, no doubt, has deterred mining men from branching out and assisting the prospector. Consequently our best men are confining their efforts to patented and proved or partly developed properties. These are becoming scarce. Recently one of the largest mining companies, out of 600 reports on mines, found only two worthy of purchase. It is becoming a serious question what shall be done to revive interest in mining, especially in prospecting and assisting the prospector; for without this the industry must soon cease.

It is to the prospector, who overcomes hardships not equaled in any other business, that the mining industry owes so much. Now there is not one man in the field, where there were 300 ten years ago. Most practical mining men and engineers of large experience will admit that a development company which will pick out a dozen prospects under the advice and judgment of experienced men, and do a certain amount of work on each, eliminating those not worthy of further development, will make more in the long run, with less capital, than when developed mines are purchased. Still, it is one of the hardest things in mining to interest capital in the development of a prospect except in the case of some illegitimate wild-cat the promoter of which has no regard whatever for the merits of the property or for what he states regarding it. Thanks to the action of the postal authorities and to the laws in some of the states, such promotion is becoming more difficult. We can all assist the cause if we will only have a little backbone, and, when asked about a property which we know is a fake, instead of passing it on with the Mexican's shrug of the shoulders and *quien sabe*, fearlessly tell the truth.

A revision of the mining laws along the lines of the recent article by Horace W. Winchell, in the *Mining and Scientific Press* of March 9, 1912, is very much to be desired, especially so in the authorization of appeals from the decisions of the political officers. That abuse of power in this connection should have been allowed to continue without an uprising is remarkable, and certainly no credit to the intelligence of the mining fraternity.

It is not believed that American citizens will take kindly to any system of leasing from the Government. It is inherent in our own people as a race to want to own that in which we are interested. It will be admitted that the West would never have been opened and developed under other conditions. Leasing from the Government, permanently, and the leasing from the individual for a few months or a year, are separate and distinct propositions.

It will not be difficult to place sufficient restrictions around our present or revised laws to properly protect all interests. We must get together and pull together, if we would reinstate mining in its legitimate place. There is plenty of capital for honest mining enterprises if the capitalists be shown that they have a chance of success equal to that in other lines of industry. In the mining of precious metals competition is practically eliminated, and this should give the industry the preference.

Ely, Nevada, March 23. ENGINEER.

Agitating and Ciculating Solutions

The Editor:

Sir—Under the above caption you figure, in your issue of February 13, a device which is apparently offered as an innovation. It is, as a matter of fact, a rather crude application of a method which I developed some years ago and employed with great success in the agitation of slime in the cyanide process. The system was fully described, with illustrations, in an article published in the *Engineering and Mining Journal*, February 11, 1904, entitled 'Trapezoidal Slime Agitator.' It was so designed as to keep the entire mass of pulp in active movement and to carry large quantities of air deep into the solution by means of the vortex formed where the stream from the pump impinged upon the surface. The vat was shallow and wide at the feed-end, and narrow and deep at the discharge-end. The jet swept the inclined bottom of the vat, and eddies formed on each side continuously carrying the pulp into the central current. The delivery-pipe from the pump was accurately bent into a curve offering a minimum of resistance to the circulating pulp, and the power requirement for circulating a vat containing 20 tons of slime (dry) diluted to about 65% moisture was a trifle less than 2½ hp. The high velocity of impact was also found to assist in flocculating highly aluminous slime, thus facilitating a high recovery of the gold-bearing solution.

As this system was elaborated so far beyond the suggestion thrown out in your article, it seemed to me desirable to again direct attention to its merits. The device is not covered by patent, and was freely offered to the profession. It will be found extremely efficient as an agitator and aerator, and at the same time very economical of power. COURTENAY DE KALB.

Tucson, Arizona, April 22.

MINING of sulphur in Louisiana is an interesting process. The sulphur deposit, situated near Lake Charles, lies about 440 ft. beneath the surface and is about 100 ft. thick. Beds of quicksand overlying the sulphur render the sinking of shafts impossible, and the sulphur is therefore pumped to the surface. A well is driven through the overlying strata to the sulphur-impregnated beds, in much the same manner as is usual in sinking wells for oil and gas. In each well there are placed four concentric lines of pipe, having diameters ranging from 10 in. to 1 in. Superheated water and hot air are forced down the pipes and the spaces between them to melt the sulphur and to bring it to the surface. The hot water flows down between the two outer pipes, which are respectively 10 in. and 6 in. diameter, and passes into the sulphur-bearing mass, melting the sulphur. The quantity of sulphur melted and the range of action of the water depend on the temperature of the water and on the pressure at which it is supplied. The heavy melted sulphur runs back into the sump around the bottom of the well pipe, which it enters through holes provided for this purpose. Hot compressed air is forced down through the smallest or 1-in. pipe and at the bottom of the well mixes with the melted sulphur and forms an aerated mass sufficiently low in specific gravity to allow the water-pressure to elevate the melted sulphur to the surface, where it is discharged into large rectangular vats, constructed of rough planking. The dimensions of the vats vary somewhat, but they are made as large as 350 by 250 by 40 ft., and some of them are so arranged that railroad trains can pass between them. After the sulphur has cooled and solidified, it is regularly mined.

Special Correspondence

NEW YORK

TITANIC'S LOSS AFFECTS MARKET.—COPPER PRODUCTION. AMALGAMATED DOUBLES DIVIDENDS.—REPORTS OF PORPHYRIES.—REINHARDT'S FAILURE.—GENERAL NOTES.

The loss of the *Titanic* caused a backset in the general market in Eastern financial centres. It is somewhat shameful to speak of the one exception in this regard: the prominence given to wireless telegraphy in this occurrence has been widely used as advertising matter to further the huge manipulation that is being carried forward in the various issues of the Marconi wireless companies.

The copper situation remains very interesting. The best authorities are estimating increased output at 150,000,000 lb., but as opposed to this it is argued that this increase in copper production will not catch up with the increasing rate of consumption. This is altogether a question of general business conditions, rather than a question of the factors that are inherent in the copper situation alone. The uses of copper metal have been greatly extended, and a careful analysis of the future is of more importance than comparisons with the past. It is said—though the state-

RAY CONCENTRATOR, FROM TOP OF POWER-HOUSE.

ment must be taken with large grains of salt—that the copper producers have been compelled to act very strenuously to prevent a runaway market in the metal, and that prices could easily have been pushed to much higher levels. It is a little hard to accept this statement without qualification, after the long, dull, lean period which the copper producers have experienced is considered. Though producers have been able to push quotations to higher levels without difficulty, on the other hand there is some danger of curtailing consumption by this very measure. Low prices made for wider uses of the metal, while advanced quotations tend to drive consumers to the use of cheaper substitutes. It is beyond question that the public is beginning to accept higher prices without as much skepticism as ruled 60 or 90 days ago. Perhaps one of the best indications is the tone of the report made by the chairman of the board of the Rio Tinto at its recent meeting. The Rio Tinto is not a mine, it is an institution; a copper producer about which much history has been written, and the only property to which can be applied the famous passage of Macaulay regarding the Church of Rome in his essay on Ranke's History of the Popes. Rio Tinto, like the Church as described by Macaulay, "reaches back into the shadowy ages of antiquity", a producer for many centuries. The chairman spoke in hopeful tones of the campaign as laid out for years to come. The Rio Tinto is now making a large share of its profits from the pyrite and wash-ores used in the manufacture of sulphuric acid. Rio Tinto is remarkable in that it is a mine operated without the heavy expenditures for development that are ordinarily required on this side.

The improved conditions in the copper market are beginning to show in the resumption of dividends, and in increased payments by those properties that did not suspend distributions; and also in increase in value which has brought quotations up, although the volume of trading has not increased proportionately. After much discussion and rumor by way of stock market capital, the Amalgamated Copper has doubled its quarterly dividend and is now paying $1 per quarter, being at the rate of 4%. The shares are still selling very much too high if dividend record is to be considered apart from market action. Amalgamated is a trading issue, as distinguished from an investment issue. North Butte is evidently making strenuous efforts to get back into its former position, and the property is being much discussed in New York and in Boston with reference to its possibilities, and every favorable development is being emphasized. There has been a little 'odd-lot' activity in Anaconda. A good many of the Butte Coalition shareholders, feeling that their holdings in Anaconda were too small to look up, have liquidated them in the market. Some weeks ago it was rather expected that an early announcement would be made of the taking over of the Shattuck-Arizona by the Phelps-Dodge interests; evidently the deal could not be consummated. It is now reported that the Shattuck will resume individual operation and proceed with the erection of its smelter as was formerly outlined. The Arizona-Morenci Copper Co. is soon to begin development with a view to early production. The company's property lies next to that of the Arizona Copper Co. and the boards of the two companies are largely identical. The development in the Shannon and in the Arizona Copper Co.'s ground has been such that the board now feels that it is justified in proceeding to make a mine. Hitherto work has been confined to prospecting rather than to actual development.

The showing to be made during the coming year by the porphyries is an interesting feature, at the moment, on account of the recent publication of the annual reports by most of them. The report of Ray Consolidated covers nine months of the year 1911, and shows the production of 14,935,000 lb. of copper. Costs are figured at 9.32c. per pound. But, inasmuch as the period covered included the work of tuning up the mill and similar preliminary expense, it is only reasonable to anticipate a much lower cost. The profit for the nine months was $298,640, though this must not be considered an index to future earnings. The fifth annual report of the Nevada Consolidated covers fifteen months, owing to a change in the fiscal year, consequently the current report cannot be compared with that of the year previous. Copper produced during the fifteen months was 78,541,670 lb., at a cost of 6.97c. laid down in New York. The report states that during the months of May, June, and July there was handled a large tonnage of exceedingly low-grade ore of a copper content not heretofore considered commercially valuable, the result being that the Nevada Consolidated can estimate a considerably added tonnage in its ore reserves. The company carried forward to surplus $1,828,782, the total surplus now being $10,899,142. The Chino Copper Co. has just published a report covering work done during the past eighteen months, showing a tonnage of developed and partly developed ore in excess of 45,000,000 tons. D. C. Jackling, general manager, in his estimate places developed ore at practically 55,000,000 tons, of which 32,000,000 tons can be handled by steam-shovel. This would give to Chino a life of 30 years with the mill handling 5000 tons per day. From this estimate it would appear that Chino is to be one of the important factors in copper production. The report of the Miami Copper Co. does not show the cost of its copper laid down in New York, but estimates its copper cost with the product on board cars at Miami at 5.80c. per pound. J. Parke Channing, consulting engineer to the company, estimates ore reserves at 18,000,000 tons, but adds that he does not consider the possibilities of the company's ground by any means exhausted. He states that vigorous exploration work will be carried forward during the coming year. The mill tests which are being carried on at the Inspiration Consolidated are said to be satisfactory, and it is rather expected that records in the way of concentration will be broken when the plant gets under way. The Giroux

recently made a contract to furnish a minimum of 900 tons of ore to the Steptoe plant of the Nevada Consolidated. This contract was to become effective the middle of May. Giroux is hedging a little, and it is now doubtful whether shipments will begin before the first of June. The Giroux shareholders are a very patient crowd; they have waited long for the making of a mine, and apparently the end is not yet in sight.

A receiver has been appointed for the Manhattan Securities Co., which has been promoted in mining ventures in and about Elko, Nevada. The subsidiaries of this company are the Elko Realty & Development Co., the Tuscarora-Nevada Mines Co., and the Gardner Crusher Co. The individuals behind the company are bankers and capitalists of New York and vicinity. The mining market in New York suffered something of a setback by the recent failure of J. Thomas Reinhardt. Reinhardt was one of the spectacular promoters of the Porcupine boom, and conducted one or two 'sky-rocket' manipulations. His firm recently opened offices in London and maintained branches in Toronto and Boston. The office was closed without any notice, and the usual string of employees who came down to work found the doors locked on Monday morning.

The large mining interests operating in Mexico with headquarters in New York are more than ever disturbed by reason of the unsettled conditions prevailing, especially as it appears that matters must be worse before they mend.

BOSTON

Boston View of the Copper Situation.—H. J. Stevens' Death.—Company Reports and Their Effects.

The statement has been made recently that there has been an accumulation of about 70,000,000 lb. of copper which has been held back by the refineries in finished and unfinished shape. This claim was given some attention, but has since been denied by a leading copper interest here which says the excess of mine output over refinery during the last eight months cannot amount to more than one-half of that figure. Whatever unrefined copper is carried by the refineries is not considered in the light of excess baggage at all. The refineries during 1911 cleaned up their stocks and when the mines increased production at the end of 1911, following the improvement in the price of the metal, it was decided that normal stocks of unrefined copper should be accumulated again in order to guard against delays and to insure regular deliveries. It is believed in Boston that the copper situation is about as strong fundamentally as it appears superficially. Owing to the organization of the industry, both producers and consumers are working on closer margins of stocks than heretofore. The present metal surplus, whether viewed in a domestic or world-wide sense, is less than enough to supply the demand for 30 days. There seems to be no reason why copper should not hold its gain around the 16c. mark.

Boston learned with great regret of the death of Horace J. Stevens, the publisher of 'Stevens Copper Handbook,' of Houghton, Michigan. Mr. Stevens had not been in good health for several years past, his invalidism at times delaying the publication of his handbook. He visited Boston from time to time and was always a welcome visitor. From the old country editor type he developed into one of the world's best known authorities on copper mining. He not only ably reviewed copper mines, but enriched his work with pithy comments, some of which brought him threats of libel suits and other reprisals. He left his impress on the copper industry and his death leaves a vacancy which will be hard to fill, as he did much to cement the bond of interest between Boston and the Lake country.

Among other things, the porphyries are revolutionizing methods among the copper-mining companies as to publicity. The stockholders of the Nevada Consolidated and Chino companies have recently received very elaborate statements for the period ended December 31, 1911. Along with the statements are photographs of the mines and mills, together with other illustrations, making a graphic and altogether instructive presentation to the stockholders. One by one the copper companies, new and old, are acquiescing to the public demand for full publicity. All the porphyry directors are warm advocates of that policy. The statements of Chino, Nevada Consolidated, and Ray Consolidated are each for more than a year, the changes being made in order to make the fiscal year the calendar year. The report of Chino brings the company up from the date of starting operations to the last day of 1911. The report of the Ray Con. Co. was for 18 months. Ray Consolidated's report was considered good in Boston. The stock has acted quite slow marketwise, but those conversant with the property readily understand that it is an immense project and one which is being carefully worked out. The company just now is going through the process of carefully swallowing Ray Central—which morsel it recently secured—and until this has been done little in the way of an active market movement can be expected. The total tonnage for the Ray Con. is given at 77,314,470 tons, averaging 2.17% copper. Of this total, 64,700,000 tons are fully developed and the balance only partly developed.

Second only to the Ray Con. report in real interest was the Chino Copper news. Chino partly paid stock was admitted April 22 to trading on the Stock Exchange. The news was given out that the recent issue of new stock by the company was all taken up by stockholders. The report issued by the company covering the period from the date of starting operations to the last day of 1911, was a good one. In that period Chino produced 986,375 lb. copper, for which it received 13.3c. per lb. Since cost of production was slightly under 10c. per lb., which has since been reduced to around 7½c. per lb., the net profit for the company totaled $131,232. The company now has developed over 54,980,646 tons of ore, averaging 2.24% copper. Of the entire total, almost 60%, or about 32,000,000 tons, can be mined by steam-shovels.

GLOBE, ARIZONA

J. P. Channing on Miami Conditions.

J. Parke Channing, vice-president and consulting engineer of the Miami Copper Co., on a visit to the mine, spoke as follows:

"On the 570-ft. level the ore being opened has a copper content fully up to the average for the orebody. I have never estimated more than 50 ft. of ore below this level, but am confident that it will extend much deeper, and when the time comes a cross-cut will be driven from the main shaft on the 720-ft. level. Unexpected ore was found on the 420-ft. or present extraction level. On all the levels above, the northern limit of the orebody has been determined by an approximatly east and west fault, but on the 420-ft. level a drift north through this fault has passed through good ore for a distance of 100 ft. The cost of mining for last year, as shown in our annual report, was $1.21 per ton. It might have been 40c. less if we had desired to mine wastefully and without regard to the safety of the men. The excessive cost was due to the large amount of square-setting and top-slicing. Production is at the rate of not quite 3,000,000 lb. of copper per month. In the concentrator the Deister tables are doing good work, but changes will be made in the crushing machinery. The Hardinge pebble-mills have demonstrated their superiority over the Chilean mills for fine grinding and will probably eventually replace them in all units. It is also probable that the rigid rolls used for the intermediate crushing will be gradually replaced by heavy spring rolls in all units. The Traylor Engineering Co. is building for us a heavy set of spring rolls, 16 by 42 in., but will have a much more massive frame and heavier construction than those now in use. Seven Crocker-Wheeler 150-hp. motors have been ordered, to replace the 100-hp. motors now used in driving the rolls. Hardinge ball-mills have been tried against the rolls, but have not thus far proved equal to them. Their steel consumption is apparently greater than that of the rolls."

RHODESIA

Oceola Company. District Notes. Bwana M'Kubwa.

Success has attended two or three small Rhodesian flotations of late and elated by the result of the Turquois deal Salisbury mining men are putting another company before the South American public. This latest venture is termed the Oceola G. M. Co., Ltd., and the claims to be acquired and worked are situated in the Mazoe district of Mashonaland and about three miles from the Jumbo railway station. It is proposed to erect a 3-stamp mill and it is estimated that a profit of £4000 during the first six months will result. The capital of the company is a modest one—£8000. The property has been reported on by three well known Rhodesian mining men, Messrs. Mumford, Epton, and H. Fraser Roche. From their reports it would appear that the property is pegged on old workings from which ore has been mined to a depth of 150 ft. A main shaft has been driven 114 ft., and a drift put in 120 ft. to the west and 190 ft. to the east exposes the vein for the whole of that distance. It is stated that the vein averages 30 dwt. over 12 in. for 140 ft. Messrs. Mumford and Epton estimate that there is 1600 tons of ore above the 114-ft. level, which they state should produce a profit of from £6000 to £7000.

Affairs at Rhodesia cannot be termed exciting at the present moment. The output does not fluctuate greatly and one hears of few new finds. Furthermore, there has been something in the nature almost of a stampede on the part of certain Witwatersrand firms, who a couple of years ago rushed representatives into Mashonaland. The General Mining & Finance Corporation, Messrs. A. Goerz & Co., and Sir Abe Bailey, are retiring from the field and other wealthy and influential Johannesburg and London houses are doing practically nothing in Rhodesia at the present day. As against this it must be recorded that the Consolidated Gold Fields of South Africa has greatly strengthened its grip on the county and by the absorption of the Rhodesian Exploration & Development Co. has become a most powerful factor in Rhodesia, second only to the Chartered company. The progress of development is also a very decided bull point. A little while ago a reliable estimate of ore reserves in the territory prepared by the Rhodesia Chamber of Mines showed that the developed profitable ore in sight amounted to 6,280,908 tons containing gold to the value of £13,019,226, or sufficient to maintain the present output for a period of five and a half years. No mines belonging to small workers are included in this estimate, though properties of this class were responsible for 26% of the output for last year. Discussing these figures at the annual meeting of the Chamber held in Bulawayo the other day, Mr. Mitchell said the figures relating to the industry were such as to show there was going to be no diminution in the activity of the industry. At the same time Mr. Mitchell admitted that an early or marked rise in the gold yield of the territory is not to be expected at the moment, but it is evident that with development now proceeding on all sides, with the prospect of better conditions in the labor market and with the proposed railway extensions the day of increased gold declaration is approaching.

In Northern Rhodesia no remarkable activity is to be observed at the moment of writing. The railway to the Congo frontier was completed long ago, but capital and interest appear to have been carried on beyond it to the much-debated copper fields of Katanga, and but little seems to have been absorbed by British enterprise in Northwestern Rhodesia. However, the Board of Directors of the Bwana M'Kubwa Copper Co. proposes to proceed with the erection at the mine of a plant, capable to begin with treating 200 tons of ore per day. It will take, it is estimated, about 18 months to complete this equipment. It is, however, hoped to have a first unit, of 75 tons per day capacity, at work on high-grade ore before the end of the current year. The Bwana M'Kubwa mine is situated a few miles south of the Congo Free State's southern frontier, and it is famous for the beautiful specimens of malachite it produces. It, in fact, has been suggested, and not without reason, that it would pay the company better to sell malachite than to produce copper.

LONDON

Flotation Companies Until. Broken Hill Concentration. San Francisco del Oro Affairs. Other Notes.

It has been proverbial that the owners of rival flotation processes have been hopelessly irreconcilable when propositions were advanced for the amalgamation of interests and rights and the suspension of legal hostilities. It therefore comes as a surprise to find that the owners of the De Bavay patents on the one part and the owners of the Sulman-Picard-Ballot patents on the other part have buried the hatchet and agreed to a pooling of the royalties as far as Australasia is concerned. The new arrangement does not interfere in any way with the rivalry of the processes from a commercial point of view, and the businesses are not to be amalgamated. Briefly, a new company is to be formed in Australia to collect royalties. The Amalgamated Zinc (De Bavay's) takes 45% of the capital and Minerals Separation 55%. The chief users of the two processes are Amalgamated Zinc on the one hand and the Sulphide Corporation and Zinc Corporation on the other. These three will pay their royalties to the new company. It will be seen therefore that Minerals Separation will receive a profit from the De Bavay work, but on the other hand the De Bavay people will obtain a profit from the work done by the Minerals Separation process at the Sulphide Corporation and the Zinc Corporation. The reason why this settlement was made was that each side admitted that the other had an indisputable right to its particular processes. Minerals Separation had commenced an action against Amalgamated Zinc for infringement of their oil and bubble patents, but, on the other hand, Amalgamated Zinc had the option on the Potter hot-acid patent. Both sides are represented by strong and usually unyielding men, but even they had to admit that the force of circumstances was stronger than that of their own personalities. Hence the settlement. The combined interests are not yet absolutely free from legal trouble, because the appeal by the Elmores against the Minerals Separations' Australian judgment has not yet been heard by the Judicial Committee of the Privy Council in London. Until this judgment is rendered, I do not consider it advisable to review the flotation position created by the De Bavay-Minerals Separation agreement.

The progress in concentration practice at Broken Hill is well exemplified by the improvements recently introduced by W. E. Wainwright at the Broken Hill South Silver mine. With practically the same tonnage of ore and with no important difference in the amount or quality of the lead concentrate he has been able to increase the output of zinc tailing from 95,990 tons during the first half of 1911 to 123,969 tons during the second half, reducing the worthless tailing from 29,420 tons to 10,571 tons and the troublesome slime from 23,017 tons to 19,911 tons. The value of his work is made more obvious by saying that he now obtains 81½% of the zinc of the original ore in the zinc tailing instead of only 71% six months before. The improvement in this lead-mill may be fully appreciated when we remember that three years ago only 47% of the zinc of the ore was found in the zinc tailing. It is true that the more recent success of the plant is due to the Amalgamated Zinc, the company that treats this zinc tailing to produce the zinc concentrate, accepting a tailing containing a unit less of metal, but the fact that they are willing to do so goes to prove that their process, De Bavay's, is also improving in efficiency.

The troubles at the San Francisco del Oro mine at Parral, Chihuahua, seem never to end. The mine was introduced in England in 1903, and it contains argentiferous sulphides of lead and zinc. At first, the best ore was shipped to smelters, but in 1908 it was decided to erect a concentrating plant that would make it possible to beneficiate a much

larger amount of the ore. The plan was to sell the lead concentrate locally, and to ship the zinc middling to electric smelters in Sweden. The company was reconstructed in 1908 in order to provide the necessary additional capital. Recent reports show that operation has been hindered by the Mexican revolution, by the delay in completing the aerial tramway from the mine to the mill, and by faulty design of the new plant, especially the furnaces for roasting the zinc middling. During the four months, September to December, it was possible to concentrate some low-grade dump material. The aerial tramway has been completed since the end of the year. An interim arrangement has been made with the Cape Copper Co. for the roasting of the zinc middling at Britonferry, South Wales, but there is a prospect of the middling being sold in its raw state to the Swedish smelters in the course of a few months. Percy Tarbutt & Co. have resigned as consulting engineers, and Knox & Allen of New York have been appointed to succeed them. Until H. H. Knox's report on the mine is received, any proposal as to the modification of future policy is postponed.

The report of the Rio Tinto company, operating the premier copper mine of Spain, for 1911, shows a divisible profit of £1,093,939, which compares with £1,045,730 for 1910. The 5% preference shares received £81,250, and the ordinary shares £984,375, being at the rate of 52½%, as compared with 50% in 1910, and 60% in 1909. The average price of copper was £56 1s. 9d. as compared with £57 3s. 2d. in 1910. The extra profit for 1911 was presumably due to the continued increase in the sale of ore for sulphur content. The amount of copper ore mined during the year was 2,185,605 tons, averaging 2.144% copper, an increase of 38,840 tons; of this, 649,215 tons was selected for shipment, and 1,536,390 tons reserved for local treatment by smelting or leaching. The amount exported and invoiced for both copper and sulphur contents was 662,259 tons, as compared with 578,443 tons in 1910. In addition to the copper ore, a large amount of raw ore was exported for sulphur content alone. The report states that the deliveries of sulphur ore, both that which had been leached and the raw ore, totaled 841,964 tons, as compared with 683,505 tons in 1910, and 569,604 tons in 1909. The total copper brought to market as metal and content in pyrite was 33,385 tons. The production of copper at the mines during the year was 21,880 tons, as compared with 22,790 tons in 1910, and 24,364 tons in 1909. The report mentions that the use of machine-drills is being extended, and that the rainfall during the past winter has been excessive, the operations being to some extent hindered by storms and floods. An interesting innovation at the mine is the introduction of underground mining. For years the great open-cuts have been a wonder of the world, and the cost of removing overburden has advanced to the absolute limit. During the last few years millions of dollars have been spent from the reserve fund to make the workings safe. It is an open secret that the mine was threatened with total collapse from this cause. The introduction of mining by adit will therefore bring reassurance to those who were naturally anxious as to the future.

PIOCHE, NEVADA

THIRD INSTALLMENT OF HISTORY OF DISTRICT.—WOOLLEY'S RESIGNATION FROM NEVADA-UTAH.—DIFFICULTIES OF AMALGAMATED PIOCHE.—PRESENT CONDITIONS.

Just before the Day-Bristol Con. M. Co., the Pioche Pacific railroad, and the Mines & Smelters Corporation were launched, the Nevada-Utah, through E. R. Woolley, president, borrowed $90,000 on short-time notes from L. Vogelstein & Co., New York bankers, closely allied to the United States Metals Refining Co. The three new companies were no sooner formed than Woolley resigned all official connection with any of them, and the larger part of his holdings was transferred to L. Vogelstein & Co., which elected its own board of directors. G. Mead, a New York attorney, succeeded Woolley as president of Nevada-Utah and Amalgamated Pioche. The Nevada-Utah no longer held mines in this state, but had become solely a holding company. Entanglements followed rapidly, until all of what had been the Woolley interests became involved in a picturesque variety of snarls. First the notes for $90,000 became delinquent and the stock holdings of Nevada-Utah in the Consolidated Pioche were sold at auction, only $990 being realized. For the balance, $89,010, L. Vogelstein & Co. brought suit in attachment and tied up everything owned here by Nevada-Utah. This closed mine No. 1. No money had been forthcoming to meet the August payroll of the Amalgamated Pioche. Miners' liens had been filed and work continued. When the attachments were levied and No. 1 closed down, a new set of liens was filed. A little later an attorney for the Vogelsteins came and purchased from the holders the first set of liens, but did not take up the second set.

Soon after Mr. Woolley was elected president of Nevada-Utah and Consolidated Pioche, a bond issue of $500,000 was authorized. The bonds were not issued, but *ad interim* receipts for these bonds were hypothecated at a nominal figure. One of the first official acts of Mr. Mead was to publish a notice repudiating these receipts as being issued without authority. A Salt Lake bank had loaned the $25,000 required to pay the cash to the Godbes in their Ohio Kentucky stock transaction. This was not paid, and the Salt Lake bank brought suit to recover that, also involving the Nevada-Utah. Default was made on the note for $125,000 and suit brought to restrain the sale of the securities put up as collateral for that note. Also, as a further precaution, a receiver was asked and Herman E. Freudenthal was appointed receiver for the Pioche Pacific railroad, which he still operates under the supervision of the court. Woolley was indicted in New York. The Governor of Utah refused to surrender him, alleging that the indictment was a ruse to get him to New York and extort money, which should properly be recovered by civil proceedings. The financial ills of the Nevada-Utah having become hopelessly incurable, a receiver was appointed, and on January 15 of this year that once great company was adjudicated bankrupt in a New York court.

The latest news which comes from that city is to the effect that reorganization plans are nearly completed, that these plans involve a bond issue to be underwritten by strong financial interests, and provide ample money for all needs. The new company will be simply a holding company in Nevada. It will control Amalgamated Pioche, and the railroad, and be heavily interested in the Day-Bristol. Under these plans these companies are all to be financed, and the construction of the tunnel through the Bristol range provided for and immediately put through. At present the Pioche Pacific railroad is meeting its current expenses under the management of the receiver. The Day-Bristol, with W. F. Widdicombe, general superintendent, and James Bent, local superintendent of mining operations, is shipping about 500 tons of ore per week at a profit and paying off old obligations incurred during the Woolley regime. One of the assets of the Prince Consolidated consists of the tailing beds at Bullionville. Up to recently these were not available because no smelting company would purchase them at a profit. But when the International S. & R. Co. came into the market the entire ore situation in this district changed for the better. This company closed a contract with the Prince Consolidated for the tailing. Already from the tailing there has accumulated in the Prince treasury over $85,000, which is increasing at the rate of over $1000 per day. This solved the problem of financing the railroad spur to the Prince mine. That is now well advanced in construction. The International smelter has closed contracts with the Prince management for all classes of Prince ore, and the other smelters have shown a change of attitude highly exhilarating. The Godbes expect to be shipping soon from the Prince not less than 300 tons of ore per day. Thus the refuse of the old days has provided for the needs of the new, and from the waste of those days will be produced fortunes far eclipsing the profits of that phenomenal era.

General Mining News

ALASKA

The Innoko

Mushers passing through Fort Gibbon reported recently that the first stamp-mill of the Innoko district started operation in March. The mill has a capacity of 10 tons of ore per day.

Prince William Sound

Unusually rich ore has been discovered on the Ramsay & Rutherford property, according to a report from Valdez.

The Tanana

The Tanana Water & Power Co., recently incorporated under the laws of Arizona, with headquarters at Phoenix, has acquired from the Tanana Mines Co., through R. T. Harding, all of its water, water rights, and mineral lands. The company is capitalized at $7,000,000, in 1,400,000 shares of $5 par value. The company's holdings are in the Tatlanika district. B. H. Borland is president and J. Lindemann secretary of the new corporation. Webber & Co. have started sluicing on Esther creek. Philip McGuire reports finding many good prospects in the Beaver district.

ARIZONA

Cochise County

Outside interests recently purchased the balance of stock, amounting to $500,000, of the Empire Copper & G. M. Co., in the Cochise district. The present management will be retained, together with the consulting engineers, Ricketts & Banks.

Gila County

(Special Correspondence.)—W. H. Aldridge, managing director for the Inspiration Con. Copper Co., is at Miami. He states that sinking two 3-compartment, steel-concrete working shafts will be started in the near future, and that contracts will soon be let for the grading and excavation work for the 7500-ton concentrator and the necessary railroads. J. M. Callow, consulting metallurgist to the company, has returned and is supervising the tests that are being conducted in the experimental mill at the Inspiration mine. Representatives of several prominent manufacturers of concentrating machinery are at the mines awaiting the results of tests of their machines. They include A. R. Wilfley; E. J. O'Connel, representing the Deister company; C. I. Glassbrook, of the Mine & Smelter Supply Co.; and P. H. Craven, representing the Craven slime machine. Emil Deister, formerly of the Deister Concentrator Co., is conducting tests on his new slime-treating machine at the Miami and Old Dominion concentrators.

At the Southwestern Miami churn-drill hole No. 3 has been discontinued at a depth of 780 ft., as the string of tools was lost in the bottom of the hole and could not be recovered on account of caving of the ground. A small force of men is at work repairing the Copper Hill shaft of the Arizona Commercial mine. The work has now progressed to a point below the 300-ft. level.

Globe, April 27.

The Miami Copper Co. will pay an initial quarterly dividend of 50c. per share on May 15 to shareholders of record May 1.

Mohave County

The Tom Reed Jr. M. Co.'s shaft is down 160 ft. and has penetrated a vein of gold ore said to be as rich as the Tom Reed mine ore. D. T. Bently, of the owning company, and W. A. Davis, of the Tom Reed Gold Mines Co., with other stockholders, recently inspected the Tom Reed Jr. mine to plan future development.

On the 180-ft. level of the Oro Plata mine a 5-ft. vein of milling-grade gold ore has been intersected. On the adit-level ore assaying as high as 33% lead, and containing some silver and gold, recently was discovered.

Pinal County

The Magma company has discovered a 4-ft. vein of ore assaying as high as 72% copper and 50 oz. silver per ton, says a press despatch from Florence. James Neary is superintendent of the property.

H. J. Blaise is erecting a 2-stamp prospecting mill at his property, comprising four claims near the Reymert mill. He has a lease on the claims. It is reported that D. C. Jackling is having the Mohawk gold mine examined, and that he and associates may take over that and the Mammoth Collins properties.

Yavapai County

(Special Correspondence.)—The Copper Basin district, about ten miles west of Prescott, is being actively prospected again, owing to the proving of extensive orebodies on the properties of the Commercial M. Co., which is owned by the Phelps-Dodge interests. A railroad survey has been made, and it is said that construction will commence as soon as the contractors on the Verde Valley railroad can complete it and submit bids for the new road.

Darlington & Blickenstaff, of Prescott, have a good prospect in their group of claims in Copper basin. There is

YAVAPAI COUNTY, SHOWING COPPER BASIN.

reason to believe that they have an extension of the Commercial M. Co.'s orebodies. James Douglas, of Douglas; A. J. Pickrell, of the Commercial M. Co., of Prescott; G. E. Tenor, of the Calumet-Arizona M. Co.; and George Kingdon, superintendent of Old Dominion properties at Globe, have been at Jerome making an examination of the Little Daisy property. In the Arkansas & Arizona mine a drift from the 1200-ft. level is cutting a body of copper sulphide. The Verde Valley railroad has laid steel for fourteen miles out of Cedar Glade, and about three miles more will be laid this week. The road will be ready for use into the new smelter town below Jerome about October 1.

Prescott, April 29.

A. M. Horton has discovered ore assaying as high as $1000 per ton, according to newspaper reports, on his Ox Shoe claim in Copper basin. He is erecting a small smelter. A force under L. J. Hohl is prospecting placer ground in the Lynx creek hydraulic district. The Prescott Chamber of Commerce is arranging a permanent exhibit and information bureau regarding mining in the county.

CALIFORNIA

Butte County

The California Extraction Co. is about to construct a concentrator at Oroville for treating dredge-tailing.

Exceptionally rich ore is reported to have been found on the ranch of Mrs. Ida McCallum, on the Oroville-Quincy road, near Berry Creek. The discovery was made by a Swede in Mrs. McCallum's employ. Charles Willett, J. M. McClung, and John Kincaid have secured a lease on the mine. Water runs within 150 ft. of the discovery and there is plenty of timber nearby, according to reports.

Kern County

Reports from Randsburg state that Charles Phelps, of

Los Angeles, is planning to organize a company to develop placer claims near the Baltic property at Atolia. A process controlled by the Gold & Platinum Extraction Co. will be used. A small test-mill will be erected at once. A clean-up of 54 tons of ore from the Good Hope mine at the Red Dog mill recently resulted in a $2900 brick. The Good Hope shaft is now down 220 feet.

Los Angeles County

(Special Correspondence.)—A test run of the Kelley process for the elimination of sulphur from the gases of smelting was made today for the benefit of counsel for the Forest Service, representatives of the Bureau of Mines, and several well known metallurgists. About a ton of ore was smelted in a test lasting for several hours. Careful records of the experiment were made by those present, and while the results of the analyses have not yet been determined, the run showed that the process is not commercially feasible.

Los Angeles, April 30.

Mono County

A 10-stamp mill and cyanide equipment have been ordered for the Golden Gate mine, in Antelope valley, according to advices from Bridgeport. Hydro-electric power will be used for mine and mill. The property has free-milling gold ore.

Shasta County

(Special Correspondence.)—The Farmers' Protective Association has refused to take action on the proposition made by the Balaklala Copper Co. to compensate the grangers for any damage caused by smelter fumes. The company recently offered to set aside an indemnity fund of $250,000 for reimbursement of farmers suffering damage if the plant at Coram resumed activity. The fund was to be administered by a committee of three, consisting of Judge Morrow, of San Francisco, and representatives of the farmers and the Balaklala company. The refusal of the farmers to act on the offer means its virtual rejection. A movement has been set under way by some farmers to close the Mammoth smelter at Kennett, but opposition of other farmers, living nearer the smelter, promises to defeat the activities of the complainants. McCoy Fitzgerald, president of the association, stated no damage was being done to the vegetation on his farm, which is nearer the smelter than the lands of any other member.

W. E. Vallentine is arranging to develop gravel deposits west of Redding. A cross-cut and drift will be driven. Some of the gravel is said to run 35c. gold per foot. It is rumored the Mountain Copper Co. may install the Thiogen process at Keswick, if the Campo Seco experiments prove satisfactory in every respect. The company maintains shipments of high-grade ore from the Iron Mountain mine to the Martinez smelter, and is receiving some revenue by precipitating copper from the mine waters. In its Hornet mine the company has developed an estimated reserve of 3,000,000 tons. The ore is too low grade to justify its shipment to the Martinez or other distant reduction plants. Despite local rumors, nothing official has been given out.

Redding, April 29.

COLORADO

Clear Creek County

(Special Correspondence.)—A body of zinc 18 in. wide has been uncovered by Farragher & Co. on the Gambetta property. It assays about 54% zinc and 35 oz. silver per ton. The Mineral Chief mill has again been brought into commission after an enforced shut-down of three months. A. Swanson & Co., lessees at the Bellevue-Hudson mine, have cut an 8-in. streak of gray copper that assays 750 oz. silver and 3.50 oz. gold per ton. Driving is in progress. Trevillion & Burkholder have a lease on the Champion mine on Covode mountain. Stoping has been started and a 10-in. streak of $23 ore has been exposed. Seibert & Talley have resumed work upon the O. K. property in Lyon gulch. It is stated that work will soon be resumed on the Gold Fissure property, of which Willis Bristol is manager. The New System mill at Empire was started up last week and is now treating ore from the Mint mine. It is announced that operation will be resumed during the next 30 days on the property of the Waldorf Con. M. Co., for which C. L. Tingle is manager.

Georgetown, April 25.

Gunnison County

It is rumored that the Venture Corporation, of London, has about closed a deal for the Raymond, Gold Links, and other properties in the Ohio district. The report has not been confirmed.

San Juan County

It is reported that the Pokeepsie M. & R. Co., lessee of the Pokeepsie mine in Poughkeepsie gulch, will resume operation in the near future, and that a power-plant and mill will be erected. H. L. Damshroder, of Elmore, Ohio, is in Silverton for the company. The Bagley Tunnel Co. is about to commence the construction of a 150-ton Akron mill on its property near Animas Forks, according to a report from Silverton. Charles Gagner is manager for the company. The Telescope Mountain M. & M. Co. is preparing to resume development on its property at Chattanooga. M. A. Norton and H. C. Fisher, both of Colorado Springs, are in charge of the operations. The Ledge Consolidated property, of which Daniel McNaughton is manager, is being unwatered, preparatory to development.

San Miguel County

H. Baker, manager for the San Bernardo M. Co., stated recently that he has succeeded in financing the construction of a mill. The Colorado Vanadium Co., for which J. C. Simmons is manager, has purchased the National mill at Sawpit, and will remodel it for treatment of its ore. The Colorado Vanadium property is between Sawpit and Placerville.

Teller County (Cripple Creek)

It is rumored that the El Paso Con. G. M. Co. will announce regular quarterly dividends for the future. The Henry Adney G. M. Co. is cleaning and retimbering the shaft and has several drills operating. The Rex M. & M. Co. has acquired the Iron Clad, Pard, Magna Charta, Quartzite, and Annex claims, all on Globe hill, from the Rex Trading Co. The property formerly was owned by the Cripple Creek Homestake M. & M. Co., which now is defunct. Water has stopped work at the 1335-ft. level of the Cresson Con. G. M. Co.'s main shaft. Hodgins & Johnson, lessees on the Free Coinage G. M. Co.'s property, have intersected an ore-shoot assaying about $68 per ton. G. W. Davies has acquired by warranty deed from S. L. Duhart the Yosemite group of claims. The Vindicator Con. G. M. Co. on April 25 paid a dividend of 3c. per share. The dividend required the disbursement of $45,000.

The sump of the Last Dollar shaft is dry. While the shaft is down 1868 ft., water has stood above that level in the Vindicator mine. A plan has been suggested for draining the Vindicator and Golden Cycle shafts by driving a long cross-cut from one of the Portland shafts. At present the Golden Cycle and Vindicator are not benefited by the Roosevelt drainage adit. The Stratton's Independence mill is now treating about 10,000 tons per month of ore averaging about $3 per ton.

IDAHO

Blaine County

The Wilbert M. Co., Ltd., mill, it is reported, was started last Saturday, and soon will be running at full capacity, 150 tons per day. A. S. Ross is president of the company, which owns 15 claims in the Dome district. The property is about 40 miles from Arco.

Idaho County

The Last Chance mill is about ready for operation, and the mine is reported to be in good shape for production. The water is unusually late this season, but it is hoped that the Gold Scale placer mine can be started soon.

NEVADA

Esmeralda County

The Goldfield Con. Mines Co. has signed a contract with the International S. & R. Co. for the treatment of refractory ore discovered on the 950 ft. and 1000 ft. levels of the Clermont mine three years ago. The ore, which is not suited to the Consolidated mill, assays about 2½ oz. gold, 15 oz. silver, and 1% copper, and occurs in what is believed to be a 'kidney deposit.'

Humboldt County

(Special Correspondence.) The cross-cut from the 50 ft. shaft of the Bonanza M. Co.'s property has cut an orebody said to be 16 ft. wide. The ore contains silver sulphide and some gold. The property, generally known as the Shively, lies five miles north of Winnemucca. D. F. Shively is superintendent. McKenna & Newland recently shipped three tons of silver ore valued at about $500. Work in a small way has been resumed at the Baldwin group. A cross-cut is being extended from the adit to connect

CLERMONT SHAFT, GOLDFIELD CONSOLIDATED.

with a shaft in which some good silver ore has been opened. The Nevada Superior M. Co. is mining silver ore running over $200 per ton at Sulphur. The ore is largely from shallow surface workings. J. J. Anderson and James Brown are owners and John W. Geiger is general manager.

Winnemucca, April 26.

Lyon County

(Special Correspondence.)—The Mason Valley Mines Co.'s smelter at Thompson is treating about 700 tons of ore per day. About 350 tons is from the Mason Valley mines, and an almost equal amount from the Nevada Douglas property. Custom copper ore is being received from the Luning, Sodaville, and other districts. Stoping on adit No. 4 at the Mason Valley mines has been suspended, as sufficient ore is available to keep the plant running far beyond its capacity. It is rumored the second furnace of the smelter will probably be blown in before the end of summer. The Nevada Douglas Copper Co. has made the final payment of $100,000 on the Ludwig mine. It is understood the New Yerington is about to begin shipping. A vein of copper carbonate was recently found at the 225-ft. point. Duncan MacVichie is manager. It is rumored the Bluestone, controlled by Mr. Delamar, may resume operation. It is stated operation will be shortly resumed on the Yerington Malachite. Activity throughout the Yerrington and adjoining districts is increasing.

Yerington, April 26.

The New Yerington Copper Co. last week commenced shipping, sending one carload of ore to the smelter. It is said that regular shipments will be made. The Denver No. 2 shaft of the Baltimore M. & M. Co.'s property, Sunrise district, is down 200 ft., and is reported to have cut a 5-ft. vein assaying about $40 gold per ton. The property includes 19 claims.

Nye County

The production of the Tonopah district for the week ended April 27 is summarized as follows by the *Tonopah Miner*: "The Tonopah M. Co. sent 3150 tons, the Belmont Co. 1800 tons, the Montana Tonopah 1033 tons, the Tonopah Extension 1008 tons, the West End 750 tons, the Mac Namara 455 tons, and the North Star 40 tons, making the total production for the week 8236 tons of ore, valued at $205,900."

The report of the Tonopah M. Co. of Nevada for the year ended February 28 includes the following items:

Estimated ore reserves, tons	304,824
Ore treated, tons	174,685
Gross value	$3,503,255
Net earnings of mine and mill	1,763,018
Total net surplus	4,680,042
Dividends for the year	1,600,000
Total dividends paid to date	8,850,000

Storey County

The Ophir company last week started a new cross-cut on the 2100-ft. level, and advanced it 17 ft. Its face is in porphyry and seams of quartz. From development on the next level above, 175 tons of ore, averaging about $15, was saved. During the week 364 tons of second-class ore was shipped to the Kinkead mill. The Mexican mill was operated 55% of the time and crushed 269 tons of ore averaging about $26, with an apparent extraction of 91%. During development in the Mexican mine there was produced 154 tons of $29 ore, 105 tons of $24, and 52 tons of $21 ore. The Chollar company received, from the lessee of the company's croppings, $1000 royalty on the March production. The company engaged in the usual development. The Potosi received $484 royalty from a lessee. The water in the Yellow Jacket mill last Saturday stood 35½ ft. below the 1400-ft. station. The Yellow Jacket mill crushed during the week 472 tons of Crown Point ore. The usual activity marked the other Comstock properties.

Washoe County

The Pyramid M. Co. has taken over the holdings of the Pacific Con. Mines Co., which operated for about twenty years in the Pyramid district. Robert W. Parry, manager for the Pacific Con. Mines Co., will be manager for the new owners.

White Pine County

The Federal Ely company has levied an assessment of 1c. per share, payable May 8. The third boiler at the Ely Consolidated plant is now in place, and the mill is in better condition than it has been for some months.

Reports from Ely state that the United States Tungsten Corporation may resume operation of its holdings. The company was organized by Oscar Turner, who obtained an option on the claims from James Butler for the Tonopah M. Co. J. S. Austin, president of the Tonopah company, and J. E. Spurr recently inspected the property. The Tungsten company was in financial difficulty for some time, but it is reported to be in good condition at present.

NEW MEXICO

Grant County

The Chino Copper Co. report shows that up to the end of 1911, 2,000,000 cu. yd. of earth had been moved by the steam-shovels. Of this amount about 1,700,000 cu. yd. was waste, the remainder being oxidized copper ore. The average cost of steam-shoveling was 26c. per cubic yard. So far all ore sent to the mill has been oxidized, with correspondingly low recovery. By the middle of the year it is hoped average grade ore can be treated.

Socorro County

(Special Correspondence.)—At the Deadwood Mines in the past week 250 tons of ore was treated, which yielded 2000 lb. concentrate. The mine has been unwatered below the 300-ft. level and a new orebody has been opened on the 200-ft. level. Some of the best grade ore yet found in the Socorro mine is being taken from the bottom of the vertical shaft at a depth of 760 ft. During the week 670 tons of ore was milled by the Ernestine M. Co., with 57 sacks of concentrate. The lower tonnage was caused by mill repairs. The Pacific adit of the Oaks Co., 450 ft.

from the portal, passed through the oxidized zone into sulphide ore. Thirty-five tons was sent to the Deadwood mill from the week's development.

Mogollon, April 26.

UTAH

Grand County

The Utah Rare Metals Co., according to an announcement by W. B. G. Chadwick of Telluride, Colorado, will start shipping vanadium ore from its property near Cisco on May 10. The property is in the Castleton district.

Juab County

William Werret and H. T. Orton purchased the McIntyre mill dump ore from the Mammoth M. Co., and are having it treated at the Tooele smelter. It is reported that the price was 75c. per ton, and that some of the ore assays as high as $10 per ton. The vein of copper ore recently found on the 100-ft. level of the Opohongo has narrowed, but is still furnishing a fair amount of ore. Samuel Cox is superintendent of the property.

Tooele County

Salt Lake City reports state that three construction gangs are grading for the branch line to connect the Ophir district with the St. John station on the San Pedro railroad. The grading is to be completed by June 1, and the laying of the rails will require about 15 days. The Ophir Hill mill, owned by W. A. Clark, now having a capacity of 150 tons of ore per day, is to be enlarged to a capacity of 300 tons per day. It is reported that the plant now has 15,000 tons of concentrate ready for shipment. The Lion Hill Con. M. & M. Co., through having cheap power, is developing new ground. At the end of the Eastside adit an incline is being sunk to intersect the Chloride Point bedding.

CANADA

Ontario

(Special Correspondence.)—The Hollinger management reports that the headgear on the main shaft is in place and that the construction of the refinery has been started. In the mill the tube-mills are in place and the stamps have been set. No. 2 vein on the 200-ft. level has developed into a rich orebody. The McIntyre is proceeding with the construction of the mill. Twenty more stamps are being installed at present, and arrangements are being made for the addition of twenty more stamps. The mill returns show that 75% of the content is caught on the amalgamating plates and about all the remainder in the concentrate, the tailing running 40 to 60c. per ton. The fourth gold bar was shipped on Thursday, valued at $3170, and the fifth bar will be shipped on Tuesday. The cross-cut from No. 5 shaft at the 200-ft. level has cut the vein. The Vipond has commenced placing the machinery in the new mill today. The mill is to be in operation by May 20. The Hollinger Reserve has the shaft down 75 ft. and is installing a Rand C-2 air-compressor with a capacity of 585 cubic feet.

South Porcupine, April 22.

Yukon

(Special Correspondence.)—The consolidation of properties by A. N. C. Treadgold in a new company includes the holdings of the Canadian Klondike M. Co., known as the Boyle Concession, situated in the valley of the Klondike; the Bonanza basin, which joins the lower end of the Boyle Concession and runs thence along the Klondike valley to its confluence with the Yukon river; Last Chance creek, a tributary of Hunker creek; the Hunker Development Co., which includes Hunker creek above Gold Bottom; and the Granville Power Co., situated twenty-five miles up the Klondike river. This consolidation means another large company for the district. At present two dredges are employed on the Boyle Concession, one a 16-cu. ft. Marion, and the other a 7-cu. ft. Marion, both of which have good records. In addition to these dredges two new 16-cu. ft. Marion dredges have been ordered by the new company, with the intention of getting them to work this season. One will be placed on the Boyle Concession and the other on the Bonanza basin property. The Granville power plant will supply the necessary power for the four dredges and also for pumping water to the benches and hills of Last Chance creek for hydraulicking. It is understood that an auxiliary ditch is to be constructed this year, leading from the main Klondike river to a point on the North Fork of the Klondike slightly above the intake of the present ditch. Steam-shovels and other necessaries are now being hauled to the intake of the present ditch. Work will be started as soon as the frost leaves the ground.

The new company is known as the Canadian Klondike Co. Joseph Boyle, formerly president of the Canadian Klondike M. Co., is general manager, and Charles Boyle is resident manager. It is not known here who are interested in the company, nor where it was financed. With its equipment complete the company will be able to handle about 30,000 cu. yd. of gravel per day. The two dredges now in commission will begin work April 12, and will continue until some time in December, or for 240 days. The full equipment will no doubt dredge 6,500,000 cu. yd. per year. Present indications point to an early spring, and no doubt the eight dredges of the Yukon Gold company will get an early start. They are now undergoing the usual spring overhauling and will soon be ready for active work. All thawing plants have been busy for some time preparing the ground. The outlook for a successful season is bright, and this year's gold output should exceed that of last.

Dawson, April 9.

The financial statement of the Yukon Gold Co., submitted to the stockholders with the annual report, for the year ended December 30, 1911, is as follows:

Assets

Property and investments (including organization expenses and surveys)	$12,163,412.52
Equipment (cost of ditches, dredges, and pipe-lines)	6,495,481.33
Deferred charges (operating expenses, stripping and temporary equipment, applicable to future work)	559,456.62
Supplies and materials	605,063.45
Accounts collectable (including advances to subsidiary companies)	321,985.12
Cash	101,500.11
	$20,246,899.15

Liabilities

Capital stock	$17,500,000.00
Guggenheim Exploration	1,798,159.57
Bills and accounts payable	127,947.24
Depreciation	434,108.24
*Surplus	386,684.10
	$20,246,899.15

*Surplus after dividend December 30.

MEXICO

Chihuahua

(Special Correspondence.)—Operation at La Republica M. Co. property for the quarter-year ended March 31, was as follows: ore milled, 2683 tons; production, ₱173,775; operating charges, ₱129,560; construction and equipment charges, ₱21,691.

Operation was greatly hampered and restricted by insufficient mining labor, and the other handicaps brought about by the revolutionary troubles.

Chihuahua, April 25.

Mexico Petroleum Co., Ltd., of Delaware, and Tampico, Mexico, will pay a quarterly dividend of 1% on common stock on May 24 to shareholders of record April 30.

Jalisco

(Special Correspondence.)—Owing to attacks on trains near Irapuato, Guanajuato, the Mexican Express Co., on April 18, notified its agents not to receive valuables for transportation over the line between Guadalajara and Irapuato. This affects the Amparo M. Co., the Mololoa company, the Espada M. Co., and the Lupita M. Co. The

Amparo company will either forward bars in a special car with its own guard, as was done during the revolution of a year ago, or try the method of sending by steamer to San Francisco.

Guadalajara, April 28.

Among the Copper Mines

COPPER IMPORTS, including ore and manufactures, according to figures of the Bureau of Statistics, Department of Commerce and Labor, for the nine months ended with March, amounted to $31,500,000, and exports to $86,000,000, the aggregate movement being $117,500,000. The growth of copper imports and exports of the United States for decennial periods is shown by the following table:

Fiscal year.	Copper imports. (Millions of dollars.)	Copper exports.
1882	0.6	0.7
1892	1.1	13.2
1902	25.0	43.8
1912	40.0	110.0

UTAH COPPER'S report for the year ended December 31, 1911, includes the following items:

Net operating profit	$4,501,000
Other income	1,766,995
Total income	$6,268,895
Interest charge	30,966
Balance	$6,237,929
Dividends	4,703,022
Surplus	1,534,907
Previous surplus	3,696,539
Total surplus	5,231,446
Written off	2,500,000
Final surplus	2,731,446

Copper produced, 93,514,419 lb., sold at 12.6463c.; gold produced, 40,202,916 oz., sold at $20; silver produced, 366,906.96 oz., sold at 53 cents.

RAY CONSOLIDATED, in the period from April 1911, when production was commenced, until the end of the year, produced 14,935,447 lb. copper, which it sold for 13c., with a profit of $147,545. The cost of production during this period was 10¾c. per pound. The company began delivery of concentrate to the new smelter at Hayden on February 12, and for March the cost was, approximately, 9½c. per pound. Had the company been able to have delivered its concentrate to the new smelter at the beginning of production, its cost would have averaged 9.33c. per pound. The results so far have also been attained from an ore considerably below the average grade of the mine. The ore shipped up to the end of the year, 681,000 tons, averaged 1.83% copper. The average grade of the 77,314,470 tons developed is 2.17%. Owing to the comparatively low grade of ore treated, though it is checked closely with the drill-hole results at the points from which it was extracted, and owing to the adjustments always necessary in the starting of a new plant, the recovery was necessarily rather low—63.1%. During the month of February 1912 the recovery had been brought up to over 70% on ore averaging over 1.68% copper. The tonnage treated per unit has also been gradually increased and at times averaged over 1100 tons per day, or at the rate of about 9000 tons for the complete plant of eight units.

"There appears no question whatever about the ability of the property to produce copper at 8c. per pound when running on full tonnage and on a normal grade of ore," says the annual report. "As a matter of fact, if we were now running on a 2% ore and making no greater percentage in recovery than at present and experiencing the same costs per ton that now apply to operation at less than one-half our mill capacity, our costs per pound would be less than 8¼ cents."

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

A. E. WHEELER is in California.

E. A. AUSTIN is at Iditarod, Alaska.

M. W. KREJEI is in southern California.

CHARLES M. SCHWAB is in San Francisco.

G. W. METCALFE has been at Los Angeles.

J. MORGAN CLEMENTS has been in Chicago.

J. E. SPURR was in San Francisco Wednesday.

A. C. VEATCH was in San Francisco last week.

E. H. NUTTER has returned from British Columbia.

E. H. BENJAMIN has gone to Cripple Creek, Colorado.

C. H. MUNRO is in San Francisco on his way to Dawson.

C. H. MACNUTT will arrive in London at the end of May.

GEORGE K. EDLER, of Goldfield, has been in San Francisco.

L. J. PFEFFERBERG has returned from Lincoln, Nebraska.

J. R. FARRELL has been in Tonopah and Goldfield this week.

T. T. READ and F. G. COTTRELL were in Los Angeles this week.

WILLIS LAWRENCE will sail for Kobe, on the *Korea*, May 11.

CHARLES DUCHENAU was in San Francisco this week from Tonopah.

VICTOR VON GROT sailed from New York for London last Saturday.

W. W. MEIN and C. W. MERRILL have returned from Porcupine.

JAMES N. WHITMAN is investigating iron ores on the Pacific Coast.

J. S. WILBUR left for South America by way of New York this week.

A. J. EVELAND was in San Francisco on the way from Arizona to Utah.

J. W. MALCOLMSON left Kansas City for El Tigre, Sonora, last Monday.

E. M. RABB has undergone an operation for appendicitis in St. Luke's hospital, Denver.

W. G. ANDERSON, formerly of Zacatecas, is now with the Golconda Mining Co., Golconda, Arizona.

D. L. H. FORBES has been appointed consulting engineer for the Trethewey Silver-Cobalt Mine, Limited.

W. R. INGALLS gave the address at the annual commencement of the Michigan College of Mines, April 18.

FREDERICK G. CLAPP has recently been making geological examinations in Monongalia county, West Virginia.

OLIVER B. FINN is on mining business at Radium, Grand county, Colorado, a station on the new 'Moffat' railroad.

L. D. HUNTOON, BRADLEY STOUGHTON, and A. H. ELLIOTT have joined in the formation of an engineering firm.

E. M. HAMILTON has returned from Taviche, Oaxaca, Mexico, and is on his way to England for a vacation of two or three months.

J. F. CALLBREATH is representing the American Mining Congress at Washington and has established a temporary office at 602 Munsey building.

H. B. KAEDING has been visiting the Canal Zone, and is now at New Orleans to purchase a new mill for the Siempre Viva Mining Co. of Nicaragua.

R. P. MCLAUGHLIN has opened an office in the Mills building, San Francisco, and will engage in a general consulting practice in mining geology and mining engineering.

BAILEY WILLIS has completed the geological survey from San Carlos de Bariloche, in Argentina, to the Chilean frontier, which he has been making under the auspices of the Argentina government.

Market Reports

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	May 1.
Camp Bird Ltd	$ 7
El Oro	4
Esperanza	8
Oroville Dredging	1 1/16
Santa Gertrudis	7 1/2
Tomboy	6

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, May 1.		Closing Prices May 1.
Adventure	$ 8 1/8	Mohawk	$ 64
Allouez	44	North Butte	28 1/2
Calumet & Arizona	72	Old Dominion	53 1/4
Calumet & Hecla	489	Osceola	116
Centennial	25	Quincy	89
Copper Range	61 1/4	Shannon	13 1/2
Daly West	5 1/2	Superior & Boston	2 3/4
Franklin	12 3/4	Tamarack	43
Granby	57	Trinity	7 1/2
Greene Cananea, ctf.	8 3/4	Utah Con	13 3/4
Isle-Royale	26 1/2	Victoria	4 3/4
La Salle	7	Winona	6
Mass Copper	7 1/4	Wolverine	109 1/4

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, May 2.

Atlanta	$ .26	Mayflower	$ .03
Belcher	.55	Mexican	3.42
Belmont	10.25	Midway	80
B. & B.	.15	Montana-Tonopah	3 40
Booth	.11	Nevada Hills	2.10
Chollar	.08	Ophir	1.47
Combination Fraction	.16	Pittsburg Silver Peak	1.42
Con. Virgina	.79	Round Mountain	.50
Florence	.75	Savage	.15
Goldfield Con.	4.25	Tonopah Extension	2.25
Gould & Curry	.08	Tonopah of Nevada	7.50
Jim Butler	.67	Union	1.20
Jumbo Extension	.49	Vernal	.15
MacNamara	.26	West End	2.27

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, May 2.

Associated Oil	$45.00	Palmer Union	$ .29
Brookshire	.64	Premier	.50
Caribou (New Stock)	1.20	P. S. Petroleum	.16
Claremont	.60	Republic	.35
Coalinga National	.15	Silver Tip	.90
De Luxe	.75	Sauer Dough	1.10
Empire	1.17	Sterling	1.42
Enos	.03	S. W. & B.	.20
Maricopa 36	.64	Turner	.75
Midway Premier	.45	Union	100.37
Monte Cristo	1.37	United Oil	.25
Palmer	.60	W. K. Oil	2.00

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. May 1.		Closing Prices. May 1
Amalgamated Copper	$ 82 1/8	Miami Copper	$ 25
A. S. & R. Co	86 1/4	Mines Co. of America	3
Braden Copper	5 1/4	Nevada Con	22 1/2
B. C. Copper Co	5 1/4	Nipissing	7 1/8
Chino	29 1/8	Ohio Copper	1 1/4
First National	3 1/4	Ray Con	19 7/8
Giroux	5 3/4	Tenn. Copper	42
Goldfield Con.	4 1/4	Tonopah Belmont	10 1/2
Greene-Cananea	8 7/8	Tonopah Ex	2 1/4
Hollinger	12 1/4	Tonopah Mining	7
Inspiration	19 1/4	Trinity	8
Kerr Lake	2 7/8	Tuolumne Copper	3 3/8
La Rose	3 3/8	Utah Copper	63
Mason Valley	12 1/4	West End	2 1/4
McKinley-Darragh	1 3/8	Yukon Gold	3 3/8

ASSESSMENTS ON COMSTOCK MINES.

Company	No.	Del. Board	Sale Day	Amt.
Hale & Norcross	29	Apr. 11	May 3	.05
Gould & Curry	22	Apr. 16	May 10	.05
Con. Virginia	20	Apr. 20	May 15	.20
Bullion	23	Apr. 26	May 20	.05
Con. Imperial	75	Apr. 28	May 23	.01
Union Con.	29	May 7	May 31	.15
Julia Con.	19	May 9	June 5	.05
Caledonia	86	May 17	June 11	.10
Exchequer	22	May 21	June 13	.05
Andes	76	May 25	June 18	.05
Savage	24	May 25	June 26	.10
Alpha Con.	18	May 26	June 19	.05

LOCAL METAL PRICES

San Francisco May 2.

San Francisco is not a primary market for the common metals except quicksilver. The prices quoted below therefore represent sales of small lots and are not such as an ore-producer could expect to realize. Ore contracts usually call for settlements on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksilver, which is quoted in dollars per flask of 75 pounds.

Antimony	11—11 1/2c	Quicksilver (flask)	41.50
Electrolytic Copper	16 1/4—16 1/2c	Tin	47—48 1/4c
Pig Lead	4.45—5.40c	Spelter	7 1/4—7 3/4c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, May 2.—Trading in metals has remained quiet in New York the past week, and prices of all the standard metals are steady. Average daily prices in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
April 25	15.75	4.20	6 73	60 3/8
" 26	15.70	4.20	6.73	60 3/8
" 27	15.70	4.20	6.73	60 3/8
" 28	Sunday.	No market.		
" 29	15.70	4.20	6.70	60 1/2
" 30	15.70	4.20	6.70	61 1/4
May 1	15.70	4.20	6.70	61 1/4

SILVER

Below is given the average New York quotation, in cents per ounce, of fine silver for the months indicated:

	1911.	1912.		1911.	1912.
Jan.	53.81	56.25	July	52.57	....
Feb.	52.23	59.06	Aug.	52.17	....
Mch.	52.76	58.37	Sept.	52.43	....
Apr.	52.32	59.04	Oct.	53.37	....
May	53.31	....	Nov.	55.77	....
June	53.04	....	Dec.	54.85	....

COPPER

Daily quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Below are average monthly quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	12.29	14.09	July	12.47	....
Feb.	12.26	14.08	Aug.	12.41	....
Mch.	12.14	14.68	Sept.	12.20	....
Apr.	12.02	15.75	Oct.	12.19	....
May	11.99	....	Nov.	12.61	....
June	12.39	....	Dec.	13.55	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months.

		U. S.	European.
January	1910	141,766,111	244,961,280
January	1911	122,030,195	230,264,280
September	"	133,441,501	191,215,360
October	"	140,894,856	191,945,600
November	"	134,997,642	176,816,640
December	"	111,785,188	164,151,680
January	1912	89,454,695	178,329,920
February	"	66,280,643	153,820,800
March	"	62,939,988	141,125,680
April	"	62,367,557	137,806,000

UNITED STATES PRODUCTION AND CONSUMPTION

(Compiled from reports of the Copper Producers' Association)

	Production.	Domestic deliveries.	Exports.
April, 1911	118,185,223	52,407,650	62,129,599
May	126,962,544	64,543,963	61,078,557
June	124,554,312	61,655,561	71,460,519
July	112,167,934	56,982,582	74,380,658
August	125,493,667	59,935,364	69,885,660
September	115,588,950	57,311,584	50,824,011
October	118,255,442	64,068,656	60,084,349
November	111,876,601	68,039,776	67,049,279
December	122,896,697	65,988,474	79,238,716
Total for 1911	1,431,938,338	709,611,945	754,932,733
January 1912	119,337,753	62,343,901	80,167,904
February	116,035,809	56,228,368	63,148,096
March	125,694,601	67,847,556	58,779,566

LEAD

Lead is quoted ordinarily in cents per pound or dollars per hundred pounds delivered at St. Louis or New York. The difference is normally 15c. per hundred pounds, and any larger or smaller difference is promptly met by sales. The daily price in New York is published each week in this column. Below are the average quotations by months:

	1911.	1912.		1911.	1912.
Jan.	4.48	4.43	July	4.50	....
Feb.	4.44	4.03	Aug.	4.50	....
Mch.	4.39	4.07	Sept.	4.48	....
Apr.	4.41	4.20	Oct.	4.27	....
May	4.37	....	Nov.	4.30	....
June	4.34	....	Dec.	4.45	....

ZINC

Zinc is quoted as spelter, standard Western brands, and based upon St. Louis or New York delivery. While New York quotations, as a matter of convenience, are commonly used, relatively little spelter actually goes to or comes from New York. The bulk is shipped direct from the plants in the Mississippi Valley to manufacturers, due allowance being made for freight. New York daily quotations are published in this column each week. Below are given averages by months:

	1911.	1912.		1911.	1912.
Jan.	5.45	6.42	July	5.70	....
Feb.	5.52	6.50	Aug.	5.95	....
Mch.	5.56	6.57	Sept.	5.86	....
Apr.	5.40	6.63	Oct.	6.10	....
May	5.35	....	Nov.	6.38	....
June	5.50	....	Dec.	6.30	....

Zinc-dust is quoted separately, the price being based upon the cost of spelter in Illinois and the cost of preparation. About half the zinc-dust used in the United States is imported through San Francisco. Delivery prices are determined largely by quantities and contracts.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average monthly quotations in dollars per flask of 75 lb., are given below:

	1911.	1912.		1911.	1912.
Jan.	44.60	43.75	July	48.00	....
Feb.	48.40	46.00	Aug.	50.00	....
Mch.	52.50	46.00	Sept.	47.50	....
Apr.	50.90	42.25	Oct.	46.12	....
May	46.50	....	Nov.	45.50	....
June	46.50	....	Dec.	44.50	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations, averaging about 5c. per lb. higher than New York, are quoted weekly in this column. Below are given average monthly New York quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	41.25	42.53	July	42.40	....
Feb.	41.61	42.96	Aug.	43.32	....
Mch.	40.16	42.58	Sept.	39.75	....
Apr.	42.18	43.30	Oct.	41.18	....
May	43.11	....	Nov.	43.12	....
June	44.61	....	Dec.	44.65	....

Current Prices For Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ℔ 100 lb	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ℔ 100 lb	1.00	1.50
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ℔ lb	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ℔ lb	0.09½	0.12
Acid, muriatic, com'l, carboy, ℔ 100 lb	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ℔ lb	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ℔ lb	0.10½	0.15
Acid, nitric, com'l, carboy, ℔ 100 lb	5.25	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ℔ lb	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ℔ lb	0.12½	0.15
Argols, ground, bbl., ℔ lb	0.20	0.25
Borax, cryst. and conc., bags, ℔ 100 lb	2.75	3.85
Borax, powdered, bbl., ℔ 100 lb	3.00	4.00
Borax glass, gd. 30 mesh, cases, tin lined, ℔ 100 lb	10.00	13.00
Bone ash, 60 to 80 mesh, bbl., ℔ 100 lb	4.50	5.50
Bromine, 1-lb. bottle, ℔ lb	0.55	0.65
Candles, adamantine, 12 oz., 40 sets, ℔ case	3.50	4.15
Candles, adamantine, 14 oz., 40 sets, ℔ case	4.00	4.55
Candles, Stearic, 12 oz., 40 sets, ℔ case	4.95	5.50
Candles, Stearic, 14 oz., 40 sets, ℔ case	4.65	5.20
Clay, domestic fire, sack, ℔ 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, ℔ lb	0.20½	0.24½
Cyanide, 98 to 100%, 200-lb. case, ℔ lb	0.20	0.24
Cyanide, 128%, 100-lb. case, ℔ lb	0.27½	0.28½
Cyanide, 128%, 200-lb. case, ℔ lb	0.26½	0.27½
Lead acetate, brown, broken casks, ℔ 100 lb	8.75	9.65
Lead acetate, white, broken casks, ℔ 100 lb	10.00	10.25
Lead acetate, white, crystals, ℔ 100 lb	11.75	12.25
Lead, C. P., test., gran., ℔ 100 lb	13.00	15.00
Lead, C. P., sheet, ℔ 100 lb	15.00	18.00
Litharge, C. P., silver free, ℔ 100 lb	10.50	13.00
Litharge, com'l, ℔ 100 lb	7.50	9.00
Manganese ox., blk., dom. in bags, ℔ ton	20.00	23.00
Manganese ox., blk., Caucasian, in casks, ℔ ton (85% MnO_2—½% Fe)	42.50	50.00
Nitre, double ref'd, small cryst., bbl., ℔ 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., ℔ 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., ℔ 100 lb	7.25	8.00
Potassium bicarbonate, cryst., ℔ 100 lb	12.00	15.00
Potassium carbonate, calcined, ℔ 100 lb	15.00	18.00
Potassium permanganate, drum, ℔ lb	0.11	0.12½
Silica, powdered, bags, ℔ lb	0.03	0.05
Soda, carbonate (ash), bbl., ℔ 100 lb	1.50	1.75
Soda, bicarbonate, bbl., ℔ 100 lb	2.00	2.50
Soda, caustic, ground, 98%, bbl., ℔ 100 lb	3.15	3.50
Soda, caustic, solid, 98%, drums, ℔ 100 lb	2.65	2.85
Zinc shavings, 850 fine, bbl., ℔ 100 lb	11.80	13.00
Zinc sheet, No. 9—18 by 84, drum, ℔ 100 lb	10.00	11.25

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, ℔ ton	*$20.00	$22.50
Arsenic, white, refined, ℔ lb	0.03½	0.04
Arsenic, red, refined, ℔ lb	0.08	0.09
Asbestos, according to length and quality of fibre, ℔ ton	100.00	350.00
Asbestos, lower grades, ℔ ton	5.00	50.00
Asphaltum, refined, ℔ ton	15.00	20.00
Barium carbonate, precipitated, ℔ ton	42.50	45.00
Barium chloride, commercial, ℔ ton	42.50	45.00
Barium sulphate (barytes), prepared, ℔ ton	20.00	30.00
Bismuth ore, 10% upward, ℔ ton	*75.00	upward
Chrome ore, according to quality, ℔ ton	10.00	12.50
China clay, English levigated, ℔ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ℔ lb	2.50	
Coke, foundry, ℔ 2240 lb	13.50	15.00
Diamonds:		
Borts, according to size and quality, ℔ carat	2.00	15.00
Carbons, according to size and quality, ℔ carat	50.00	00.00
Feldspar, ℔ ton	5.00	25.00
Firebrick:		
Bauxite, ℔ M	175.00	
Magnesite, ℔ M	190.00	275.00
Silica, ℔ M	42.50	47.50
Flint pebbles for tube-mills, ℔ 2240 lb	16.50	22.50
Fluorspar, ℔ ton	10.00	15.00
Fullers earth, according to quality, ℔ ton	20.00	30.00
Gilsonite, ℔ ton	35.00	40.00
Graphite:		
Amorphous, ℔ lb	0.01½	0.02½
Crystalline, ℔ lb	0.04	0.13
Gypsum, ℔ ton	7.50	10.00
Infusorial earth, ℔ ton	10.00	15.00
Magnesite, crude, ℔ ton	5.00	7.50
Magnesite, dead calcined, ℔ ton	23.50	27.50
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ℔ ton	10.00	25.00
Manganese, prepared, according to quality, ℔ ton	30.00	70.00
Mica, according to size and quality, ℔ lb	0.05	0.30
Molybdenite, 95% MoS_2, ℔ ton	400.00	500.00
Monazite sand (5%thoria), ℔ ton	150.00	200.00
Nickel metal, refined, ℔ lb	0.45	0.60
Ochre, extra strength, levigated, ℔ 100 lb	2.25	3.25
Platinum, native, crude, ℔ oz	40.00	45.00
Sulphur, crude, ℔ ton	15.00	25.00
Sulphur, powdered, ℔ ton	40.00	45.00
Talc, prepared, according to quality, ℔ ton	20.00	50.00
Tin ore, 60%, ℔ ton	450.00	475.00
Tungsten ore, 65%	390.00	455.00
Vanadium ore, 15%, ℔ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, ℔ ton	*15.00	20.00

Mine	Location	Controlling Parties	General Office	1911 Production Lbs.	Cost 1911	Production Lbs., 1912 or with plants to capacity	Est. Cost 1912	No. of Shares Issued	Par Value	Mine	EST. EARNINGS PER SHARE Based on 1912 or ultimate prod. 12Cts.	13Cts.	14Cts.	15Cts.	16Cts.	17Cts.	High 1907		STOCK QUOTATIONS 1908		1909		1910		Low 1911		Date and Amount Last Dividend
																	H	L.	H	L.	H	L.	H	L.	H	L.	
Amalgamated Copper	Butte, Mont.	Standard Oil	New York	100,000,000	—	220,000,000	—	1,538,879	$100	Amalgamated Copper	$4 80	$6.24	$7.70	$9.10	$10.50	$11 90	82¼	41¼	88¼	45¼	96¼	65	90¼	85¼	71¼	44	50c. Q. Feb 26, '12
Ahmeek	Calumet, Mich.	Calumet & Hecla	Boston	15,196,147	7 1-5	22,000,000	7	50,000	25	Ahmeek	22 60	26 40	30 80	35 20	39 60	44.00	120	45	135	52	235	145	225	140	250	148	$4.00 Apr. 6, '12
Allouez	Calumet, Mich.	Calumet & Hecla	Boston	4,720,194	13¼	10,000,000	10	100,000	25	Allouez	2 00	3 00	4 00	5 00	6 00	7.00	74¼	19	11¼	2¼	62	34	58	31	45	21	
Anaconda Copper	Butte, Mont.	Amalgamated	New York	250,000,000	9¼	300,000,000	9¼	4,332,500	25	Anaconda Copper	1 90	2 59	3.29	3 98	4 67	5 36	75¼	25¼	53¼	27¼	54¼	37¼	54	33¼	41¼	29	50c. Q. Apr. 17, '12
Arizona Copper	Clifton, Ariz.	South Int's	Scotland	31,500,000	8 3-5	43,000,000	8	2,916,016	£5	Arizona Copper	.58	.73	.87	1.02	1 17	1.32									2 11-16	1¼	1s 3d. S.A. Jan. 25
Bolco Copper	Mexico	Rothschilds	Paris	27,500,000	9	27,500,000	9	120,000	100	Bolco Copper	6 90	9 20	11.50	13 80	16.10	18.40	Stock closely held; quotations not available										
Braden Copper	Chile, S. A.	Guggenheims	New York		—	36,000,000	7.4	2,000,000	5	Braden Copper	.64	.78	.92	1 06	1.20	1 34					5 7-16	5¼	5¼	3¼	6	3 11-16	
British Columbia	Greenwood, B. C.	Newman Erb	New York	8,468,357	•	10,000,000	9¼	591,709	5	British Columbia	.42	.59	.76	.93	1 20	1.47	14¼	3¼	8¼	3¼	9	5¼	8¼	4¼	7¼	3¼	12½c. Q. June 1, '11
Butte-Balaklava	Butte, Mont	Duluth Ints	Duluth		•		—	250,000	10	Butte-Balaklava	—	—	—	—	—	—		11	8	15¼	15	18¼	4¼	6¼	3	50c. Q. Aug. 1, '10	
Calumet & Hecla	Calumet, Mich	Agassiz-Shaw	Boston	75,145,000	8¼	75,000,000	8¼	100,000	25	Calumet & Hecla	26 25	33 75	41 25	48.75	56 75	61.75	1000	535	700	765	995	585	985	500	545	360	$8.00 Q. Mar. 22, '12
Calumet & Arizona	Bisbee, Ariz.	Calumet & Pitts. Ints.	Calumet	49,945,905	7¼	60,000,000	7	628,552	10	Calumet & Arizona	4 77	5 73	6 68	7 64	8 60	9.55	108	89	130	93	119	96¼	103	41¼	63	45	$1.00 Q. Mar. 25, '12
Centennial	Houghton, Mich.	Calumet & Hecla	Boston	1,193,834	12 3-5	1,500,000	12	90,000	25	Centennial	—	16	33	49	.66	.83	47	15	36¼	21	44¼	29	38	13¼	19	8	
Cerro de Pasco	Peru, S. A.	Haggin-Hearst-Morgan	New York	44,325,000	8	55,000,000	8	100,000	100	Cerro de Pasco	22 00	27 50	33 00	38 50	44 00	49.50	Stock closely held; quotations not available.										
Chino Copper	New Mexico	Hayden, Stone	New York		—	55,000,000	7¼	870,000	5	Chino Copper	2 85	3.48	4.12	4 74	5 38	6.01					13	6	25¼	9¼	27¼	16¼	
Copper Range	Houghton, Mich.	W. A. Paine	Boston	31,200,000	9	33,000,000	8¼	393,445	100	Copper Range	2.73	3.57	4.42	5 25	6.10	6.95	105	44¼	85¼	55	86¼	68¼	85	58	69¼	46¼	50c. Q. Apr. 2, '12
East Butte	Butte, Mont.	W. A. Paine	Boston	12,400,000	9	16,000,000	8	300,000	10	East Butte	1.86	2.40	2.94	3 40	4 00	4 54	18¼	4	10	8¼	16¼	7¼	14	6¼	14¼	8¼	
First National	Shasta Co., Cal.	Guggenheims	New York	2,535,158	•	10,000,000	10¼	600,000	5	First National	.25	.42	.58	.75	.92	1.09	12¼	1¼	3¼	1¼	4¼	2¼	6¼	1 15-16	2¼	1	
Franklin	Houghton, Mich.	S. R. Dow	Boston	820,200	—	6,000,000	12	186,686	25	Franklin	—	.36	.72	1.08	1 44	1.80	29¼	6	19¼	6¼	19	13	22¼	9	14	5¼	
Giroux Con.	Ely, Nevada	Cole-Ryan	Duluth		—	12,000,000	9¼	1,500,000	5	Giroux Con.	.20	.28	.36	.44	.52	.60	10¼	2¼	7¼	2¼	12¼	6¼	12¼	6	8¼	3¼	
Granby Con.	Phoenix, B. C.		New York	10,501,706	•	24,000,000	10¼	148,495	100	Granby Con.	2.42	4 02	5 63	7.24	8.85	10.46	152	60	109¼	78¼	110¼	91	111¼	20	43¼	26	$1.00 Dec. 30, '10
Greene Can	Cananea, Mex.	Cole-Ryan	New York	45,247,218	10¼	55,000,000	9	2,480,012	20	Greene Can	66	88	1.10	1.32	1 54	1 76	25¼	5¼	13¼	6¼	14¼	9	11¼	6¼	8¼	5 9-16	25c. Mar. 1, '12
Inspiration Con.	Globe, Ariz.	Thompson-Ryan	New York		—	75,000,000	8	965,024	20	Inspiration Con.	3.11	3 88	4.67	5.43	6 22	7.00					9 9-16	5	10¼	6¼	10¼	5¼	
Isle Royale	Houghton, Mich.	Calumet & Hecla	Boston	7,400,120	10 8-10	10,000,000	10	150,000	25	Isle Royale	1.33	1 99	2.66	3 33	3.99	4.65	36¼	11¼	26¼	17¼	33¼	22¼	28¼	13¼	23	11¼	
Lake Copper	Ont'n'gon Co., Mich.	W. A. Paine	Boston		—	3,500,000	10	100,000	25	Lake Copper	.70	1.05	1.40	1 75	2.10	2.45	8	4	24¼	10	74¼	16	94¼	28¼	40	21¼	
Mason Valley	Mason, Nevada	Gunn-Thompson	New York		-	15,000,000	—	254,000	5	Mason Valley	—	—	-	—	—	—					3 5-16	¼	11¼	6¼	12	6¼	
Miami Copper	Globe, Ariz.	General Dev. Co.	New York	15,758,840	•	40,000,000	8	718,235	5	Miami Copper	2.13	2 67	3.20	3.74	4 27	4.80			18¼	8¼	28¼	12¼	29	17	20¼	18¼	50c. Q. May 15, '12
Mohawk Copper	Calumet, Mich.	Stanton Ints.	New York	12,291,056	10 2-5	15,000,000	10	100,000	25	Mohawk	2 60	3.90	5.20	6 50	7.80	9.10	97	37	73	45	70¼	57¼	75	43	57	36	$1.00 S.A. Feb. 1, '12
Nevada Con.	Ely, Nevada	Utah Copper Co.	New York	63,000,000	7	70,000,000	7	1,998,762	5	Nevada Con	1 75	2 10	2 45	2.80	3.15	3.50	20¼	6	20¼	8¼	30	16¼	27¼	17¼	21¼	15	37½c. Q. Mar. 30, '12
North Butte	Butte, Mont.	Cole-Ryan	New York	24,000,000	9¼	30,000,000	9	410,000	15	North Butte	2.20	2 93	3.66	4 38	5.13	5 88	120	30	89¼	40¼	85¼	47	50	18	36¼	20	40c. Q. Apr. 20, '12
Ohio Copper	Bingham, Utah	F. Aug. Heinze	New York	7,500,000	10	11,000,000	9¼	1,385,470	10	Ohio Copper	20	28	.36	.44	.52	60			5¼	2¼	8¼	3 15-16	6	1 5-16	1¼	1	
Old Dominion	Globe, Ariz.	Phelps-Dodge	Boston	26,482,000	9¼	30,000,000	9	293,215	25	Old Dominion	3 07	4 10	5.12	6 15	7.17	8.19	63	18	60¼	28¼	59	47¼	55	29¼	49	34¼	75c. Q. Apr. 6, '12
Osceola	Calumet, Mich.	Calumet & Hecla	Boston	18,388,193	9¼	20,000,000	9¼	96,150	25	Osceola	5 75	7 80	9 87	11 97	14 00	16.05	181	71	135¼	77	170	122	166	114	124	81	$3.50 S.A. Jan. 31, '12
Phelps-Dodge	Arizona and Mexico	Phelps Dodge	New York	134,119,627	9	135,000,000	9	150,000	100	Phelps-Dodge	9 00	12 00	15 00	18.00	21.00	24 00					252	175	270	180	245	195	$2.50 Q. Mar. 29, '12
Quincy	Houghton, Mich.	Todd Ints.	New York	22,252,943	10¼	22,500,000	10	110,000	25	Quincy	4 10	6 15	8 20	10.20	12 30	14.40	148	70	100	77	99	83	92	66	76	55	$1.00 Q. Mar. 25, '12
Ray Con.	Kelvin, Ariz.	Aldrich McNeill	New York	15,201,000	•	100,000,000	8¼	1,587,400	10	Ray Con.	2.20	2 84	3.47	4 10	4 73	5.36					27¼	7¼	27¼	15	19	12	
Shannon Copper	Clifton, Ariz.	N. L. Amster	Boston	14,770,000	11¼	18,000,000	11	300,000	10	Shannon Copper	60	1 20	1 80	2 40	3 00	3 60	24¼	7¼	19¼	9¼	17¼	13¼	18	8¼	12¼	7	50c. Q. July 1, '07
Shattuck-Ariz.	Bisbee, Ariz.	Duluth Ints	Duluth	1,111,000	•		—	350,000	10	Shattuck-Ariz.	—	—	—	—	—	—	17	12¼	19	12¼	23	15¼	30	19½	24	14¼	$1.00 Jan. 20, '11
South Utah M. & S.	Newhouse, Utah	Samuel Newhouse	New York	3,548,376	13¼	4,500,000	12	860,000	5	South Utah M. & S.	—	.05	.10	.16	.21	.26					1 9-16	3¼	4¼	99c.	1 1-16	¼	
Sup. & Boston	Globe, Ariz	Houghton Ints	Houghton	1,827,000	9¼		—	263,827	10	Sup. & Boston	—	—	—	—	—	—					18	13	18	3¼	8¼	2¼	
Superior Copper	Houghton, Mich.	Calumet & Hecla	Boston	3,230,233	15¼	5,000,000	12	100,000	25	Superior Copper	-	50	1 00	1 50	2 00	2 50	23	7	36¼	14	67	34	68¼	36	42¼	20	
Tamarack	Calumet, Mich.	Calumet & Hecla	Boston	7,191,077	15¼	8,000,000	12	60,000	25	Tamarack	—	1 33	2 66	4 00	5 33	6.66	170	91	88	50	90	62	78	45¼	52	20	$4.00 July 23, '07
Tennessee Copper	Ducktown, Tenn.	Lewisohn Bros	New York	13,848,940	10¼	13,700,000	10¼	200,000	25	Tennessee Copper	3 65	1 34	5 04	5 71	6 40	7 09	53¼	17	62¼	25¼	69	—	91	40¼	49¼	43¼	30¼	$1.50 A. Feb. 20, '12
TeziutlanCop.M.&S.Co.	Teziutlan, Mex.	Robt. S. Towne Ints	New York	9,728,088	8	12,000,000	7¼	100,000	100	Teziutlan Cop.M.&S.	5.40	6.00	7 80	9 00	10.20	11.40	Stock closely held; quotations not available.										$1.00 Q. Feb. 10, '12
Tuolumne	Butte, Mont.	Butte Ints	Butte	4,261,705	•	10,000,000	9	800,000	1	Tuolumne	37	50	.62	.75	87	1 00					4¼	2¼	4¼	2¼	5	2¼	15c. Q. Aug. 15, '11
United Verde	Jerome, Ariz.	W. A. Clark	New York	33,164,573	—	40,000,000	—	300,000	10	United Verde	—	—	—	—	—	—											75c. M. Apr. 1, '11
Utah Copper	Bingham, Utah	Guggenheims	New York	93,000,000	7 95	125,000,000	7¼	1,612,649	10	Utah Copper	4.57	5 57	6 58	7.55	8 64	9 54	59¼	13	52¼	20	67¼	39¼	60¼	39¼	52¼	33¾	75c. Q. Mar. 30, '12
Utah Con.	Bingham, Utah	Standard Oil	New York	9,162,023	8	9,000,000	8	299,980	5	Utah Con.	1.22	1 52	1.82	2.14	2 43	2.74	70	25¼	50	20¼	49¼	37¼	46	25¼	20	9¼	50c. May 6, '12
U. S. Smelting	Arizona, Utah, California, Mexico, Nevada	Boston Int	Boston	22,199,141	—	25,000,000	—	Com. 351,105 Pfd. 486,319	50	U. S. Smelting Com.	—	On a 4 % dividend basis				—	70	24¼	46¼	28¼	59	39	55	30	40¼	30¼	$1.00 Q. Apr. 15, '12
										U. S. Smelting Pfd.	—	On a 7 % dividend basis				—	49	27¼	47	37	54	44	53¼	45¼	49¼	45¼	$1.75 Q. Apr. 15, '12
Wolverine	Calumet, Mich.	Stanton Ints	New York	9,639,639	7¼	9,800,000	7½	60,000	25	Wolverine	7 35	8.97	10 61	12 22	13 86	15.50	200	92¼	155	115¼	158	139	150	102	122	74	$5.00 S.A. Apr. 1, '12

Copper Production, Earnings, and Dividends

As Estimated by Thompson, Towle & Co.

The production, earnings, and dividends of the important copper mines of the United States, Mexico, and Canada in 1912 is estimated by Thompson, Towle & Co. in the table opposite, supplemented by the remarks below:

Amalgamated Copper, has $12,500,000 5% notes outstanding, due April 1913. Sold to acquire U. M. S. Co.

Ahmeek, ultimate production 25,000,000 lb. Earned $17.40 per share in 1911.

Alaska, property should be able to double output in 1912. Outlook promising.

Anaconda Copper,[7] cost should be materially decreased in 1913 with construction work completed.

Arizona Copper, building new smelter which should make possible increased production and decreased cost.

Bebee Copper, actual figures not available. Cost and production estimated.

Braden Copper, entire 3000-ton mill operating in April. Has $7,000,000 convertible bonds.

British Columbia, 1911 operations handicapped by coal strike, now settled.

Butte-Ballakalava, production has been intermittent. Company involved in litigation with Anaconda.

Calumet & Hecla, income from Ahmeek and Osceola dividend offset by interest on notes.

Calumet & Arizona, in 1911 merged with Superior & Pittsburg. Company building $2,000,000 smelter.

Centennial, conditions underground showing improvement. 1911 cost showed considerable reduction over 1910.

Cerro de Pasco, 1912 production will show considerable increase. The 55,000,000 lb. is rough estimate.

China Copper, ores partly mined by steam-shovel. Proposed capacity July 1. Has $2,500,000 convertible bonds.

Copper Range, company owns all Baltic and Tri-Mountain and one-half Champion.

East Butte, smelter being enlarged. Production 1912 may reach 18,000,000 pounds.

First National, shut down July 1911, owing to smoke trouble. Investigating new method.

Franklin, 1912 production should show large increase. Outlook greatly improved.

Giroux Con.,[8] production shown does not include any high-grade smelting ore from Alpha mine.

Granby Con.,[9] operated 1911 for 8 months, owing to coal strike. Operation resumed December 1911.

Greene-Cananea, ultimate capacity 70,000,000 lb. Has cash and copper on hand of about $4,000,000.

Inspiration Con.,[10] has $6,000,000 convertible 6% bonds.

Isle Royale, production to be increased to 15,000,000 lb. when additional mill capacity is provided.

Lake Copper, has begun production in limited way, using Baltic mill of Copper Range.

Mason Valley,[11] treats own ores and does custom smelting business.

Miami Copper, has $1,500,000 bonds. Production of 1912 should be close to figure shown.

Mohawk Copper, 1912 operations somewhat improved over 1911.

Nevada Con., operations at mine carried on both by steam-shovel and underground.

North Butte, 1912 may show decreased cost.

Ohio Copper, operated 1911 on half-mill working. With entire plant operating, production 20,000,000 pounds.

Old Dominion, costs now at lowest point in company's history.

Osceola made very creditable showing in 1911. Outlook for 1912 quite favorable.

Phelps-Dodge. The production shown for 1911 includes 10,495,649 lb. from custom ore.

Quincy. 1911 profits $507,000. Cost 10.62c., including construction.

Ray Con.[12] production will reach 100,000,000 lb. and possibly more.

Shannon Copper, cost of production decreased to as low as 10c. for some months.

Shattuck, *Arizona*, shut down in 1911. Development work only being carried on.

South Utah M. & S., began production September 1910. Has made little money to date. Outlook more favorable.

Superior & Boston,[5] shipments suspended in summer of 1910.

Superior Copper has acquired additional stamp-mill facilities and will soon increase production.

Tamarack, higher metal market has changed the situation considerably.

Tennessee Copper,[13] total production including custom ore in 1911 was 17,641,982 lb., or 1,000,000 lb. increase over 1910.

Tezuitlan Copper M. & S. Co., costs for 1911 would have been lower but for Mexican revolution.

Tuolumne, management estimates production of 1,000,000 lb. per month by spring of 1912.

United Verde, cost not available; 1911 dividends aggregate $2,250,000. Company is building new smelter.

Utah Copper,[14] was merged with Boston Con. in 1910. Owns 1,000,050 shares of Nevada Consolidated.

Utah Con., produced in 1911 3,311,939 lb. lead. Profit credited against the cost of copper.

U. S. Smelting, copper but small proportion of company's output. Earning principally from gold and silver production. Profit for 1911, after heavy depreciation charge, was $2,840,412, as compared with $2,484,318 for 1910.

Wolverine, operations for 1912 should differ but little from 1911.

The explanation of the subscripts on the table opposite is as follows:

[1]The production shown for the operating mines is that which should be made in 1912, while in the case of the non-producing mines, low-grade porphyries, etc., the figures shown are based on the reduction plants working to capacity.

[2]Total stock issued when all outstanding bonds have been converted.

[3]With present plant, built or contemplated, operating to normal capacity.

[4]Where actual figures were not available estimates have been used.

[5]Production when operating under normal conditions.

[6]*Amalgamated's* income is derived from 3,185,802 shares of Anaconda stock, 100,000 shares of Greene-Cananea, and the entire ownership of the United Metals Selling Co., which owns 43,000 shares of the International Smelting & Refining Co. stock. On April 30, 1911, Amalgamated had nearly $5,000,000 cash on hand.

[7]*Anaconda's* cost has been steadily decreasing as a result of numerous operating efficiencies effected. The earnings shown include profit on custom ore and from subsidiary companies, the latter estimated at $350,000 per year. The company has cash and quick assets amounting to from $24,000,000 to $25,000,000.

[8]*Giroux Consolidated* has made contract with Nevada Con. for treatment of 900 to 1200 tons of porphyry ore per day, beginning May 1. The production shown is on this basis.

[9]*Granby* management plans treating 2000 tons per day from company's Hidden Creek property, resulting in a production of 20,000,000 to 25,000,000 lb. per year, which ultimately would give Granby 45,000,000 to 50,000,000 lb. per year.

[10]*Inspiration*. This company owns properties formerly of Inspiration Copper Co. and Live Oak Development Co. The company purposes erecting 7500-ton concentrator. Production should begin by middle of 1913.

[11]*Mason Valley*. Estimated earnings are placed at $2 per share on 14c. to 15c. copper. Increased earnings will be made from additional custom ores treated; $995,000 convertible 6% bonds issued.

[12]*Ray Consolidated*. Early in 1912 this company took over the Ray Central. Approximately $1,700,000 by this transaction passed into the Ray Con. treasury, Ray Con. assuming $1,800,000 of Ray Central's bonds.

[13]*Tennessee*. Earnings shown include profits from acid plant. The company early in 1912 was producing 675 tons of sulphuric acid per day. The company has $1,350,000 bonds outstanding.

[14]*Utah Copper*. By summer of 1912 the company will be in a position to increase production from Bingham Canyon mines to 150,000,000 lb. Under these conditions earnings should be, at 12c. copper, $5.75 per share; 13c. copper, $6.85 per share; 14c. copper, $8 per share; 15c. copper, $9.20 per

share; 16c. copper, $10.30 per share; and 17c. copper, $11.50 per share. Cost should be reduced to 7c. At present Utah receives $1,500,000 dividends from Nevada Consolidated.

[15]Old stock.

[16]Figures given are for year ended September 30.

[17]Cost after allowing heavy depreciation charge.

[18]Cost and production shown are for 1910.

[19]Quotations Inspiration Copper stock.

*Cost not representative of the mine, hence if given would be misleading.

ORE RESERVES PORPHYRY MINES

	Tons.	Per cent.	Years' life on plants built or contemplated.
Utah Copper	203,000,000	1.67	29
Ray Consolidated	84,000,000	2.20	24
Chino	55,000,000	2.24	31
Inspiration Con.	45,000,000	2.00	17
Nevada Con.	40,000,000	1.70	14
Miami	18,000,000	2.51	17
Braden	12,000,000	2.85	11
Giroux	16,890,000	1.87	40†

†Based on small production of 1200 tons treated per day.

The Tin Market

Straits shipments for the first half of April are cabled as 1257 tons, and for the whole month are estimated at 3600 tons, according to L. Vogelstein & Co. Supplies from other sources will probably not exceed 1000 tons, a total of 4600 tons. Deliveries are likely to exceed this amount by about 4000 tons. If so, the visible supply will on April 30 fall below 12,000 tons, comparing with the visible of previous years as follows:

	Tons.
April 30, 1911	14,441
April 30, 1910	17,932
April 30, 1909	18,825

Should this prediction as to the visible supply on April 30 prove correct, it will be the lowest since October 1907. The country then was in the midst of the panic of that year and the price was only £146 (31¾c.), afterward falling to £115, while the visible supply mounted steadily until, at the end of January 1910, it has reached 23,024 tons; the high-water mark. These figures, therefore, do not represent either the extent or the rapidity of the shrinkage in stocks, which in a little over two years have been more than cut in two. It should be borne in mind also that whereas previous low figures of the visible supply were made after a series of prosperous years, those of 1912 are being made (unless all signs fail) at a time when business is steadily increasing and promises to expand beyond all previous records. Under these circumstances, L. Vogelstein & Co. are quite strongly of the opinion that while the market may be expected to fluctuate in its usual violent and erratic way, its tendency is more likely to be up than down. In fact, very much higher prices would not be surprising, especially if there is an adjustment of contracts on the London Metal Exchange satisfactory to the Syndicate, negotiations to that end being now in progress. The London stock is entirely in the hands of the Syndicate and has shrunk from 5104 tons on January 31 to only half that quantity, at the present time, with likelihood of further depletion owing to the small April Straits shipments.

Dividends

The Bunker Hill & Sullivan M. & C. Co. of Kellogg, Idaho, has paid its one hundred and seventy-fifth dividend, making a total of $13,491,750 paid to date. Monthly dividends of $64,500 are paid.

The Daly West Mining Co., of Park City, Utah, paid its regular quarterly dividend of 30c. per share on April 20 to stockholders of record April 10.

The Centennial-Eureka Mining Co. of Eureka, Utah, paid a dividend of $1.50 per share on April 30.

The Utah Consolidated Mining Co., of Bingham, Utah, has declared a dividend of 50c. per share.

The Success Mining Co., of Wallace, Idaho, paid a dividend of 1c. per share for March.

Company Reports

HOLLINGER GOLD MINES, LTD.

This company is capitalized at $3,000,000, in 600,000 shares of a par value of $5 each, and owns gold mines in Tisdale township, Ontario, Canada. In the first annual report, for the year ended December 31, P. A. Robbins, manager for the company, states that in spite of the disastrous fires of May and July, the company is in sound financial condition, and of the stock, 50,000 shares remain in the treasury. The current indebtedness of $132,866 is covered by funds advanced by the original syndicate, the members of which have arranged to provide $275,000 additional to complete work now under way. When milling is started the company will have a plant and completed development valued at $700,000, and ore reserves estimated at $10,000,000. The fire loss for the year was $111,815, or more than was spent on development, $96,573. Cash on hand amounts to $7867. Ore reserves are estimated at 462,000 tons, with a gold content of $10,230,000. Development completed January 1 was 3717 ft. No prospecting has been done below the 200-ft. level, but the ore reserve estimate includes ore to a depth of 300 ft. The company owns four claims, No. 13,154, 13,155, 13,156, and 13,157. Development has been limited to a small area on claims 13,155 and 13,156, and surface prospecting to those claims and No. 13,154. The mill, about completed, will have a capacity of 300 tons per day, and the cyanide plant 500 tons per day. The mill, which is to be electrically driven, will employ coarse grinding, stamping in cyanide solution, tube-milling, concentration followed by amalgamation of concentrate, cyanide treatment of both gangue and concentrate residue.

NORTH STAR MINES COMPANY

This company operates the North Star and other mines in the Grass Valley district, Nevada county, California. During the year ended December 31, the gross production of the North Star property was $1,025,088. Operating expense was $509,925, and the cost of development $46,481, leaving a net profit of $468,681. Disbursements for the purchase of property and for development in the Cincinnati Hill mine amounted to $58,065, leaving a balance of $410,616. Interest and dividends on invested funds brought the company's net income for the year to $452,890, of which $425,000 was paid in dividends, at the rate of 17% on the capital stock. The North Star ore crushed at the Central mill amounted to 95,401 tons, which yielded an average of $10.745 at a cost of $5.345 per ton for operating and $0.487 for development. The net profit per ton was $4.913. The lower yield, as against $13.683 per ton for the previous year, is attributed to the systematic working of the stopes, without special attention to the richer ore. The operating cost, despite more careful sorting in the mine, was reduced 27c. per ton. Of the total production, 77.1% was recovered in the mills by amalgamation and 22.9% in the cyanide plant. During the year 1978 tons of concentrate was produced, which, after fine grinding, was treated by the cyanide process. The tailing from the cyanide plant assayed about 24c. per ton, indicating a total metallurgical loss of about $23,000 for the year, or 2% of the ore content. The ore in the upper mine (above the 2700-ft. level) has been exhausted and work there has been discontinued. Some ore of fair grade was found on the 5300-ft. level, the deepest in the mine. At the Cincinnati Hill mine, 3119 ft. of exploration work was done, at a cost of $46,445. The company expended in purchasing outlying claims, $11,620, and advanced for the equipment and development of the local hydroelectric plant, $20,000. Early in the year the company secured an option on the Champion group of mines, at Nevada City, about six miles from Grass Valley. The option was subsequently surrendered, and a new one obtained which gives the company until July 2, 1913, to reach a decision as to purchasing the property. In developing this property $154,701 has so far been expended.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

OIL AND GAS LEASE—NOTICE OF FORFEITURE

Where by the terms of an oil and gas lease, 30 days notice of cancellation for non payment of royalties was required, it was insufficient to give such notice to the former manager of the leasing company, said company having passed into the hands of a receiver. Notice should have been given to the receiver.

Young *v.* Scott, (Kansas) 119 Pacific, 873. January 6, 1912.

MINING CLAIMS—EFFECT OF ISSUANCE OF FINAL RECEIPT

The locator of a mining claim and applicant for patent is not required to do annual assessment work after making final proofs under his patent application and the issuance to him of a receiver's receipt in conformity with the statute and rules of the General Land Office. The acceptance and allowance of the final proofs and the issuance of receipts of purchase constitute a segregation of the lands claimed from the public domain, and such lands are no longer subject to entry or location by a person attempting to set up an adverse location for purposes of contest.

Batterton *v.* Douglas Mining Co., (Idaho) 120 Pacific, 827, December 13, 1911.

SMELTER FUME—MEASURE OF DAMAGE TO CROPS

Where a growing crop had been injured by sulphur fumes and damages were sought by the farmer from the smelting company whose plant had generated the fumes, it was held that the measure of damages is the difference between the value of the crop before and after the injury, at the time and place thereof. If the crop has been injured from time to time throughout the growing season by the fumes, but was not destroyed entirely, the damage to it may be measured under this rule by the difference between the value of the actual crop at that time, less the actual expense of fitting for market that portion of the probable crop which was prevented from maturing by the injury.

United States S. R. & M. Co. *v.* Sisam, (Utah) 191 Federal, 293. October 21, 1911.

PLACER LOCATIONS—NECESSITY OF A DISCOVERY

In an action to quiet title to a placer claim the plaintiff testified that his prospecting work had been limited to washing two pans of dirt taken from two places on his claim; that he had found gold in each of them; that he had heard that the ground contained gold under a lava flow, but did not know the depth of the lava or whether a gravel channel lay underneath. It was held that this evidence did not indicate a discovery such as would support plaintiff's claim. The test is the discovery of minerals in such quantities and evidence of such a character as would "justify a person of ordinary prudence in the further expenditure of labor and means, with a reasonable prospect of success, in developing a valuable mine."

Garibaldi *v.* Grillo, (California) 120 Pacific, 425. January 22, 1912.

LODE CLAIMS—CASTING OFF EXCESS GROUND

Where a locator's preliminary notice called for a lode claim 600 ft. wide and 1500 ft. long, but the boundaries marked on the ground gave him 1650 ft. in length, or 150 ft. in excess of what the law allows, the locator was allowed to cast off the excess, and his location was not thereby invalidated. As it did not appear that the adverse locator in this case had seen or acted upon the basis of the description in the senior location notice, the usual rule that stakes and monuments upon the ground will prevail over the calls of a location notice in case of discrepancy, was followed, and the senior locator was allowed to claim accordingly, after casting off the excess.

Cardoner *v.* Stanley Con. M. & M. Co., (Idaho) 193 Federal, 517. December 8, 1911.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

TEMPERATURE does not increase uniformly with depth beneath the earth's surface, according to some recent researches by Königsberger, who has proved that the rate of increase is more rapid in the vicinity of ore deposits. Near coal seams he found the temperature increased 1° C. for each 26 to 30 metres of depth, while near petroleum it rises 1° C. for every 8 to 11 m. It has usually been assumed that the average rise is 1° C. for every 35 metres.

AN excellent soldering paste which neither spatters nor corrodes is prepared in the following way: Make a mixture of zinc chloride and cheap grease, such as petroleum. Make the zinc chloride by dissolving zinc in strong hydrochloric acid, using an excess of zinc to neutralize all acid. The solution will be thick and oily and is to be mixed thoroughly with the petroleum in the ratio of 1 fl. oz. to 1 lb. This is used extensively in electrical work as a flux for soldering, especially for copper wires, where no acid should be used.

RIPARIAN RIGHTS are not recognized in New Mexico. Appropriation is made by filing an application with the state engineer before commencing work. Publication of notice of appropriation is required after its approval by the state engineer. One-fifth of the construction work must be completed within one-half of the allotted time, which is commonly five years, and water must be applied usually within four years thereafter. Final certificate issues upon inspection after completion of work. All permits, decrees, and documents regarding water rights must be filed in the office of the probate clerk and *ex-officio* recorder of the county in which the works are situated.

LEAD seldom occurs native in nature, being usually found in the form of a carbonate or sulphide. Metallic lead has, however, been found in the form of thin plates and embedded scales and small rounded globules. Shot-like masses of lead have been commonly found in the gold placers of California, but in such conditions that they have usually been held to be from shot or bullets, and of adventitious origin. Dana lists a number of places, however, at which native lead has been found, and while some are doubtful, others are considered genuine. Ritter Von Grot has recently brought to this country specimens of metallic lead with native gold, found in the Mongolian placers on the Tro river north of Urga. The specimens are small globular masses of lead a millimetre or less in diameter with bits of wire gold showing through the lead. They come from frozen ground 24 ft. under cover and occur with anglesite. There are small veins of galena in the country and the lead is supposed to have been reduced during the process of weathering preceding the formation of the placers.

ELECTRIC BELLS, signaling devices, induction coils, and other apparatus of a like nature is generally actuated by a primary battery, either of the dry or wet type. These batteries, however, require a considerable amount of attention from time to time, and eventually have to be renewed altogether. A small, low-priced transformer which can be connected in the lighting circuit of any alternating-current installation gives much more satisfactory service. The secondary is wound to give 4 or 6 volts. This, being low tension, is suitable for connecting to the usual bell, fire-alarm, or other low-voltage circuit. It completely takes the place of a primary battery, and will operate devices requiring intermittent current. The labor and disorder of recharging batteries is done away with, and the bells operate from year to year without fail. The transformer has no moving parts, is ironclad, enclosed, and entirely safe in use. It is claimed that owing to the small amount of energy used, the average meter will not take any record of it.

Recent Publications

THE PRODUCTION OF ASBESTOS IN 1911. By J. S. Diller. U. S. Geol. Surv. Pp. 9. Washington, 1912.

BRITISH GUIANA GOLD AND DIAMOND INDUSTRIES. By the Commissioner of Land and Mines. Pp. 15. British Guiana. January 1911.

THE PRODUCTION OF LEAD IN THE UNITED STATES IN 1911. By C. E. Siebenthal. U. S. Geol. Surv. Pp. 7. Map. Washington, 1912.

PROGRESS OF THE MINERAL INDUSTRY OF TASMANIA, FOR THE QUARTER ENDING DECEMBER 31, 1911. By W. H. Wallace. Pp. 14. Tasmania, 1912.

COAL NEAR THE BLACK HILLS, WYOMING-SOUTH DAKOTA. By R. W. Stone. U. S. Geol. Surv. Bulletin 499. Pp. 66. Ill., maps, index. Washington, 1912.

PRESIDENTIAL ADDRESS. By H. O'K. Webber, president of the Transvaal Chamber of Mines at the Annual Meeting, February 29, 1912. Pp. 16. Johannesburg, 1912.

DAVIS HANDBOOK OF THE PORCUPINE GOLD DISTRICT. By H. P. Davis. Supplement No. 1. McIntyre-Porcupine Mines, Ltd. Pp. 10. Ill., map. New York, March 30, 1912.

GEOLOGY AND COAL FIELDS OF THE LOWER MATANUSKA VALLEY, ALASKA. By G. C. Martin and F. J. Katz. Bull. 500, U. S. Geol. Surv. 98 pp.; index, ill., maps. Washington, 1912.

CRIPPLE CREEK MINES. OFFICIAL SUMMARY OF CERTIFIED REPORTS OF LISTED COMPANIES. By the Colorado Springs Mining Stock Association. Pp. 36. Ill. Colorado Springs, March 1, 1912.

MINING INDUSTRY IN THAT PART OF NORTHERN ONTARIO SERVED BY THE TEMISKAMING AND NORTHERN ONTARIO RAILWAY. CALENDAR YEAR 1911. By Arthur A. Cole. Pp. 57. Ill., map. Toronto, 1912.

REPORT OF THE BUREAU OF INSPECTION OF SAN FRANCISCO CHAMBER OF COMMERCE FOR MONTH ENDED FEBRUARY 29, 1912. By Bureau of Inspection of Public Improvements. Pp. 16. San Francisco, 1912.

AN INVESTIGATION OF THE COALS OF CANADA WITH REFERENCE TO THEIR ECONOMIC QUALITIES. By J. B. Porter and R. J. Durley. Vol. I. Canada Department of Mines, Mines Branch. Pp. 250. Ill., maps, index. Ottawa, 1912.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1910. PART II. SOUTH ATLANTIC COAST AND EASTERN GULF OF MEXICO. By M. R. Hall and J. G. Mathers. Water-Supply Paper 282. Pp. 109. Map, ill., index. U. S. Geol. Surv., Washington, 1912.

BASE MAP OF ILLINOIS. State Geological Survey, F. W. DeWolf, director. Urbana, 1912. This map shows the geographical features, with towns, political boundaries, railways, rivers, and (in red) the elevation of all railway stations. It is on the scale of 1:500,000, approximately 8 miles to the inch. A new and accurate base map of Illinois has long been needed, and Mr. DeWolf has done well to supply this one in advance of completion of the great map for which topographic surveys are now being made.

Commercial Paragraphs

THE OLIVER CONTINUOUS FILTER CO. has six carloads of filters packed at its warehouses ready for immediate shipment to Mexico when conditions permit. One carload of filters had been shipped before the present trouble became acute, and is now at the Mexican border, being held at El Paso.

May 5 to 11 is 'Pocket Smelter Week.' The WAY'S POCKET SMELTER CO., of South Pasadena, California, is offering a valuable cigar lighter, or a copy of the new edition of the 'Prospector's Manual' free to everyone who purchases one of its outfits during this week. In addition to this, the First National Bank of South Pasadena guarantees that every person will get his money back, in the event he should not be fully satisfied with an outfit.

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

TASCHENBUCH FUR BERGMANNER (Pocketbook for Miners). By Hans von Höfer, Sr., and Hans von Höfer, Jr. 2 vol., 1152 pp., ill. Third, enlarged edition. Leoben, 1911. For sale by the *Mining and Scientific Press*. Price $5.70.

Höfers' Pocketbook is too little known to American mining engineers, who find so much to read in English that there is little incentive to thread the intricacies of the German language. There are several reasons why the effort is worth while, however, the chief being that as a reference book this is far superior to those published in English. Both the senior and junior editors are engineers of experience and have enlisted the aid of a dozen other well known engineers, who have contributed the discussions of special topics, such as boring, shaft-sinking, mining machinery, transportation, ore-dressing, briquetting, coking, surveying, and electricity. Over against the disadvantage that the treatment of these topics is adapted to German conditions and methods of work, may be set the fact that German methods are now adapted to meet conditions that are gradually developing in America, and frequent reference to what has already been done in Germany is of invaluable service in directing American progress. Examples of this are seen in the use of gas-engines and in the briquetting of fuel and ores, as in both cases practice was well developed in Germany before it had received much consideration in the United States. Much of the great store of data included in the volumes is of only academic value to the American engineer, but anyone whose work extends beyond ordinary routine will also find much of value and service.

Catalogues Received

THE HAYWARD CO., 50 Church St., New York. Catalogue No. 39, 'Hayward Buckets.' 40 pages. Illustrated. 6 by 9 inches.

KEYSTONE PLACER DRILL CO., Beaver Falls, Pa. Catalogue No. 6, 'Downie Deep Well Pumps.' 78 pages. Illustrated. 8 by 11 inches.

THE DENVER ENGINEERING WORKS CO. Bulletin No. 1055, 'Improved Richards Pulsator Classifier.' 8 pages. Illustrated. 8 by 11 inches.

THE BROWN HOISTING MACHINERY CO., Cleveland, Ohio. Catalogue D-1912. 'Tramrail Systems, Trolleys, Electric Hoists.' 48 pages. Illustrated. 6 by 9 inches.

ROBINS CONVEYING BELT CO., New York. Bulletin No. 48, 'Chains, Sprockets, and Elevators.' 52 pages. Illustrated. 6 by 9 inches. Bulletin No. 49, 'Conveyor Belts.' 4 pages. Illustrated. 6 by 9 inches.

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletin No. 4916. 'Mine and Industrial Haulage Supplies.' 328 pages. Illustrated. 8 by $10\frac{3}{4}$ inches. By means of this catalogue the General Electric Co. places in the hands of its customers information which will enable them to readily select repair parts for the maintenance of locomotives used in mine and industrial electric traction, and of electric crane and hoist equipments. The catalogue includes also a comprehensive list of rail bonds and of materials for the suspension and insulation of trolley and feeder systems. The arrangement of the catalogue is such that from a knowledge of the serial number of a locomotive, any and all repair parts for it may be ordered with accuracy and in a manner to assure prompt filling of orders. While, owing to the much greater variation in conditions for which they have been designed, it has been impractical to catalogue repair parts for crane and hoist equipments in the same manner as for locomotives, all the principal parts for both motors and controlling devices, used in such equipments, will be found listed in appropriate order.

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EDITORIAL

SALE of seven million pounds of aluminum in one order for southern California shows that the rise in price of copper has already begun to restrict its use.

THE twenty-fifth annual meeting of the Montana Society of Engineers, held at Anaconda, April 11 to 13, was marked by good-fellowship as well as technical interest. We hope the society may long continue its successful life.

FIRE destroyed, April 20, the plant of the *Mexican Mining Journal*, but the energetic publisher of that excellent exponent of technical journalism promptly arranged for new equipment, and the May number will appear but a few days late. Our sympathy goes to our contemporary. We trust this misfortune may show, as our own of six years ago did, that honest journalism rests on a foundation more substantial than paper and presses, and that disasters have their compensations in the revelation of friendships that they bring.

EXPORTS of copper from the United States have grown during the past thirty years from $700,000 to $110,000,000 annually. During the same period imports have grown from $600,000 to $25,000,000, representing ore, matte, and blister sent to this country for refining. Though there are only nine electrolytic refineries in operation in the United States, they handle, in addition to domestic blister, over one-third of the copper produced elsewhere in the world. Reports of production for the first quarter of 1912 indicate an increase of about 17 per cent in the United States output and a slight decrease in foreign production.

ELUTRIATION is a word often wrongly used by engineers, under the impression that it is synonymous with classification. To elutriate a material is to purify it by washing; thus bird-shot spilled upon the ground might be swept up and elutriated by stirring with water and pouring off the muddy liquid. To classify a mixture of mineral grains, such as an ore, is to separate them into classes of particles which settle in water at an equal rate; unless the particles have been previously sized no separation of one kind from another is thus possible. A nice observance of such distinctions of meaning will lead to a metaphorical elutriation of ideas.

CO-OPERATIVE studies of mining conditions in Illinois are now being conducted under agreement between the United States Bureau of Mines, the State Geological Survey, and the Department of Mining Engineering of the University of Illinois. These studies are directed to conserving the lives of mine workers and the mineral resources of the state, and involve both field and laboratory investigations. A systematic hygrometric survey of the mines is being made together with studies of the gas in coal, of the dust, explosives, and roofs in the mines, and in fact all the natural mining conditions. The work has the active support of operators, miners, and inspectors, and is much the most comprehensive series of investigations relating to mining ever undertaken by an American state.

LITIGATION over title to the mines of the Pittsburg Silver Peak Gold Mining Company was decided by the Supreme Court of Nevada, May 4, favorably to the Blair estate, from which the operating company derives its rights. The dispute, which has extended over nearly twenty years, arose from an old option which, it was claimed, had never been properly voided. The company now owning the mines having proved them of value, the inevitable litigation followed. At present a profit of roughly $360,000 per year is being earned. The property and improvements have been paid for out of earnings, and a surplus has been accumulated, but, pending the decision as to title, no dividends have been paid. Dealings in the stock heretofore have been largely speculative, and in anticipation of a favorable decision the price was run up to $1.60 this week. While the exact amount of the surplus is not certainly known, it is hardly likely to justify any such price, and quotations have already fallen. The mine is a good one, excellently handled, and, now that uncertainties as to title are out of the way, may be expected to become a regular dividend payer.

EFFORTS are being made at Washington to secure a definite appropriation for the support of investigations by the United States Bureau of Mines in the metal mines of the West. When the work begun by the Geological Survey was transferred to the newly created Bureau of Mines the only funds made available were for the investigation of coal mining. It is a curious fact that exact statistics of accidents in metal mines are not collected except in a few states. Such figures as are available seem to show that loss of life is as great in metal as in coal mining, and a limited inquiry recently conducted by the Bureau of Mines suggests that danger in the metallurgical industries is more common than has been supposed. The health and safety of men in all branches of mining should be the first consideration of those in charge. If needlessly dangerous conditions are being overlooked, sharp attention should be called to them, and an impartial government bureau is the best agency for conducting the necessary investigations. We are glad to see that a start has been made in studying the health conditions of mine workers. In this as in other matters the Bureau will have the cordial support of both operators and men, and Congress may well appropriate the small amount of money necessary to make the work effective.

The Value of Gold

Few topics are provocative of greater discussion and variety of opinion than the question as to the stability of the value of gold. As in most discussions, this is largely due to the use of terms in differing senses, or without a clear conception as to their exact meaning. Elsewhere in this issue Mr. A. J. Pillsbury takes issue with Mr. F. J. Martin in this regard, and in pointing out Mr. Martin's error in asserting that gold has a fixed value, falls into the greater error of supposing that gold can be increased in price by increases in the cost of its production. The price of gold cannot be increased, since gold itself is the standard of prices. The value of gold can and does fluctuate, as is seen by the variation in the prices of other commodities from year to year. Price is worth estimated in money, value is worth estimated in commodities in general. The price of gold in the United States is $20.67 per ounce, the value of gold to a hungry man in the desert, or on Market street, San Francisco, can be roughly determined from the amount of food and drink, or other desired commodity it will procure. Many overlook this elemental distinction, or in making it rush to the opposite extreme and assume that all changes in prices can be directly ascribed to changes in the output of gold. Such an assumption is as untrue as the assertion that prices are independent of the production of gold. Commodity prices depend upon the available supply of gold, but the relation is a complex one, and the exact relative importance of the different factors is as yet unknown. Perhaps the best analysis of their relationship is that by Mr. Irving Fisher, who contends that the price level of commodities depends upon the amount of money available, the velocity with which it circulates, the amount of bank deposits and their activity, and the volume of trade. It is interesting to note in this connection that the visible available supply of gold in the banks of the world was $4,447,005,910 on December 31, 1910, and that the same banks at the same time had notes in circulation amounting to $5,407,022,935 and loans and discounts amounting to $20,593,333,483. The international volume of trade in 1911, according to the estimates of the Bureau of Commerce and Labor, was $35,500,000,000. The increase of commodity prices in recent years has often been greatly exaggerated, through a confusion of ideas; the average increase in the past twenty years has probably been less than 20 per cent, the annual gold production having in the same period increased from about $119,000,000 to $466,000,000, or an increase of nearly 300 per cent. The rate of increase of production is now declining, and it is quite possible that the production also will begin to decline in the not far distant future.

Alaska at Washington

Introduction at Washington, with the approval of the Alaskan affairs committee of the American Mining Congress, of bills for the leasing of coal lands and the construction of a government railway, marks a distinct step. It is an open secret that neither Alaskans generally nor the leaders in the American Mining Congress are predisposed toward either a leasing system for the mineral lands or government ownership of railways. Those concerned, however, are practical men. They are seeking a workable method of ending the present intolerable conditions and they recognize the force of public opinion. There can be no doubt that the ruling public opinion of the country is opposed to any more land grants to railways and to reopening the coal lands on the old basis. At the same time, as Mr. Falcon Joslin has forcibly shown, it is foolish to impose conditions that compels such communities as Fairbanks to burn 60,000 to 80,000 cords of wood per year, doubling the fuel bill for its citizens, while valuable coal beds are within easy reach. It should be entirely possible to safeguard every proper public interest without any such extreme result; and it will be possible, when the various persons concerned make a genuine effort to get together in any spirit of fairness. Mr. Joslin, who knows Alaska thoroughly, is opposed to the leasing system, but has stated that he is "not certain that a leasing bill may not be drawn that would be a workable and just law," and the committee of which he is chairman has shown good faith by proposing a leasing bill. Now let others show equally good faith by co-operation in securing the passage of a bill modeled on the one offered. We believe that in changing from fee to leasing system the details of the new law should be modeled as closely as possible to the wording of the old. We wish also to state again our conviction that from the national standpoint revenue should be the smallest consideration. If there is any considerable income from the leasing of the land it should go to the state or territory in which the land is situated. This is especially important in the case of Alaska, where the need of public works is great and the sources of revenue are few. In the resolutions passed at Cordova,

April 3, it will be noted that staking by power of attorney is condemned, and in this Alaskan public opinion coincides with informed public opinion everywhere. Reasonably to reward the man on the ground is one thing, but to permit the excesses that have obtained in the past is another and entirely different one. There are obvious faults in the old laws. These should be corrected and the way kept clear for still other changes as the need arises, but Alaska should be developed, and to accomplish that it is necessary to open the coal and other lands to use, and to build railways. We have already stated our conviction that, there being no sufficient inducement for private capital to enter into railway building there, the United States Government should assume the task. Alaskans have made proper concessions to Eastern public opinion. It is now 'up to the East to make good' by providing the needed legislation.

Porphyry Coppers and Ore Reserves

Reports of a number of the great copper mining companies have recently been distributed. We printed last week a summary statement of the work of the Nevada Consolidated Copper Company for the period ended December 31, as given by Mr. Pope Yeatman, consulting engineer for the company. This week we present a similar summary of Mr. D. C. Jackling's report as general manager for the Utah Copper Company. Reports on the work at Ray and Chino are at hand and abstracts will be printed later. In examining these reports, attention is first attracted to the large scale of work, and second to the low grade of ore now being successfully handled.

In the year ended December 31, 1911, the Utah Copper Company treated 4,680,801 tons of ore having an average copper content of 1.51 per cent. The Nevada Consolidated, in the fifteen months covered by the last report, treated 3,338,242 tons of which the average copper content was 1.80 per cent. The Ray Consolidated Copper Company and the Chino Copper Company only began milling in 1911, and their outputs are accordingly small. At Ray, however, 681,000 tons containing an average of 1.83 per cent copper was handled. Perhaps a better impression of the scale of operations is given by the statements of ore reserves submitted with the annual reports. These are as follows:

Company.	Tons.	Per cent copper.
Utah	301,500,000	1.532
Ray	77,314,470	2.17
Chino	54,970,646	2.24
Nevada	40,083,371	1.66

These figures are not strictly comparable. In the reserve of the Nevada Consolidated, Mr. Yeatman has included only the "profitable ore remaining in reserve." In the case of the Utah Copper Company, Mr. Jackling's figures, the ones quoted, include both developed and partly developed ore. The Ray and Chino estimates also include partly developed ore, though the Ray estimate, it is stated, may be 25 per cent less than the total amount of ore really available. Allowing, however, for all such differences in methods of computation, it still remains true that the totals are impressive. Hardly less impressive is the continued increase in ore reserves, despite the large amount annually sent to the mill. Last year the statement of ore reserves of the Utah Copper Company was as follows: Fully developed, 60,000,000 tons of 2 per cent copper ore, and 92,130,000 tons of 1.6 per cent; partly developed, 51,370,000 tons of 1.4 per cent ore; total fully developed 152,130,000 tons; total fully and partly developed, 203,500,000 tons. For the year 1911 the corresponding statement is: Fully developed, 62,040,000 tons, of 2 per cent ore, 92,130,000 tons of 1.6 per cent, and 75,660,000 tons of 1.30 per cent, partly developed, 71,670,000 tons of 1.28 per cent ore; total fully developed, 229,800,000 tons; total fully and partly developed, 301,500,000 tons. Evidently the increase is mainly due to including as ore reserve material too low in grade to be so rated the preceding year, and the complete blocking of the partly developed ore of the year before; presumably through additional drilling. The higher grade ore in reserve, that containing 1.6 and 2 per cent copper, remains practically as it was the year before. The 51,370,000 tons of 1.4 per cent partly developed ore has become 75,660,000 tons of 1.3 per cent fully developed ore, while 71,670,000 tons of material containing 1.28 per cent copper is rated as partly developed ore. Since the amount of ore partly developed in the steam-shovel stopes remained roughly the same, 22,325,000 tons in 1910 and 26,790,000 in 1911, and underground work in this mine is decreasing, it is evidently the churn-drill that makes the difference. At Ray it is explained that ore defined by drill-holes at intervals of 400 feet is considered partly developed. When additional holes are drilled at distances of 200 feet or less the ore is considered fully developed. It is easy to see that partly developed ore can, on this basis, be quickly defined enough to become fully developed, especially if the standard of copper content be at the same time lowered. Every increase in the price makes it possible to count as ore what was previously waste, but it must not be forgotten that when enormous tonnages are taken into account the time factor becomes important. Before this lowest-grade ore can be mined the price of copper may fall to where there would be no profit in handling it. It is impossible to keep the mine in such shape that the low-grade material may not need to be handled regardless of profit. To put it through the mill may be the cheapest means of disposing of it, once the material has been uncovered, but with a fluctuating price for the metal, and a narrow margin at best, there is always the danger of wearing out equipment without adequate return. Material once 'on the run' in a big copper mill can be made to contribute to operating profit if it contains as little as 0.9 per cent copper, but we are still far from the expected stage when rock containing 1 per cent of copper constitutes an ore reserve, and it is a fair question whether the 1.28 per cent 'partly developed' ore of the Utah Copper Company ought not be further qualified by calling it also 'provisional' ore. The Nevada Consolidated Copper Company in June 1911, treated 294,793 tons of ore containing 1.36 per cent copper, 0.009 oz. gold, and 0.071 oz. silver, with a saving of 66.31 per cent and a ratio of concentration of 12.87. The average price of electrolytic copper in New York that month was 12.47 cents per pound. This, we believe, is the record for large-scale treatment of low-grade ore, and certainly it strongly supports claims for considering, at least provisionally, 1.28 per cent rock as ore.

Another striking feature of modern copper concentration, and one much less encouraging, is the enormous amount of waste. In the case of the two leading properties in the group under review, the amount of copper that gets away yearly amounts now to over 50,000,000 pounds. This is the startling result of milling ore of a grade where low operating cost must always be the first consideration. In our pride at the technical work which has converted mountains of rock into ore, it is worth taking an occasional sobering thought of the unachieved. No one anticipates a time when a perfect saving will be made, and no one is working more earnestly toward improvement of technical processes than are the engineers concerned with copper mining and milling. They have accomplished great tasks and are making excellent progress, but the journey is not yet done.

Presenting Assay Results by Graphic Methods

By J. B. Stewart

Because of his early experience as field engineer, accustomed to report to his superiors in the profession, the average engineer acquires the habit of making a purely technical exposition of tabulated data, and the customary assay plans of a mining property. He is apt to forget that in all important cases one of the greatest uses to which his report may be put is the convincing of comparatively untechnical men, whose duty it may be to decide upon the business merits of the prospective deal. It should not be necessary to re-write a report for submission to such readers. Many engineers have witnessed the confusion of a board of directors or group of prospective stockholders, who for lack of technical knowledge and practical experience, were unable to appreciate even approximately the relative meaning of a mass of tabulated data of widths, distance, tonnage, and assay values.

Let a report be ever so complete in its method of analysis and subject to simple arithmetical demonstration, yet the conclusions will never be as apparent to the untechnical reader as they are to the engineer who did the work. The significance of this deplorable point is appreciated by the engineer (or new manager) who, called upon to give an opinion to owners of an unprofitable property which is still being worked, has to convince them that it is wise to abandon the property, or at least cease further operations. Many an engineer has despaired of ever making it possible for the untechnical and unpractised reader of his report to synthetically reassemble all the tabulated data of his analysis so as to give as clear a mental conception of the existing conditions as he himself has obtained. It is with such an end in view that I offer the following simple, graphical method for demonstrating conclusions regarding assay data.

This scheme for graphically representing the commercial value of the ore in a mine by combining the factors of available tonnage and the corresponding assay value per ton has proved very satisfactory, because of the data which it condenses, and the ease with which the unprofitable portions of ore may be marked out. In addition to such advantages it furthermore serves to bring together on the same sheet much geological data, thus throwing some additional light upon the probable method of mineralization and subsequent alterations; as oxidation, leaching, and enrichment. For the purpose of rendering the whole of this subject interesting and intelligible to those who are not familar with the methods of obtaining all the data to be condensed in the graphical diagram, it may be well to rehearse briefly what is an old story to engineers. To begin with, this system is intended to apply chiefly to ore deposits of relatively great length and depth as compared with their width; commonly spoken of as veins in distinction from large stockworks, fahl-bands, and lenses. Likewise it offers its greatest advantages in consideration of banded veins, or those in which both the width and value of the ore vary considerably not only at intervals along its length, but also from wall to wall across any given section. In order to accurately fix all data upon the diagram, it is necessary to locate all points of sampling in the mine with reference to some vertical plane, as a shaft, which connects with all levels of the mine, or by simple survey methods to provide for such accuracy. It is customary to sample the entire width of the vein at regular intervals of from 5 to 10 ft. (according to the degree of accuracy required) along the length of the vein. If the valuable minerals were evenly distributed throughout the whole of the gangue, one single sample would be enough, and no diagram would be required. But since it often happens that the mineral content varies greatly at intervals of 10 ft. along the vein, it follows that there is even more reason for the variation of bands of ore in the vein from wall to wall at any given section. Hence the sample to be taken at every 10-ft. interval along the vein should consist of as many separate samples as there are separate changes of ore. I use the word changes in preference to kinds of ore. For should a vein show apparently the same kind of ore on both the foot and hanging wall with a different streak between, no matter how narrow or wide, each of these bands of ore (on foot and hanging) should be separately sampled, and a note made of their corresponding width. Whether the intervening strip should be sampled depends upon its width and value, as previously shown by several preliminary samples for former work done. If it is known to be worthless, then it will, as a rule, be sufficient to only note the width of it, and take no sample. Again, if its value is seldom very different from the rock on either side of it, and it is comparatively narrow, say less than 4 in., it may be sufficient to only note its width and take no sample. But if the value of such a streak in connection with its width should be of some importance in calculating the average value of ore at that section then it must be sampled also. Imagination will, of course, suggest conditions where a ½-in. streak might be of high enough content to require separate sampling, whereas in other cases a group of two to four bands of ore aggregating 10-in. width might be safely tested all in one sample. The object of the examination is to determine the extent of variation and relative value of each separate band as well as the gross value of the ore. From such data, will be determined the width of ore to be mined, and its resultant value in numerous small blocks.

In addition to the variation in content of different bands of ore at any given section the importance of taking separate samples is apt to become apparent to the man doing that work because of the difference in the degree of hardness of the rock to be moiled off. It is only too easy to get large or small-sized samples from a comparatively soft section of rock. But when the next band is hard as flint, the difficulty and the time consumed in taking as much per inch of width from the hard rock as was taken from the soft one adjoining it practically precludes all reliability, and any attempt to take the two varieties in the same sample will prove useless.

It is desirable when measuring the width of each separate sample cut, to locate them all with respect to either the foot or the hanging wall, and preferably always to the same wall if possible. Later on much consideration may be given to the manner in which the good ore tends to follow closer to one wall than another, or perhaps tends to cross over from one wall to the other. For recording such data during examination, the left hand page of the sample book may be ruled off as suggested in Table 1. The right hand page is most conveniently reserved for notes regarding the geological conditions in the immediate vicinity of the sample.

The reason and method for thus gathering the data at hand should now be plain. It is now necessary to consider the calculations based upon the above data as given in Table 1, and provide for tabulating the results as in Table 2. Here, under the head of 'total dollar-inch value,' is the product of the total value per ton (in terms of dollars) of every separate sample by its corresponding width in inches. From this column is to be calculated the maximum width of ore which will average better than the bare cost of putting such ore upon the surface. In this particular case circumstances made it unprofitable to break ore of less than $5 per ton wherever it could be avoided. Moreover, the minimum width of stope which could be economically worked was 18 inches.

From this it will be plain that in any case where ore of profitable grade, or over, is less than 18 in. wide, it is necessary to average with it enough of the next best ore adjoining it to obtain the greatest width possible (over 18 in.) which will average $5 per ton or better. If the ratio

of widths, and assay values for the adjoining ore is such as to preclude choosing a working width which will average $5 per ton, then such portions must be left unmined and hence should not be taken into account in the final estimates.

widths of ore exceeding $5 per ton as much additional width of next best ore as will give the maximum width which will just average $5 per ton. Hence, by trial as many adjacent samples are combined as will give the de-

TABLE I

Sample No.	Distance in ft. from Shaft, 100 ft. E.	Location of Sample, inches	Actual Width of Sample	Assay Value. Au, ounces	Ag, ounces	Cu, per cent	Total Value, $ T.	Remarks.
54	15	F.W.-40	40	..	8.40	2.80	10.92	
55	15	40-52	12	0.05	39.10	7.60	37.84	
56	15	52-71	19	..	0.90	0.12	..	
57	25	F.W.- 8	8	Tr.	8.30	6.42	19.56	
58	25	8-35	27	..	4.40	1.72	8.33	
59	25	35-58	23	..	5.00	1.94	7.16	
60	35	F.W.-14	14	..	1.40	0.25	..	
61	35	14-25	11	..	4.50	1.76	..	
62	35	25-42	17	..	3.80	2.00	..	
63	35	42-60	18	0.03	21.50	2.68	17.81	
64	45	F.W.-16	16	0.05	2.50	0.50	..	
65	45	16-39	23	0.02	6.10	2.60	9.29	
66	45	39-43	4	0.09	41.60	8.84	42.04	
67	55	F.W.-30	30	..	15.40	3.72	16.63	
68	55	30-46	16	..	0.22	0.06	..	

TABLE I. LEFT PAGE OF SAMPLE BOOK

TABLE II

Sample No.	Distance in ft. from shaft, 100 ft. E.	Width of sample. in.	Assay value per ton — Ag	Cu	Total.	Dollar-Ton-Inches — Ag	Cu	Total.	Gross Width, in.
54	15	40	$4.20	$6.72	$10.92	168.00	268.80	436.80	
55	15	12	19.55	18.29	37.84	234.60	159.48	453.96	52
57	25	8	4.15	15.41	19.56	33.20	123.28	156.48	
58	25	27	2.20	6.13	8.33	59.40	165.51	224.91	
59	25	23	2.50	4.66	7.16	57.50	107.18	164.68	58
63	35	18	10.75	6.43	17.18	193.50	115.74	309.24	18
65	45	23	3.05	6.24	9.29	70.15	143.52	213.67	
66	45	4	20.80	21.22	42.02	83.20	84.88	168.08	27
67	55	30	7.70	8.93	16.63	231.00	267.90	498.90	30

TABLE III

1 Distance in ft. from shaft.	2 Half length to adjacent samples	3 Gross width of sample	4 Gross value, $/T./in. Ag	5 Cu	6 Total	7 Column, 4 by 2, Ag	8 Column, 5 by 2, Cu	9 Column, 6 by 2, total
15	20	52	402.60	428.28	890.76	8,052.0	8,575.6	17,815.20
25	10	58	150.10	395.97	546.07	1,501.0	3,959.7	5,460.70
35	10	18	193.50	115.74	309.24	1,935.0	1,157.4	3,092.40
45	10	27	153.35	228.40	381.75	1,533.5	2,284.0	3,817.50
55	10	30	231.00	267.90	498.90	2,310.0	2,679.0	4,989.00
65	10	32	183.40	251.66	435.06	1,834.0	2,516.6	4,350.60
75	10	29	59.45	395.27	454.72	594.5	3,952.7	4,547.20
85	10	23	135.70	109.25	244.95	1,357.0	1,092.5	2,449.50
95	10	22	502.70	408.54	911.24	5,027.0	4,085.4	9,112,40
105	10	43	139.75	202.10	341.85	1,397.5	2,021.0	3,418.50
115	10	34	62.90	210.46	273.36	629.0	2,104.6	2,733.60
125	5	26	39.00	122.20	161.20	390.0	1,222.0	1,612.00

of the total tonnage of available ore of profitable grade. But since the purpose is to determine the total tonnage of ore available which will average $5 per ton from which may be eliminated later on, the tonnage corresponding to the higher assay values, it is desirable to combine with all

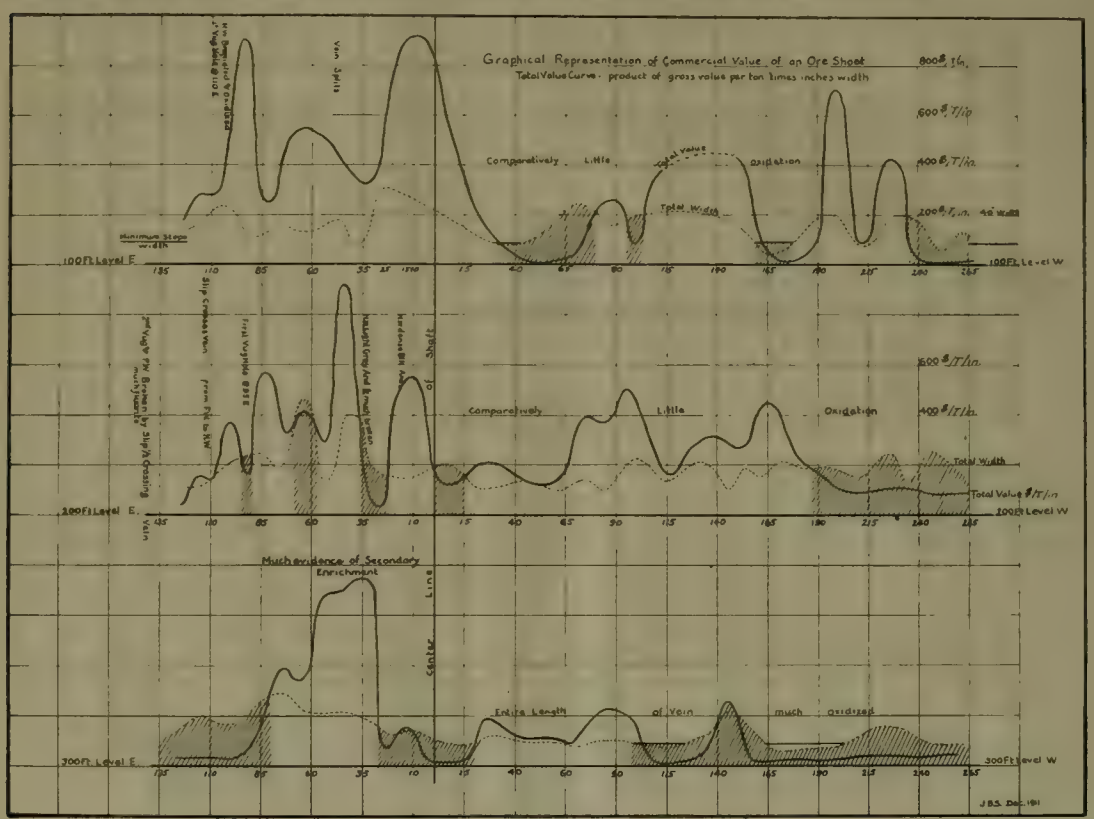
sired result, and bracketed in the manner shown in Table 2, given above.

A third sheet for condensing only such data as has thus been bracketed is then prepared as in Table 3. The real need of this third sheet is in order to provide for averaging

longitudinally along the vein as well as across it, as has just been accomplished in Table 2. If, however, all of the points of sampling have been equidistant there is no need of making this step if the lengths of all ore-shoots are considerable. When their lengths are small then the obvious corrections (for the end samples) would be applied to the sum total of dollar-ton-inches. But it often happens that owing to old stopes or caved ground, certain places corresponding to equidistant points which should be sampled are inaccessible. Hence, both the total width and its corresponding total dollar-inch value for every point sampled must be multiplied by one-half the sum of the distances intervening between it and the next points of sampling on either side, in terms of feet.

This gives the final two columns of Table 3, in which the

this particular case the drifts, east and west, in each level, were practically so straight that there was no need to locate the points of sampling by actual projection. But it will occur to the reader that if such workings were tortuous, a plat of each level could very conveniently be added to the diagram just below the horizontal base line here used for each level. In such a case the points of sampling should be located exactly as they were measured in the mine, following the curves of the drift, and their corresponding projections located upon the horizontal base line as the points from which the successive ordinates are to be erected for each curve in turn. In all such cases the usefulness of the graphical representation would be still further enhanced by noting the actual assay values, as is the usual custom, in conjunction with the plat of the level.



GRAPHICAL PRESENTATION OF VALUE OF AN ORE-SHOOT. TOTAL VALUE = VALUE PER TON × WIDTH IN INCHES.

sum of the factors of width divided by the total length represented gives the real average width of the ore along the vein. And the sum of the factors of dollar-inches divided first by the total length sampled, and then by the total sums of widths gives the correct average value of the ore per ton over that section.

Instead of making one entire section of any whole level, it is customary to make several sections of each level according to the conditions which may govern the future working of such blocks of ore. Eventually all such blocks are to be tabulated with their corresponding tonnages, average assay value per ton, and the products of such assays by the respective tonnage they represent. Thus, the final average assay value and total tonnage are deduced for the whole level, and in like manner for the whole mine. It is the sum total of all this data which the present graphical method condenses, and offers a most simple solution of the problem of blocking out the tonnage of any required grade of ore.

The method of constructing a curve to show these results will be best understood by reference to the diagram given, which is the result of actual data from a recent examination. First, however, it is necessary to remark that in

For convenience, let us adopt the following scales:

Horizontal scale for length along vein			25 ft. = 1 in.
Vertical	"	" total width of ore	40 in. = 1 in.
"	"	" stoping width	40 in. = 1 in.
"	"	" total width × total value	200 = 1 in.
"	"	" " ×any special value	200 = 1 in.

This, I trust, makes the method of construction clear. Now, considering the meaning of the total width × total value, which I shall call the total value curve, it may be spoken of as dollar-ton-inches, and represented symbolically by the sign $ T in. All of the especial advantages of this diagram are dependent upon this choice of factors to represent the total value of ore in terms of dollar-ton-inches; which it will be seen is likewise in direct proportion to actual tonnage of ore available, multiplied by its average assay value per ton, since the factors take into account the width of the ore as well as its value.

From this it must be apparent that, owing to the ratio of the width curve to total value curve, wherever these two curves intersect the value of ore must necessarily be $5/T, hence, all areas included between these two curves will be of ore above $5/T if the area is above the width curve, and of ore below $5/T if the area lies below the width curve.

This feature is the one which most recommends the use of this system of representation. This made clear, all other refinements suggest themselves at once as follows:

The tonnage of any such areas may be deduced by measuring the area between the width curve and the horizontal base line, between the vertical co-ordinates corresponding to the two points of intersection where the width curve crosses the value curve. Since the width curve is to the vertical scale of 40 in. = 1 in. and the length along the level is to the horizontal scale of 25 ft. = 1 in., any square inch area is equivalent to 25 ft. of ore, 40 in. wide or $25 \times 3\frac{1}{3} = 83.33$ sq. ft. of ore. This area then multiplied by 100 gives the cubic feet of such ore for 50 ft. above and below the area in question. This figure must be divided by the number of cubic feet of ore in place required to make a ton. Too much attention cannot be called to the importance of determining this factor accurately. For a uniformly dense rock of 3.2 sp. gr. would run exactly 10 cu. ft. per ton, yet because of cracks, crevices, and small and large vug-holes, such a rock, throughout any considerable extent of the mine, is more apt to average 12 to 14 cu. ft. in place per ton. But let us assume that this factor should be 12. We then have $\frac{83.33 \times 100}{12} = 694.41$ tons of ore per square inch of area for a 100-ft. vertical section of the vein. So that for all purposes, allowing for the errors in plotting to scale, the round figure of 700 tons per square inch may be used or mental approximations.

To obtain the average value of the ore in any such area, it is sufficient for all practical purposes, and most convenient to remember that because of the ratio between the width and value curves the following conditions hold true. When the vertical co-ordinates of both curves agree the value of the ore is $5/T. If the co-ordinate of the value curve is one-fifth of that of the width curve, then the value is $1/T. If it is four-fifths the value is $4. If it is twice as high as the co-ordinate of the width curve then the value is $10 per ton, and so on.

A little consideration of the above suggests how readily the total value curve may be intersected by curves drawn parallel to the total width curve, which will block off the diagram into ore of $10/T to $15/T, $15/T to $20/T, $20/T to $25/T, etc., the $0/T to $5/T being already blocked out by the width curve itself. This would be obtained by successively halving the scale to which the width is plotted as 20 in. = 1 in., 10 in. = 1 in., 5 in. = 1 in.

There is one more addition which may be required by way of a refinement. Having blocked off the horizontal cross-sections of all the ore which, according to assay value per ton, it will not be profitable to mine, suppose it is now necessary to eliminate all sections in which, owing to the combined factors of value and narrow width, it will be impractical to mine. The minimum width of stope that it is practical to carry has been assumed as 18 in. Placing a straight-edge in position so that a horizontal line may be drawn for the whole length of the diagram at a height above the base line equal to 18 in., draw this line in pencil, wherever the total width curve passes below it. Now, considering the sections of the line thus drawn, it is only necessary to note whether at any point the total value curve shows co-ordinates of at least twice or more the height of the of the width curve. For, in any such case, the value of the ore being $10/T, or better, it will pay to break double the width of ore existing, providing that double the width will exceed 18 in. If there are any such conditions the portion of this stope line corresponding to them is to be erased. Whatever is left of the original pencil line is now to be inked in and shows that the ore vertically above and below these sections cannot be mined if the length is considerable, say 15 ft. or over.

GOVERNMENT authorities of German Southwest Africa estimate that the revenue from the diamond industry will amount to £500,000 in the Budget year of 1912. This amount is mainly composed of the export duties, and to a smaller extent of the mine taxes. According to the *Berliner Tageblatt*, the estimates for this year are of special interest, as it had been reckoned that the export duties would be reduced or converted, but the Budget again provides for the imposition of duties of $33\frac{1}{3}$%, which may be assumed as a proof that a sweeping alteration in the duties cannot be counted on for the time being. Having regard to the fact that a number of diamond fields will be worked out this year, and the northern fields cannot be certainly expected to yield production, the Government authorities estimate the output of diamonds at 850,000 carats for this year, as compared with an estimate of 900,000 carats for 1911.

Russian Copper Production in 1911

ST. PETERSBURG CORRESPONDENCE

The report on the 1911 copper production of Russia is now published and shows that during the year the Russian copper industry has developed very satisfactorily and is justifying the hopes based on the returns of preceding years. So far as metallic copper is concerned, these are record figures and point to a not very distant period when, in order to relieve the local market, particularly in the Caucasus, foreign buyers may have to be sought. In other parts of the Empire, however, the situation is such as to preclude any expectation of exports. The districts are too far inland, and in any case their increased production is still unequal to the increasing demand of the country for copper. It can hardly be expected that the Siberian copper fields as known today will ever yield such a surplus of copper as to glut the Russian market to an extent which will make it profitable to incur the cost of carriage to seaboard for export purposes. Should this ever take place it would probably be through the White Sea, possibly St. Petersburg. However, such a contingency is still a long way off. It is not so in the Caucasus, where the demand is not so local and where it may very soon pay to ship copper to foreign countries. Last year the total production of metallic copper reached the level of 1,582,187 poods. This compares with 1,383,456 poods in 1910. This is an increase for the whole country of 21.6 per cent.

The districts in which this copper has been produced, with the respective quantities which they have contributed, are as follows:

District.	1911, poods.	1910, poods.
Ural	809,000	566,000
Caucasus	487,000	471,000
Altai	1,700	3,500
Siberia	228,000	196,000
Works and refineries (presumably re-smelting scrap)	56,000	57,000

Although these figures are given as the actual returns, they are not necessarily exact; in fact, may be far from it. The returns given for the Ural, for example, in this general statement differ materially from those issued a few weeks ago for that area, and it is difficult, indeed, to reconcile these divergent figures. The statistics given above are perhaps more likely to be correct, being issued later. The important point to notice is that the great increases have taken place in the great centres of copper production, and where decreases are noticed, they are only to be found in the Altai neighborhood, which has for long shown signs of weakening, and in the works and refineries probably because the larger works are collecting and re-smelting waste themselves. If this is so, a certain average, which it is quite impossible at present to establish, would have to be deducted for this waste or scrap. The area where most of the increase has taken place is the Ural, where the advance is 43%. The report referred to above for the Urals alone issued some weeks ago shows an increase of only 32.8%. The largest contribution to the total was made by the Bogosloff estate. Another large contribution was made by the Soimakovsky factory. This factory accounts for a very large proportion of the increase in the production, because in 1910 it had not yet started work.

Yukon Gold

By O. B. Perry

*During the past year the Yukon Gold Co. acquired a number of creek claims, both by outright purchase and by working agreement. The principal purchases are situated on Upper Bonanza and Eldorado, with some few claims in other portions of the district within the limits of the operation. The total which has been added to the property is estimated at 1,930,000 cu. yd., practically all creek gravels suitable for dredging.

Equipment.—The dredging equipment was increased during 1911 by the addition of two 7-cu. ft. dredges, leased from the Guggenheim Exploration Co., which makes a total of nine in all on the company's property. The two new dredges represent the latest improvements in dredge construction and differ from the ones previously employed in that the hull and superstructure are built of steel, instead of wood. The steel hulls have decided advantages in the way of strength and rigidity, and are so designed that the dredges can be taken down and moved without entailing any loss of material. The first of the two new dredges was finished and started operation on September 23 on claim No. 6 Above Discovery on Bonanza; the second dredge, No. 9, was completed and started operating on October 7 on claim No. 7, Eldorado. The total weight involved in the construction was 1340 tons, and over 55,000 rivets were driven in the construction of each dredge.

The thawing plants were increased by the addition of four new boilers of standard type, with their steam lines and accessory equipment. In connection with the hydraulic work, two new pits were opened on King Solomon hill and completely equipped with two independent sluice-lines, pipe-lines, and monitors. This plant is now ready for operation the coming season. At Trail gulch hydraulic equipment was installed during July, and mining was carried on at this point during the remainder of the season.

Operation.—Dredging operations in 1911 were begun approximately three weeks earlier than in 1910. The dredging season for seven dredges averaged 171½ days, as compared with 159 days in 1910. The dredges started on May 6, average date, and closed for the winter on October 23. The early start in May was made possible by the completion of the steam-driven plant of the Northern Light, Power & Coal Co., which enabled the company to purchase power before its own hydro-electric plant was capable of being operated. The dredges handled 4,151,249 cu. yd. during the season and produced $2,671,845 gross gold. This represents a gain of 27% in gross value recovered. The average value per cubic yard was 64.35c., as compared with 66.18c. last season, showing a slight decrease, owing to the fact that No. 5 dredge was digging largely in worked ground and tailing, which decreased the average grade of the material handled by this dredge as compared with the season before.

The cost increased from 31.09c. per cu. yd. for 1910, average, to 35.43c. for 1911. A number of different factors entered into this increase. The May operation was disproportionately expensive on account of the necessity for thawing some of the ground in April, when the weather was still cold; the repair costs increased somewhat, due to the heavy bedrock encountered by some of the dredges, and the power costs also were higher from purchasing power locally for the early spring and late fall requirements. The principal increase in cost was in the thawing operation, due to the greater percentage of frozen ground met in this season's operation, which had to be thawed by steam, the ratio of frozen ground to cubic yards dredged in 1911 showing an increase of 19.33% over 1910. The cost per cubic yard was higher on account of this increase, although the thawing cost per square yard of bedrock was lower than in 1910 by about 10%. In the dredging cost are included all thawing charges, preliminary stripping operations, gross gold tax, selling charges, and depreciation.

The extremely dry season affected the dredging operation, causing a scarcity of water for flotation. The length of the operating season was also reduced on this account by approximately three weeks.

Hydraulic Operation.—During the season a total of 2,125,551 cu. yd. of gravel was washed in the hydraulic mines, including the yardage from leased ground, an increase of 19% over the season of 1910. The total gross production was $434,382. It will be noted that the production shows a decrease as compared with 1910 of over $300,000. This is accounted for by the fact that the mechanical elevators were not operated during the season of 1911. The elevators were operated on rich creek gravel, and added materially to the gross production for the season of 1910. The reason for discontinuing the elevator operation is that the dredges have been found to do the same work at much less cost; in fact, they are now handling ground successfully which it was not thought possible to mine by this method. On this account the water from the main ditch system was applied altogether on the hill or bench deposits instead of on both bench and creek gravels, as formerly. The hill deposits being much lower grade, the gross production decreased, although the yardage shows a substantial increase.

The hydraulic work has been confined, thus far, largely to the lower-grade deposits on account of the lack of dump room to permit the working of the better portions. The dredges are rapidly mining the creek ground, so that dump room is being provided, and this difficulty, which has arisen from carrying on both operations simultaneously, will soon disappear. The hydraulic mines were handicapped by extremely low water in the latter part of the season. The Yukon, as well as the Alaska interior, suffered from an extremely dry season, and the flow of the creeks and rivers was the lowest that has been known since records have been kept. This resulted in a shortage of water-supply during the months of August and September which cut down the yardage for these months and increased the operating cost. Even with this handicap the hydraulic cost decreased, the figures for 1911 being 15.5c. per cu. yd., which is the lowest that has yet been reached in the operation.

The main ditch system from the Twelvemile river was operated 150½ days, which was 97.1% of the possible time, as compared with 78.8% for 1910. The average daily delivery, measured at the Klondike pipe-line discharge, was 3089 24-hour miner's inches, and the total water delivered was 482,580 miner's inches, as against 459,319 in 1910. From this it appears that while the increase in operating time was 23.3%, the increase in the amount of water delivered was only 5%, which shows the effect of the extreme dryness of the season. The total charge for operation and maintenance for the ditch for 1911 was $135,710. Of this amount $11,859 was charged to power-plant operation and $123,851 to hydraulic operations. No unusual difficulties were encountered in the operation of the system.

General.—It is apparent from the above analysis that the dredging operations showed a gain in yardage and in gross value, and that the hydraulic operation also showed continued improvement. The dredging cost was high for the reasons pointed out above, but this cost will probably be reduced materially in the next and following seasons. With the construction work now complete and the plants on an operating basis, more time can be given to the factors that make up the cost, and the tendency should be downward. The work for next season will be continued along the same lines as last. The management probably will not attempt to start the dredges as early as last season, unless the conditions are more favorable, but the season should be about the same length.

*Report of operations for the year ended February 1, 1912.

Austrian mining engineers will hold a decennial congress at Vienna September 16 to 20 of this year and many important papers are expected to be presented.

Zinc-Dust Tests

By W. J. Sharwood

*The increasing interest in zinc dust as a precipitant suggests the publication of details of a few tests which have proved of some use in examining and comparing samples. Unfortunately no definite criteria have as yet been established for valuing zinc dust for precipitating purposes, but the following will serve to give some idea as to the availability of a sample for the cyanide plant. It should be dry and fine; nearly all, say 95%, should pass a 200-mesh sieve (aperture 0.003 in.), while very little, say not over 1 or 2%, should remain on 100 mesh (0.006 in.), and practically none on 50 or 60 mesh. It should not show any signs of caking, or contain lumps which do not break up at once when shaken on a sieve. Generally speaking, an ash-gray color is a more favorable indication than a decidedly blue or whitish cast; but color cannot be taken as a positive criterion. The presence of a little lead, say 2 to 3%, is an advantage. Laboratory tests made with pure zinc, and with equal weights of alloys containing up to 5% lead, in the same state of fine division (filings between 0.006 and 0.003 in.), have invariably shown more rapid and more nearly complete precipitation of gold and of silver in the case of the lead alloys, although the weight of actual zinc present was less. The presence of a little zinc oxide is apparently without detrimental effect, except as diminishing the percentage of active metal. Attempts to remove the oxide by solvents inevitably lead to the dissolving of more or less metallic zinc, and possibly to the destruction of the finest particles. No injurious effect has been traced to the small amount of cadmium usually present, and other impurities are generally negligible in amount. A number of samples which have proved satisfactory in actual use have shown from 85 to over 95% metallic zinc (that is, zinc in the metallic state), most of them over 90 per cent.

Various published analyses have shown metallic zinc ranging from less than 30 up to 92%, zinc oxide from traces to over 50%, and cadmium from traces up to 1.3% in Belgian, and 1 to 2.5% in Silesian samples. A number of analyses from various sources are to be found in Schnabel's 'Metallurgy' under Zinc, Ingalls' 'Metallurgy of Zinc and Cadmium,' and in 'Mineral Industry,' Vol. II, p. 258. Some of these show carbon up to 3 or 4%, and silica or insoluble up to 9 or 10%, but in general very little of either will be found, and only traces of iron or arsenic. A few of these analyses are summarized in the annexed table, together with incomplete determinations of some samples used in gold precipitation.

Typical Analyses of Zinc-Dust[1]

	Metallic zinc.	Zinc oxide.	Lead.	Iron, cadmium, carbon, and insoluble.
1. Belgian	91.5	Little	0.5	..
2. Belgian	88.74	6.60	2.5	2.1
3. Belgian	79.16	11.16	1.9	7.2
4. Average Belgian	84.5	9.3	1.6	4.0
5. Silesian	84.5	4.9	4.3	6.2
6. Silesian	88.5	7.4	2.0	..
7. Silesian	..	88.2	4.0	3.0($SO_3$4.1)
8. American	29.6	57.5	Trace	(Insol. 9.6)
9. American, good quality	96.0	..	..	..
10. European, imported into U. S., good quality	90.9	4.0	2.7	..
11. European, similar, fair quality	85.0	..	2.0	..
12. European, similar, fair quality	94.6	3.7	0.2	(Iron 0.3)
13. Used at Deloro, Canada	...	3 to 5	1.74	..

Various authorities state the specific gravity of zinc as from 6.85 to 7.21, of zinc oxide from 5.6 to 5.78, and zinc carbonate 4.3 to 4.5. Samples of zinc-dust have shown results from 6.82 to about 7.0, while the material itself weighs approximately 2 to 2.5 gm. per cubic centimetre, or about 120 to 155 lb. per cubic foot, depending largely upon the extent to which it has been shaken down. No connection has been proved between the apparent density and the quality, but at least one 'heavy' sample was found to give unsatisfactory precipitation.

The following serves to illustrate the desirability of avoiding contact with moisture or moist air in the transportation and storage of this material. On a carload of imported zinc dust used some years ago in Montana the railroad charges were found to be based on a considerably greater weight than was indicated by the weights of the several casks invoiced as originally shipped from Europe. The total weight found by the daily use of the material bore out the railroad figures, and confirmed the suspicion that the discrepancy was due to oxidation from contact with moist air. This was further proved by analyses for oxide and metallic zinc, a sample taken near the staves of one cask showing about 10% more oxide than another from the middle of the mass. In another case, where very bad precipitation was noted, the material from the bottom of one barrel was lumpy and yielded 39% zinc oxide, while a sample from near the top of the next barrel opened contained 13.5 per cent.

Estimation of Lead in Zinc-Dust.—Weigh 10 gm. into a large beaker (400 to 600 c.c.), moisten with water, then add 200 c.c. water and stir well, then 10 c.c.[2] strong sulphuric acid, stir well and cover. Stand beaker on hot plate and warm to 60 or 70°C.; if action is very slow at the start add a single drop of very dilute platinic chloride solution; stir at intervals. After action becomes slow add 10 c.c. more acid and continue warming until nearly all the zinc has dissolved. Decant the solution upon a filter, wash the residue in beaker two or three times with water, passing washings over the filter.[3] Rinse residue back from filter into beaker. Dissolve residue with a little nitric acid,[4] transfer to a casserole, and rinse beaker into casserole. Add 5 to 6 c.c. strong sulphuric acid and evaporate to dense fumes. Cool, dilute with water, stir well, cool thoroughly, filter, wash well with water containing 5% sulphuric acid.[2] Dissolve the lead sulphate in hot ammonium acetate solution, and wash filter thoroughly with the same solution. Dilute this solution with hot water (about 80°C.) and titrate the lead with standard ammonium molybdate, using 1% tannin or ferrocyanide solution as outside indicator.

The molybdate is standardized on pure lead foil, treated in the same way as the lead residue from the zinc-dust. If the ferrocyanide titration is substituted for the molybdate method, the same standard solution will serve for both lead and zinc.

Estimation of Zinc Oxide in Zinc-Dust.—Approximate method based on solubility of zinc oxide in ammonium chloride and ammonia. Solution required, 250 c.c. water; 70 gm. ammonium chloride; 150 c.c. strong ammonia water, sp. gr. 0.90.

Method.—Weigh out 1 gm. zinc-dust into a stout test-tube holding 35 to 50 c.c. Use a disc of soft rubber packing $^1/_{16}$ in. thick as a cover for the tube, or use thumb as cover while shaking. Add 25 c.c. of the prepared solution, cover tube, and shake well for exactly five minutes. Agitation must be violent enough to insure all lumps being broken up. Throw mixture promptly on a 9 cm. or 11 cm. filter, rinse tube, and wash filter with hot water, receiving in a 200 or 250-c.c. beaker. Dilute filtrate with hot water to about 100 c.c. Add a drop of phenolphthalein indicator, then HCl till about neutral, then 5 c.c. strong hydrochloric acid. Heat to 80°C. and titrate zinc with standard ferrocyanide, using uranium acetate or nitrate as in-

*From the *Jour.* Chem., Met. & Min. Soc. of S. A.

[1]No. 1 to 4 by Firket, 5 to 7 by Steger, 1 to 7 quoted by Ingalls; 7 and 8 from Schnabel, intermediate products in smelting; 10, analysis supplied by importers, quality excellent; 13, Harland, *Jour.* Soc. Ch. Ind., 1897, p. 968; 9, 11, and 12 original; No. 9 to 13 used in cyanide precipitation at various plants.

[2]The use of 25 c.c. of strong hydrochloric acid, in place of 10 c.c. sulphuric acid, gives equally satisfactory results.

[3]The two filtrates from the lead and lead sulphate contain the iron, cadmium, and zinc; they may be mixed, made up to a definite volume, and these metals determined in suitable aliquot portions.

[4]If any considerable residue (silica, carbon, etc.) remains at this stage after treatment with nitric acid, it may be filtered off, washed thoroughly, and determined. If in this case a white residue remains after washing, it should be treated with hot ammonium acetate solution, and this should be added to the acetate solution obtained later.

dicator. Zinc found in solution × 1.245 = zinc oxide in 1 gram.

This method is rapid and gives fairly approximate results, which are closely comparable if constant conditions are maintained in all tests. The results are slightly high, for the reason that metallic zinc is itself slightly soluble in the solvent employed—but there is no known solvent for the oxide which will not also attack the metal. Tests with freshly prepared zinc filings, passed through a 200-mesh sieve, show that the error from this source is negligible if only five minutes' contact is allowed with the above solution. Carbonate of zinc dissolves in the same way as the oxide.

Estimation of Total Zinc.—Dissolve 1 gm. of dust in dilute hydrochloric acid, heating moderately. Make up to 200 or 250 c.c. in an accurate flask, remove 50 c.c. with an accurate pipette. Add 5 c.c. strong hydrochloric acid and about 2 gm. ammonium chloride, dilute to about 200 c.c. with hot water, heat to 80°C., and titrate with ferrocyanide. The ferrocyanide solution is standardized on pure metallic zinc, dissolved in hydrochloric acid, and treated as above.

Determination of Metallic Zinc in Zinc-Dust.—Many methods have been worked out, most of which are not altogether satisfactory. Those which depend on measuring the volume of hydrogen evolved by the action of acid are hampered by the slow rate at which zinc-dust dissolves in dilute acid, and by the readiness with which hydrogen diffuses through rubber tubing and leaky connections. A number of the methods proposed are given in Sutton's 'Volumetric Analysis' (10th ed., pp. 382-383).

I. Very good results are obtained by determining (1) *total zinc* and (2) *zinc in the form of oxide*, by the methods given above. The difference is assumed to be *metallic zinc*. This has the advantage of requiring only one standard solution—potassium ferrocyanide—for both titrations.

II. Reduction of chromic acid, by subjecting the zinc-dust to the action of potassium bichromate acidified with sulphuric acid. The bichromate should be present in considerable excess of the calculated amount necessary for the zinc used. The residual chromic acid is determined by titrating an amount equal to that originally taken, and the solution after the zinc has acted, or aliquot parts of each, either:

(1) by means of KI, titrating the liberated iodine with thiosulphate (Sutton, p. 383); or
(2) by means of a standardized solution of ferrous sulphate;
(3) by adding an excess of a standardized solution of ferrous sulphate and completing titration with standard bichromate.

III. Reduction of ferric chloride or sulphate and titration of the ferrous salt obtained by standard permanganate or bichromate. Sutton (p. 383) recommends using 0.5 gm. zinc-dust with 7 gm. of ferric sulphate and titrating one-fifth of the solution with permanganate. Presumably 14 or 15 gm. of ferric alum would answer equally well for this purpose.

IV. The reduction by the zinc-dust of a solution of iodine in potassium iodide has given fair results, but it is only safe to use small quantities, say 0.1 or 0.2 gm., titrating the residual iodine with thiosulphate.

The following are results obtained with a sample of zinc-dust:

	Per cent.
Method I:	
Total zinc	91.6
Zinc as oxide (and carbonate)	12.9
Metallic zinc by difference	78.7
Method II:	
Metallic zinc by reduction of bichromate (3)	79.6
Method III:	
Metallic zinc by reduction of ferric alum	77.1

Whatever *reduction* method is employed for direct determination of the metal, the metallic zinc can be calculated thus:

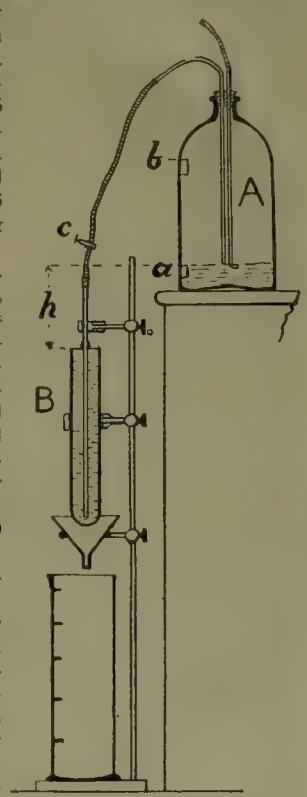
1 c.c. *N*/10 standard solution = 0.00327 gm. zinc.

Determination of Precipitating Efficiency of Zinc-Dust.—Solution required. A solution of potassium silver cyanide is prepared by dissolving 10 gm. silver cyanide (AgCN) and 5 gm. of 99% potassium cyanide in a little water and diluting up to 1000 c.c. It is then adjusted by addition of a little more KCN or AgCN until the solution indicates from 0.12 to 0.15% *free* KCN by titration with standard silver nitrate. The titration is best made by using a 10 or 20-c.c. sample, adding 1 c.c. 2% potassium iodide and a slight excess of ammonia; the end-point is then sharper. Or 15 gm. of pure crystallized $KAg(CN)_2$ may be dissolved in a litre of water and 1.5 gm. KCN added.

Method: Weigh out 0.5 gm. zinc-dust into a 300-c.c. beaker. Add a few cubic centimetres water and stir till zinc is well mixed, then pour in 250 c.c. of the prepared solution, stirring vigorously. See that all lumps are broken up, and continue stirring for fully five minutes. Stir occasionally (at least every 10 minutes) until the end of two hours from the addition of the solution. Then filter upon an 11-cm. filter, wash precipitate thoroughly, sprinkle with test lead, wrap it carefully in the paper, place in a scorifier with about 20 gm. test lead, burn paper cautiously in muffle, scorify 5 minutes, cupel at low temperature, and weigh silver. Milligrams silver obtained from 0.5 gm. zinc × 0.0606 = percentage precipitating efficiency.

By taking 0.303 gm. zinc-dust instead of 0.5, each milligram of silver is equivalent to 0.1% efficiency. Instead of cupeling, the silver may be dissolved in dilute nitric acid and titrated with standard thiocyanate with ferric indicator, using the whole or one-half of the solution for titration. C.c. *N*/10 KCNS used for 0.5 gm. × 0.654 = percentage efficiency.

This test was devised by A. J. Clark in 1904, with the idea of utilizing a reaction analogous and taking place under conditions similar to those actually prevailing in the everyday use of the zinc-dust in the cyanide plant. While the results obtained by this method are not entirely satisfactory, they have afforded, during seven years' experience, a better indication of the results to be expected in practical work on the large scale than those obtained by any other system of examination so far tried. Satisfactory samples of dust usually show efficiencies between 40 and 60%, and sometimes as low as 35%, 100% being the standard calculated for the complete replacement of pure zinc by silver. A better method—one which completely eliminates the personal factor in manipulation—is desirable, but a simple determination of the metallic zinc is not sufficient; the test must automatically take into account the physical condition as well. Attempts to carry out the test in a mechanical shaker, and determining the silver left in solution after filtering after a specified time of contact, have always given much lower results than are obtained as above.



CLASSIFICATION APPARATUS.

Mechanical Tests of Zinc-Dust.—Sizing Test: When sized with sieves of 100 and 200 meshes to the linear inch, using a sample of 20 to 50 gm., good samples of zinc-dust

usually show at least 95 and often 98%, or more passing the 200 mesh, and not more than 1% remaining on the 100 mesh. This sizing is irrespective of caked lumps, which should never be found in freshly opened barrels.

Classification Test: This is based on the separation of the finest particles by a rising stream of water in a vertical tube, the velocity being about 1 cm. per second. It promises to throw some light on the fineness of division of the portion passing 200-mesh, which, as above indicated, ought to include nearly all of the material.

A convenient arrangement is that shown in the figure. A 2500 c.c. acid bottle (A) is fitted with a 2-hole rubber cork, with a Mariotte tube reaching nearly to the bottom and turned at a right angle at the lower end, and a siphon outlet tube reaching to about the same level, thus giving a constant level water-supply. A mark is placed at *a*, the level to which the siphon empties the bottle, and another at *b* to indicate the surface when 2000 c.c. additional water has been put in. The working cylinder B may be a tall 250-c.c. measuring-glass, but it is better to use a large tube with rounded end, say 1.25 in. diameter by 12 or 15 in. long, with a $\frac{1}{4}$-in. glass tube placed centrally in it and connected with the siphon by a rubber tube with a spring clip *c*, both being fastened to a stand by clamps. A large graduated cylinder and funnel are placed below. The net area of the cross-section of the working cylinder is best obtained by sticking two labels or making two marks on it 20 cm. apart, then filling with water to the lower mark and measuring the number of cubic centimetres required to fill it to the upper, the central tube being clamped in place. Then the area of cross-section (= volume in c.c. ÷ height in cm.) is obtained once for all. To adjust the velocity fill the bottle to the upper mark, fill the working cylinder, open spring clip and take time with a stopwatch while 1000 c.c. flows out.

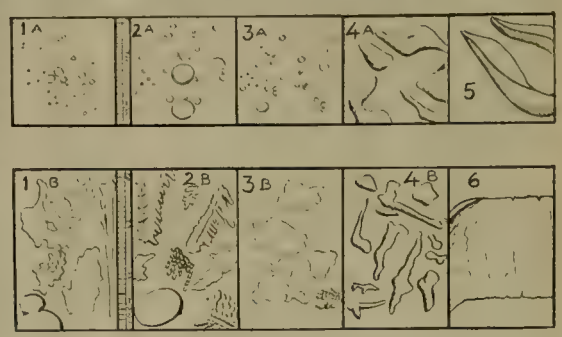
$$\text{Then } \frac{\text{1000 c.c.}}{\text{Area} \times \text{No. sec.}} = \text{velocity in cm. per second.}$$

By raising or lowering the working cylinder the velocity can be adjusted, the effective head *h* being the vertical distance of the top of the cylinder below the level of the Mariotte tube inlet, the velocity varying approximately as the square root of *h*. The clip on the siphon should be removed or kept wide open during the test, and care should be taken that the rubber connections are not sharply bent or allowed to obstruct the flow. When the point is found at which an upward velocity of exactly 1 cm. per second is obtained, or some point sufficiently near, it is well to mark the position of the cylinder and clamp or measure the height *h*, so that this position can be reproduced, all the other adjustments remaining the same.

Method: Put 20 gm. of zinc-dust in the cylinder, moisten with a little water, then add 50 or 100 c.c. and stir till all air bubbles are removed, then fill cylinder with water. A wire stirrer is used, reaching to bottom. The bottle being filled to *b*, open clip and start the flow. Use the stopwatch as a check on the velocity, timing the first 1000 c.c. The wire stirrer must be used at first to prevent packing; most of the fine passes off with 500 to 1000 c.c. of water, but it is best to let 2 litres flow through. Then allow the remaining material to settle a few seconds, rinse into an evaporating-dish or casserole, decant off water, wash twice with a little alcohol, dry, and weigh the residue. This may be tested with 100 and 200-mesh sieves, if not sifted before making the test, and further examined with the microscope. By commencing the test with a velocity of say 0.8 cm. per second, and repeating with the same material at 1 and 1.2 cm., several distinct fractions may be obtained from the material passing 200-mesh. The comparatively coarse particles are of several kinds: (1) impurities, usually chips or sand; (2) round particles of zinc, or aggregate made up of round particles, looking like grape-shot; (3) feathery or fern-like aggregates of minute crystals of zinc, often forming very thin platy masses.

A separation of the coarser particles can, of course, be more simply made by repeatedly stirring with water in a beaker and decanting, but it is impossible to obtain comparable results unless a constant upward velocity is maintained in some such way as indicated.

The accompanying figures illustrate some of the variations shown in the appearance of certain samples of zinc dust when examined under the microscope. The upper row, highly magnified, show the appearance of the medium portion of the 'through 200' fractions of three such samples, the very finest part (under $\frac{1}{20,000}$ in.) having been removed by classification. As may be seen, these are almost perfect spherules, and under the highest powers appear to have clean smooth surfaces, and to consist of nearly pure metal. The coarser particles, over 0.003 in. remaining on a 200-mesh sieve, are shown below, and vary greatly in appearance. In several of the more satisfactory samples, illustrated by No. 1 and 3, many of these larger particles have a rough coke-like surface, but some generally exhibit branching crystalline, fern-like aggregates, and other aggregates resembling miniature bunches of grapes. It is possibly only a coincidence that the unsatisfactory sample (No. 2) had an unusually large proportion of the fern-like forms and also showed more relatively large spherules in the 'through 200' portion. The extreme minuteness of the fine is shown by comparison with the equally magnified filing



Description of Figures.—(1) Imported (German) zinc-dust; satisfactory, precipitation good. (2) Imported (German) zinc-dust; unsatisfactory, precipitation not good. (3) Domestic (U. S.) zinc-dust; satisfactory, precipitation good. (4) Granular zinc. (5) Zinc filings, passed 200-mesh sieve. (6) Zinc shaving, extra fine about 1/50 in. wide.

(No. 5) which had passed a 200-mesh sieve, and the granulated zinc, also passing 200-mesh (4A), the method of preparation of which is not known, but which had a very low precipitating efficiency.

Surface Exposed by Zinc-Dust.—As the efficiency of this precipitant is mainly due to its fine division or extensive surface, some calculations of the latter may be of interest. To calculate the surface exposed by zinc-dust, use may be made of the fact that the total surface exposed by one ton (2000 lb.) of any material in uniform grains—either cubes or spheres—is $\frac{2304}{g\,d}$ sq. ft., *g* being the specific gravity of the material and *d* being either the edge of the cube or the diameter of the sphere, expressed in inches. Hence, the density of zinc being very nearly 7, assuming it to be in the form of spheres of a uniform diameter of *d* inch, then square feet surface exposed by 1 lb. $= \frac{0.165}{d}$.

Thus the portion which will *just* pass a 200-mesh ($d =$ 0.003 in.) sieve will expose only 55 sq. ft. per lb., while the material averaging only 0.0001 in. diameter—which constitutes a considerable proportion of the whole, as may be seen by a microscopic examination of the finer portion—exposes 1650 sq. ft. per lb. It is interesting to compare this with zinc-shaving. Assuming this material to consist of a continuous rectangular strip, of width *a* and thickness *b*, then:

Area exposed by 1 lb. zinc-shaving $= 0.055\ (\frac{1}{a} + \frac{1}{b})$ sq. ft.

If, instead of being rectangular, the cross-section of the

shaving is a parallelogram of angle A, the above expression must be multiplied by cosec A; in this case the thickness b is measured at right angles to the width a.

For instance, with shavings $^1/_{32}$ in. wide and of various thicknesses, the surface exposed would be:

Thickness	1/800	1/1000	1/1500 in.
Sq. ft. per pound	45.8	56.8	84.3

The number of particles (spheres) of zinc-dust in a pound, assuming the specific gravity as 7, is $\frac{7.544}{d^3}$. Hence, if the diameter is 0.001 in., 1 lb. will contain 7544 million particles, while at an average diameter of 0.0005 in. there will be 8 times as many. Thus some idea of the intimate nature of the mixture can be obtained if an emulsion of zinc-dust is prepared by distributing it with absolute uniformity through the solution to be precipitated. Suppose $^1/_2$ lb. of zinc-dust is used per fluid ton (55,296 cu. in.) of solution, or 1 in 10,000 parts by weight, the diameter of the particles being taken as 0.001 inch. From the above figures it appears that each cubic inch will contain about 27,300 particles, if uniformly distributed, whence the average distance between the particles will be approximately $^1/_{30}$ in. If the particles are of half this diameter and equally distributed, there will be 8 times as many to the cubic inch, and half the distance apart.

All samples shown in the upper row highly magnified (see scale); those marked (A) are carried off by a stream of water rising 1 cm. per second, but finest dust has been removed. Those marked B remain on a 200-mesh sieve and are less magnified, as shown by the scale beside 1.

In the October *Journal* of the Chemical, Metallurgical & Mining Society of South Africa, is a communication from M. Thornton Murray on this subject. The sample of zinc-dust examined by him appears to have been somewhat coarser than the average, as it is usual to find in the material of less than 0.003 in. diameter a good deal of dust not over 0.0001 in. diameter, and some considerably finer, so that I should be disposed to consider 0.0005 in. more nearly an average for this fraction.

Mr. Murray's assumed gravity (6.92) would give $\frac{0.1665}{d}$ instead of $\frac{0.165}{d}$ which I have assumed for the sq. ft. per lb., or approximately 1% more surface than my formula would indicate. Thus, instead of 144.8 sq. ft. per lb. as calculated by him for a mean diameter of 0.00115 in., my formula gives 143.5 sq. ft. Actually I have found a range from 6.82 to 7.0 in the specific gravity of samples of zinc-dust tested.

Mr. Murray has, however, seemingly obtained his 'mean diameter' by multiplying the assumed diameter of each of his fractions by its percentage weight, and dividing the sum of these products by 100, which is not mathematically correct for the reason that there are far more particles in 1% of the finer grades than in 1% of the coarse,[5] considering a given weight of the total material. This makes his calculated mean diameter too high, and the resulting surface correspondingly too low. This may be seen by computing the surface for each fraction separately, as below, from Mr. Murray's data for percentages and diameters of the various fractions, the finest fraction alone giving a larger surface than he has computed for the whole.

If the average diameter of the particles in the finest fraction be assumed at 0.0005 in. instead of 0.00085, the surface becomes approximately 330 sq. ft. for each pound of that grade, or 312 ft. for a pound of the total dust, or about 288 sq. ft. of zinc reckoning 90% of metallic zinc, the surfaces exposed by the coarser fractions being negligible in comparison. As others have pointed out in a previous discussion on fine grinding,[7] the results of the calculation depend almost entirely upon the average diameter assumed for the material passing the finest sieve used, which there is no means of precisely determining.

Fraction between	Mean diam. of fraction (d inch)	Sq. ft. for 1 lb. of fraction 0.165/d.	Per cent of fraction	Sq. ft. for 1 lb. of total zinc	Sq. ft. for 0.90 lb. of metallic zinc
0.0197 and 0.0100	0.149	11.07	0.16	0.018	0.0162
0.0100 and 0.0060	0.008	20.63	2.42	0.05	0.045
0.0060 and 0.0030	0.0045	36.67	2.88	0.106	0.0954
0.0030 and 0.0	0.00085	194.1	94.54	183.50	165.15
Total	0.0009[6]	183.67	100.00	183.674	165.3

[5] This is obvious from a consideration of an extreme case. Suppose a mixture of equal weights of bullets of two sizes, half the weight being balls of 1.0 in. diam., and half of 0.10 in. The mean diameter is not 0.55 in. (as would be found by calculation based simply on distribution by weight), since for every 1-in. ball there are 1000 balls of a diameter of 0.10 inch.

[6] Approximate true mean diameter calculated back from total surface by formula (0.165/d. = sq. ft. per lb.)

[7] See *Jour.* Chem., Met. & Min. Soc. of S. A., Vol. VII., pp. 120, 207, 265, 289.

Nickel in Canada, 1911

The mining and smelting of nickel-copper ores in the Sudbury district of Ontario was carried on actively throughout 1911, and although the production was slightly less than in 1910, it was still very much larger than in any previous year. Active operations were, as usual, carried on by the Mond Nickel Co. at Victoria mines and the Canadian Copper Co. at Copper Cliff, Creighton, and Crean Hill, while the Dominion Nickel Co. continued to develop its property at Norman Station.

The ore is first roasted and then smelted and converted to a matte containing from 77 to 82% of the combined metals, copper and nickel, the matte being shipped to the United States and Great Britain for refining. A portion of the matte is now used for the production of monel metal, which is obtained directly from the matte without the intermediate refining of either nickel or copper. The total production of matte in 1911 was 32,607 tons, valued at the smelters at $3,945,593, a decrease of 2462 tons, or 6.9% from the production of 1910. The metallic contents were copper, 17,932,263 lb., and nickel, 34,098,744 pounds.

The aggregate results of the operations on the Sudbury district nickel-copper ores during the past four years were as follows, in tons:

	1908.	1909.	1910.	1911.
Ore mined	$ 409,551	$ 451,892	$ 652,392	$ 612,511
Ore smelted	360,180	462,336	628,947	610,834
Matte produced	21,197	25,845	35,033	32,607
Copper content of matte	7,503	7,873	9,630	8,966
Nickel content of matte	9,572	13,141	18,625	17,049
Value of matte shipped	$2,930,989	$3,913,017	$5,380,064	$4,945,592
	Pounds.	Pounds.	Pounds.	Pounds.
Exports to Great Britain	2,554,486	3,843,763	5,335,331	5,023,393
Exports to U. S.	16,865,407	21,772,635	30,679,451	27,596,578
	19,419,893	25,616,398	36,014,782	32,619,971

MICHIGAN is the second salt-producing state in importance in the Union, being surpassed only by New York. The output of salt in the state i n1910, according to the U. S. Geological Survey, was 9,452,022 barrels, or 1,323,283 tons, valued at $2,231,262. The total salt production in 1910 was 30,305,656 barrels, against only 979,306 barrels imported, valued at $370,922. At the same time salt to the value of $320,926 was exported. The indications are that the salt production for 1911 will show an increase over the figures for the preceding year.

AMERICA has only one-fourth of the total number of electrolytic copper refineries in the world, but these produce 86% of the world's output of copper.

Work of the Utah Copper Company

By D. C. Jackling

The Mine

Development.—The total amount of underground work done in the original Utah Copper group during the year 1911 was 8930 ft., making a grand total done since the mine was opened of 190,271 ft., or 36.04 miles. During the year 33,504 ft. of new underground work was driven in the original Boston Consolidated group, making a total in that area since the commencement of development of 188,947 ft., or 35.78 miles. The total of all underground development, consisting of adits, drifts, and raises, done since the beginning of development and up to the end of the year 1911 was 379,218 ft., or 71.82 miles. Of this total, 217,591 ft. or 41.21 miles, have been destroyed by underground mining and surface operations, and the total length of underground workings remaining accessible in both groups at the end of the year was, therefore, 30.61 miles.

During the year 1911, 15 churn-drill holes were driven for development purposes, the aggregate depth of which was 8533 ft. The combined depth of all diamond-drill and churn-drill holes existing previous to 1911 was 10,015 ft., and the combined depth at this time of all drilling, comprising 42 holes, is, therefore, 18,548 ft., the average depth of hole being 442 feet.

The cost of underground development for the year amounted to 15.66c. per ton for all ores mined from underground. Development costs applying to all ores shipped from the mines, both from underground and surface operations, was 4.11c. per ton. The cost of churn-drill development during the year amounted to 1.20c. per ton on the total ore produced from both sources. The cost of both underground and surface development work, therefore, amounted to 5.31c. per ton of ore mined. The whole of this cost was charged to operation and is included in the per ton mining costs for the year.

Ore Area.—At the end of the year 1910 there had been outlined in the Utah and Boston groups, by underground workings and churn-drilling, a known ore area fully and partly developed of 166.15 acres, of which 114.63 acres were in the original Utah Copper area and 51.52 acres were in the original Boston Consolidated group. During the year 1911 the total area of ore fully and partly developed was increased to 214.61 acres, of which amount 119.46 acres are in the original Utah group, 86.94 acres in the original Boston group, and 8.21 acres in the Pay Roll group. The average thickness of developed and partly developed ore at the end of the year 1910 was 345.5 ft., and by the end of the year 1911 this average thickness had been increased to 418 feet.

Ore Reserves.—By the churn-drilling in various parts of the property, and by underground development in the southwesterly portion of the orebody, during the year 1911, a large additional tonnage of ore was developed, both laterally and in depth, so that it became necessary to make a complete recalculation of the developed and partly developed ore in the entire property. The orebody was reblocked, and for the purpose of determining the average thickness of capping and ore, 32 longitudinal sections, as well as a large number of other sections which were necessary in order to determine the amount of capping and ore in the slopes, were made and used.

After deducting all the ore that had been mined from the property previous to January 1, 1912, there yet remained 301,500,000 tons of fully developed and partly developed ore, of which amount 229,830,000 tons were fully developed and 71,670,000 tons partly developed. The above mentioned tonnage of developed and partly developed ore includes about 26,790,000 tons of partly developed ore in the slopes of the steam-shovel workings. Of the fully developed ore, the average assay of 62,040,000 tons is 2% copper, the average assay of an additional 92,130,000 tons is 1.60% copper, and the average assay of the remaining 75,660,000 tons is 1.30% copper. The average assay of the 71,670,000 tons of partly developed ore is 1.28% copper, making the average assay of the 301,500,000 tons of developed and partly developed ore 1.532% copper. As it will not be possible in mining operations to keep the ore absolutely clean, the average assay of all the ore is considered as 1.50% copper. In this connection, it is of interest to note that during the entire life of both the Utah and Boston mines there was mined and milled, previous to January 1, 1912, a total of 15,885,521 tons of ore, having an average assay of 1.6018% copper. In making the calculations to determine the tonnage of both classes of ore, the same factor was used for the 1911 estimates as for those made in 1910, namely, 13 cu. ft. of rock in place per ton of ore. In obtaining the average assay of the 301,500,000 tons of ore, there were used 38,824 assays, representing 14,035 ft. of diamond-drill holes and churn-drill holes, and 246,900 ft. of drifts, raises, and winzes, or a total of 260,935 linear feet of development.

In addition to the above-mentioned tonnage of ore, there is a good mining assurance of developing a considerable tonnage of profitable ore immediately adjacent to and outside of the boundaries of the 214.61 acres of ore area mentioned on the next page. Some work has already been done in this material, but not sufficient to make possible any definite statements regarding its quantity or quality. In the northeastern part of the property there is an extensive mineralized area that has not yet been prospected, and there are indications that warrant the expectation of finding a large tonnage of ore in that part of the property. There is also a good possibility of developing more ore in depth underneath the area already covered by development. In the churn-drill prospecting it has frequently been necessary to abandon holes, although the bottom samples were of commercial grade, because of difficulty in drilling, and it is safe to say that the results of deeper drilling will show a greater average thickness of ore in the 214.61 acres than the 418 ft. previously stated.

Stripping Operations.—In the report for 1910 it was estimated that the average thickness of capping on the original Utah group was 80 ft., and on the original Boston group 160 ft., making an average thickness over the entire orebody, as then developed in the two groups, of 105 ft. During the year 1911 additional data as to thickness of capping were obtained, with the result that at the end of the year the average thickness on the Utah group was still shown to be 80 ft., the average thickness on the Boston group was 134 ft., and the average thickness on the Pay Roll group was 173 ft., making an average thickness over the entire orebody as developed at the end of 1911 of 106 ft. It is believed that further development on the Boston and Pay Roll groups will result in showing reductions in the average thickness of capping, and it is expected that these will be sufficient to bring the average thickness over the entire orebody down to not exceed 100 feet.

During the year 1911 the total amount of capping removed was 5,450,604 cu. yd., or at the average rate of 454,217 cu. yd. per month. During the first six months of the year 2,352,653 cu. yd. was removed, a rate of 392,109 cu. yd. per month, while during the second six months 3,097,951 cu. yd. was removed, an average of 516,325 cu. yd. per month. Previous to the last report

*From a report to the company for the fiscal year ended December 31, 1911.

the total amount of capping that had been stripped from the combined areas of the Utah and Boston properties since the beginning of their development was 7,162,556 cu. yd. Adding to this amount the total amount of stripping removed during 1911, the total 12,613,160 cu. yd. representing all the capping removed previous to January 1, 1912. Of this amount 9,129,170 cu. yd. has been removed from the Utah group and 3,483,990 cu. yd. from the Boston group. The total area upon which stripping operations were extended over an additional area of 47.26 acres, making a total area of 98.51 acres on the Utah group and 33.75 acres on the Boston group, or for the combined properties a total area over which such operations had been conducted up to January 1, 1912, of 132.26 acres.

The extension of the actual area completely stripped on both groups during the year 1911 amounted to 12.65 acres. The area so stripped, as reported in our last annual, was 20.87 acres, making the total of completely stripped area on both groups, at the end of 1911, 33.52 acres. The total yardage removed from both areas represents the equivalent of completely stripping 86.85 acres. Of this area, 70.73 acres is on original Utah Copper ground, where the capping, as previously stated, averages 80 ft. in thickness; the remainder of 16.12 acres is on Boston Consolidated ground, where a capping 134 ft thick exists. This area over which stripping has been completed, or partly so, contains an average of a little more than 1,400,000 tons per acre, and the overburden removed to date, therefore, represents the equivalent of completely stripping over 121,000,000 tons of ore. Of this quantity 15,885,521 tons, or about 13%, has been mined and shipped to the mills. At the time of the preceding annual report, this figure was nearly 20 per cent.

Mining Operations.—Underground mining operations at the Boston mine were continued throughout the year, and for a portion of the time at irregular intervals, some underground mining was done in the original Utah mine on the east side of Bingham canyon. Of the total ore mined during the year, 74% was obtained by steam-shovels from the original Utah Copper mine, 4% was mined underground in the Utah mine, and 22% was mined underground in the Boston mine. The average cost of steam-shovel mining for the year was 33.73c. per ton, of which 9.12c. was charged to cover the cost of prospecting with churn-drills and of stripping expense, leaving a cost, including all general charges, except development and stripping expense, for producing shovel ore of 24.61c. per ton. The average cost of underground mining for the year was 68.35c., of which amount 15.66c. was charged to cover the cost of underground development. The cost of underground mining at the Boston mine was considerably less than at the Utah mine, on account of the greater rate of tonnage at which the operations at the former point were conducted. The average cost of mining all the ore obtained both from surface operations and underground operations during the year was 44.79c. per ton, of which 12.81c. was charged to cover prospecting with churn-drills, underground development, and stripping expense, leaving a net cost for actual mining, including general and fixed charges, of 31.98c. per ton.

It is still the purpose to discontinue underground mining as soon as possible, but it has not been possible to do so as rapidly or as soon as was predicted in the preceding report. The areas which are now being stripped on Boston Consolidated territory are those over which the capping is thickest, and it will be some months before any material tonnage can be derived from them. It is not expected to be able to furnish the plants with a tonnage entirely from steam-shovel mining, even at their present capacity, until some output can be secured in this way from the Boston area. Furthermore, the capacity of the plants is being increased rapidly, as will be hereafter described, and the result of the two circumstances will probably be that it will be found necessary to continue some underground mining throughout the current year.

Equipment and Improvements. — During the year there were added to the mine equipment 20 standard-gauge 12-yd. steel dump-cars, 2 steel under-frame flat cars, and 2 standard-gauge 50-ton locomotives, making the complete list of this class of equipment at the end of the year: 22 standard-gauge steam-shovels, 35 standard-gauge switching locomotives, 1 standard-gauge Shay locomotive, 11 narrow-gauge switching locomotives, 100 standard-gauge 12-yd. dump-cars, 117 standard-gauge 6-yd. dump-cars, 144 narrow-gauge 4-yd. dump-cars, and four 100,000-lb. capacity flat cars. There are also 11 churn-drills used in drilling for development and blasting purposes.

It was found necessary during the year to change the position of the machine-shop and the compressor plant at the Utah mine in order to provide more capacity in the auxiliary yard for the use of the Bingham & Garfield railway. It was also necessary to provide an additional air-compressor of 2300-cu. ft. capacity, making two of this size on the Utah property. Four small compressors were acquired with the Boston Consolidated property, and these are still in operation, the total capacity of all compressors now available for use being approximately 8000 ft. of free air per minute.

Claims and Lands Owned.—There have been some small changes in acreage from that shown in the preceding annual report, due in part to the acquisition of additional property and in part to an error in the last report in the statemen of millsite acreage acquired from the Boston Consolidated company near Utah lake.

	Acres.
Original Utah Copper claims	194.938
Original Boston Consolidated claims	359.729
Outlying fractional claims	8.158
Shawmut Consolidated group of claims	100.721
Pay Roll group of claims	60.324
Total area of lode mining claims	723.870

In addition to the above, the millsites and other lands owned by the company are as follows:

	Acres.
Bingham Canyon lands (old Copperton plant site)	1587.39
Garfield lands at Magna and Arthur plants and adjacent to them	3357.94
Utah and Davis county lands near Utah lake, acquired with Boston Consolidated property	668.49
Total	5613.82

Construction and Operation at the Mills

Construction.—No extensive improvements or additions were made at the Magna plant during the year. The capacity of the coarse-crushing departments was increased by the installation of a screening plant in the coarse-ore bins to remove a greater percentage of fine material as the ore is dumped from railroad cars and thus relieve the crushers. This arrangement has proved of material advantage, particularly in seasons when the ore comes to the mills wet. The shops and warehouse here were increased in capacity to an extent necessary to accommodate the work of the Bingham & Garfield railway. The work of remodeling the Arthur plant continued throughout the year at such a rate as was necessary to complete sections as rapidly as they were needed to accommodate the increase in tonnage from the mines. The first section of the remodeled plant was started up in February, and another section was started before the end of the first quarter. During the second quarter, two additional sections were started and, about the end of the second quarter, the entire stamp-mill portion of the plant then in operation was permanently closed down, as the four remodeled sections were capable of milling practically as much tonnage as the thirteen original stamp-mill sections of the plant. The fifth remodeled section was put in commission during the third quarter, and the sixth section before the end of the year, at which time the seventh and eighth sections were also nearly completed. The seventh, eighth, and ninth sections have since been completed and the seventh and eighth put in commission. The

ninth section is ready to receive ore at the date of writing this report. The reconstruction of the four remaining sections of the Arthur mill can be completed as rapidly as required, and it is the present intention to finish the last one about the middle of the year.

During the year the capacity of the foundry department at Arthur was increased by erecting an entirely new and larger building. This was done in order to accommodate the business of the Magna plant and the Bingham & Garfield railway; and now all the iron and brass castings required at the mills and the mines and by the railroad are manufactured at this foundry.

Operations at the Mills.—The total ore treated at both plants for the year was 4,680,801 tons, as compared with 4,340,245 tons for the previous year. The Magna plant milled 3,725,404 tons, an increase of approximately 515,000 tons, as compared with the previous year. The Arthur plant, the full capacity of which was not required throughout the year, milled 955,397 tons, an increase of about 18,000 tons as compared to the previous year. The Magna plant has readily handled 1000 tons per section per day during periods when the ore-supply was plentiful and regular, thus proving its ability to treat 12,000 tons per day. The new sections of the Arthur plant have, under like conditions, milled at the rate of 9000 tons for the entire plant, and it is, therefore, demonstrated that the two plants will, when Arthur is completed, have a combined capacity sufficient to economically mill 21,000 tons per day of the same grade and character of ore milled during the past year.

The average copper content of the ore treated at both plants was 1.51%, as compared with 1.54% for the year 1910. The average recovery at both plants was 69.53%, corresponding to 21.03 lb. copper per ton, as compared to an average extraction of 66.55% and a recovery of 20.51 lb. for the previous year. The average extraction at the Magna plant was 69.28% and at the Arthur 70.49%. The average recoveries stated for the Arthur plant include the comparatively inferior results of the portion of the old mill in operation up to the middle of the year, and the average results experienced at that plant, since the operation of the old sections was discontinued, are comparatively better on the same grades and quality of ore. In fact, it is apparent that the new arrangement of the Arthur plant is superior to that of the Magna mill in point both of economy of operation and metallurgical results.

The average cost of milling at both plants was 41.68c. per ton, as compared to 46.63c. for the previous year. The milling cost at Magna was 40.06c. and at Arthur 48.01c. per ton. The higher cost at Arthur was due largely to the operation for a part of the year of the old sections of the plant, but partly to intermittent running at less than full capacity. When this plant is running at full capacity, it is expected that its costs will, as previously suggested, be somewhat lower than those of the Magna plant. The milling costs stated include their proper proportion of all fixed and general charges.

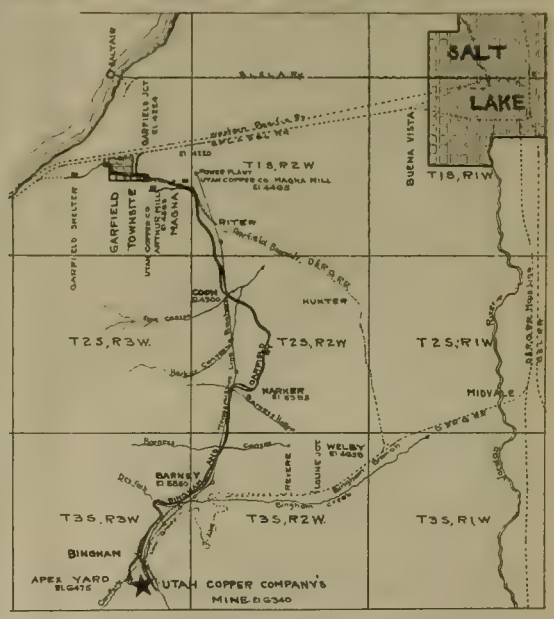
Production and Costs.—The total production of copper contained in concentrate from both plants for the year was 98,436,224 lb., as compared to 89,019,511 lb. for the previous year. The average grade of concentrate produced was 25.62%, as compared to 27.28% for the year 1910. The reduction in average grade of concentrate was due principally to the treatment of ores mined from underground in the Boston Consolidated area which contained a somewhat higher percentage of iron than the ores from the Utah Copper area. The production for the year by quarters is as follows:

	Pounds.
First quarter	21,296,709
Second quarter	24,469,812
Third quarter	25,851,456
Fourth quarter	26,818,247
Total	98,436,224

The average cost per pound of copper produced, based on the net pounds of copper resulting after smelting reductions and allowances were made and after applying credits for gold and silver recovered, was 7.8055c., as compared to 8.069c. for the year 1910. The net value of the gold and silver recovered amounted to 1.07c. per pound. The costs given include all expense of smelting, transportation of the blister copper to the refinery, refining, and selling expenses, but do not include delivery of refined metal.

The average total cost for the year of mining and milling, exclusive of transportation charges, was 86.47c. per ton, as compared to 87.6c. per ton for the previous year. Included in this cost is the charge, previously referred to in the discussion of mining costs, of 12.81c. per ton, covering the expense of drilling and underground development and including a fixed charge of 7½c. per ton for the retirement of stripping expense.

As will be seen by a comparison of the milling costs for the past two years, these are being reduced continually, and further reductions will result from the treatment of increased tonnage. It is obvious, from a comparison of the costs of steam-shovel and underground mining, that the mining costs will be materially lower when the entire tonnage can be derived from surface operation. The costs of transportation of the ore from the mines to the mills will be decreased for the future by contract provision that became effective early in the year 1912 by 2½c. per ton, as compared to these charges for previous years. Economies in the cost of power, water-supply, and other operating factors are also being made and, taken together, these will result at an early date in a very substantial reduction in the cost per pound of producing copper.



SALT LAKE CITY AND VICINITY.

Bingham & Garfield Railway

Grading for the Bingham & Garfield railway was started on April 22, 1910, and completed in August 1911. During that period there was removed in excavations for the line 746,970 cu. yd. of solid rock, 618,222 cu. yd. of loose rock, and 315,079 cu. yd. of earth, a total of 1,680,271 cu. yd. Four tunnels were driven having an aggregate length of 4798 ft., of which it was found necessary to line 2963 ft. with timber. These tunnels are all in the first three miles of line from the Bingham end. In that distance there are also three steel bridges containing about 3000 tons of steel and having an aggregate length of 2000 ft. The maximum heights of these bridges, beginning with the one across Carr fork at the upper end of the line, are 190, 225, and 188 ft., respectively. The total length of tunnels and bridges, together with their approaches, in the upper three miles of the line constitute about one-half that distance. The

main line between the Utah Copper mine and the mills at Garfield is laid with 90-lb. steel. The extension from the mills at Garfield to connect with the San Pedro, Los Angeles & Salt Lake railway and the yards at all points are laid with 65-lb. steel. The line was completed and put in operation for freight service on September 15, 1911.

At the end of the year 1911 the tracks belonging to the Bingham & Garfield railway already constructed and in use for ore and commercial purposes were as follows:

	Miles.
Main line from Garfield to the mines, including the track to the Garfield smelter	22.296
Yard and siding tracks at Garfield and Bingham and along main line, including extension of the switchback system at Bingham necessary to reach Utah Copper and other mines	19.910
Other tracks at Bingham which the Utah Copper Co. has the right of use	34.200
Total	76.406

A double-track incline tramway 554 ft. long has been constructed for the handling of passengers, express, and light freight between the Bingham station of the railway and a substation near the centre of the town of Bingham.

As has been previously stated, freight service was started on September 15, 1911, and at the same time passenger service, consisting of two trains each way per day, was inaugurated between Bingham and Salt Lake City. Up to the end of the year the total traffic amounted to 754,584 net tons of ore and other freight, and the total number of passengers handled was 15,276. The facilities for handling freight and passengers at the Bingham terminal were not completed until late in the year, and the business of the line suffered accordingly. Since these were completed, business has been increasing rapidly. The operation of the road has proved satisfactory and economical in every respect. The heavy Mallet compound locomotives readily handle a train of 40 ore-cars containing 65 net tons each of ore, a net trainload of 2600 cars, between the mine and the mills at Garfield in 1 hour and 30 minutes, the 'empties' being returned to the mine in the like time without the assistance of additional motive power. It, therefore, requires less than one shift's service of 10 hours for two train crews to handle 10,000 tons per day.

Copper Producers' Association Report

The Copper Producers' Association May statement shows a decrease during the preceding month in accumulation in this country of 2,927,829 lb. The details are as follows:

	Pounds.
Stock of marketable copper of all kinds on hand at all points in the United States April 1, 1912	62,367,557
Production of marketable copper in the United States from all domestic and foreign sources during April	125,694,001
Deliveries for consumption, April	69,513,846
Deliveries for export, April	53,252,326
Stock of marketable copper of all kinds on hand and at all points in the United States May 1.	65,295,386

The changes in surplus since May 1, 1911, have been as follows, in pounds.

	Increase.	Decrease.
May 1911	440,024	.....
June	.....	8,561,768
July	.....	19,695,306
August	.....	4,297,357
September	7,453,355	.....
October	.....	5,897,214
November	.....	23,212,454
December	.....	22,330,493
January, 1912	.....	22,173,252
February	.....	3,301,944
March	.....	572,431
April	2,927,829	.....

Alaskans on Alaska's Needs

The following resolutions were passed at a representative gathering of Alaskans from Cordova, Seward, Katalla, Fairbanks, Valdez, Chitina, and other points, held at Cordova April 3 and reported in the *Cordova Daily Alaskan:*

Whereas it appears to be generally accepted by those who are unfamiliar with Alaska conditions that the people of the territory are unable to agree upon matters of proposed legislation by Congress; and,

Whereas, there are certain great vital questions affecting the material progress and development of this vast territory upon which the whole people, irrespective of party affiliation, are united, and upon which they demand immediate action at the hands of Congress; and,

Whereas, by reason of the fact that, among others, there is in attendance upon this convention the delegates of both the Republican and Democratic territorial conventions of the Territory of Alaska, which conventions have just concluded their proceedings and deliberations;

Now, therefore, in order that there may in the future be no misunderstanding as to the matter upon which the whole people of Alaska are united and upon which they demand relief and constructive legislation at the hands of Congress, the following resolutions be unanimously adopted and promulgated:

1. We demand the immediate opening of the coal and oil fields, and the abolishment of the forest reserve.

2. Rail transportation. A trunk line railroad from the Gulf of Alaska to the Yukon is a vital and pressing necessity to the proper development of the territory. Under the present attitude of Congress and the regulations of the Government, private capital is barred from such a venture. We, therefore, demand that the Government immediately construct, maintain, and operate such a trunk road.

3. We demand from Congress liberal annual appropriations for extension and maintenance of roads and trails, and urge the immediate construction from the coast to Fairbanks of a trunk automobile road to facilitate the mail service and other transportation. Our territory is so vast that any appropriation less than one million dollars annually for a number of years will be inadequate.

4. We urge that the present mining laws, in so far as they apply to Alaska, shall be so amended as to prevent existing abuses of staking mining claims by agent or power of attorney, and that the location of association placer-mining claims shall hereafter be prohibited or that the annual assessment work required for said claims shall be increased so that $100 worth of work shall be required for each twenty acres of said claims.

5. We favor liberal appropriations by which justice may be done to, and care taken of, those worthy pioneers of Alaska who have blazed the way for civilization, but who are themselves often left to an old age of penury and want.

6. We believe that all appointments to Federal offices in Alaska should be made from *bona fide* residents of Alaska.

7. We recommend as a vital need that Government hatcheries be provided from funds derived from increased and equitable taxation of canneries, and that a more rigid inspection be maintained with a view of conserving this great natural resource.

8. We demand that additional lights and beacons be installed along the coast of Alaska.

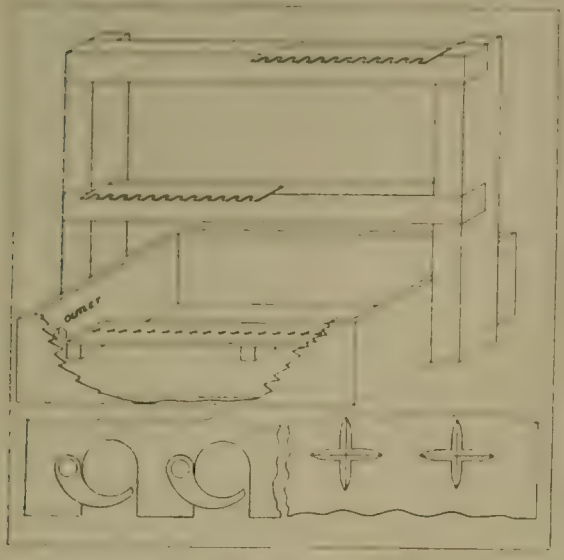
9. We demand a full measure of territorial form of government.

ASPHALT is produced in Switzerland at Travers, Neuchatel canton, by the Neuchatel Asphalt Co., of London, England. The annual extraction amounts to about 25,000 metric tons, and there is enough asphalt to keep the company running for a hundred years.

BOLIVIAN tin exports, according to reports given out by the customs authorities, reached 23,499 tons during 1911, a gain of 2000 tons over 1910.

Rack for Drill Steel

Tempering machine drills after sharpening slows down the work unless some sort of a stand is provided so that blacksmith or helper need not hold each drill in position. The one figured below is in use at the Treadwell mines, and its essential features are a rack that holds the drill rigidly vertical and a supporting plate that allows the edge of the bit only to stand in the water. As shown in the illustration, notched iron plates are provided at suit



ALASKA TREADWELL DRILL RACK.

able heights to receive the shanks of long and short drills. In the detailed drawing, at the lower left-hand corner, is shown the locking device which holds each drill firmly in place. In the lower right-hand corner is a detail showing the slotting of the supporting plate which is fixed in the box at the proper position with reference to the outlet. In the drawing the latter is shown too high, as only the tip of the drill should rest in the water. The box is made of wood except for the supporting plate and rack, which are cut from boiler plate. A flow of water through the box is maintained and at the proper instant each drill is taken from the box and quenched under the outlet flow.

Loss of Copper in Slag

The slag losses of copper, other than mechanical, depend upon the composition of the slag, according to V. Vanyukov in *Metallurgie*. Both matte and slag are electrolytes, the concentration of the different ions varying with the different amounts of the elements present. It is evident that the concentration of cations of a given base in the slag will be affected by the presence of sulphur compounds of this base. The higher the concentration of given base in the slag, the greater the tendency to dissolve sulphur compounds of this base, and along with it some associated Cu_2S. The degree of this tendency decreases with the affinity of the element for sulphur and the degree of dissociation of the silicate and sulphur compound. The affinity for sulphur of various metals is in the following order: Cu, Ni, Co, Fe, Mn, Zn, Ca, Mg, Al. With slags high in the metals near the end of the series the losses in copper are much lower than with slags high in the metals at the beginning of the series.

CONSTRUCTION of the new Nahuel Huapi railway in Argentina, with its extensions across the Andes, is well advanced on the Argentine side between Port San Antonio and Port San Carlos de Bariloche, and the work may be completed within two years.

Utah Copper Quarterly Report

The following tables show the gross production of the Utah Copper Co. for the first quarter of 1912 and the preceding quarter, of total copper contained in concentrate, according to the quarterly report of the president, C. M. MacNeill:

	Pounds.		Pounds.
January 1912....	8,156,612	October 1911....	8,660,729
February "	8,612,739	November "	9,117,961
March "	8,160,199	December "	9,039,557
Total	24,929,550	Total	26,818,247
Av. mo. prod....	8,309,850	Av. mo. prod....	8,939,416

The total amount of ore treated at both milling plants for the quarter was 1,299,315 tons, as compared with 1,365,910 tons for the previous quarter. The Magna plant handled about 69% and the Arthur plant about 31% of the tonnage. The average grade of ore for this quarter was 1.435% copper, as compared with 1.418% copper for the previous quarter. The average cost per pound of net copper produced during the quarter, after making allowances for smelter deductions and without crediting miscellaneous income, was 8.62c., as compared with 7.85c. for the fourth quarter of 1911. The difficulty of conducting operations at both the mines and the mills during the severe winter weather that prevailed throughout the entire quarter and the consequent decrease in production was responsible for this increase in cost. The following tabulation shows the financial results of the operations of the company for the quarter:

Net profits from milling operations for the quarter	$1,409,985.66
Additional income from rents and miscellaneous sources in Utah	12,478.76
Income from Nevada Con. Copper Co. dividends	375,187.50
Total net profit for the quarter	$1,797,651.92
Dividends paid	1,181,287.50
Net surplus for quarter	$ 616,364.42

These earnings are computed on the basis of 14.25c. per pound for copper for the months of January and February, and 15.25c. per pound for copper for the month of March. At the close of the quarter no copper due for delivery from the refinery remained unsold. The Magna plant was in continuous operation throughout the quarter, but its capacity, as well as that of the remodeled sections of the Arthur plant which were in operation, was below normal on account of the constantly cold and stormy weather during the quarter. The frozen condition of the ore prevented rapid unloading of the cars during the cold weather, and during moderate weather the ore was so wet on account of melting snows that it was difficult to put anything like regular tonnage through the coarse-crushing departments. Steps are being taken to protect operations against a recurrence of this condition.

The seventh remodeled section of the Arthur plant, or old Boston Consolidated mill, was completed and placed in operation about the middle of January; the eighth section, the last of February, and the ninth section early in April. The stripping work was hampered by the severe winter weather and a constant scarcity of fuel. During the quarter there were removed from the Utah and Boston groups a total of 1,354,761 cu. yd. of capping, as compared with 1,520,058 cu. yd. removed during the fourth quarter of 1911, being a decrease of 165,297 cu. yd. The Bingham & Garfield railway did a good business during the entire quarter, an average of 7910 tons of ore per day having been hauled from the mines to the mills, and an average of 571 tons per day of other freight having also been handled over the line from Garfield to the mills and mines.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Russian Platinum Prices

The Editor:

Sir—In the issue of your valuable paper dated April 27, in the article 'Russian Platinum Market,' the current price for 83% platinum is given as 9 rubles 90 kopeks per 'pood'—which, evidently, is meant per 'zolotnik.'

Below are the weights used in the Russian metal market:
1 pood = 40 funt = 36.112 lb. = 16.3805 kg.
1 funt = 96 zolotnik = 0.9028 lb. = 0.409 kg.
1 zolotnik = 96 dolya = 0.1504 oz. = 4.2659 gm.
1 dolya = 0.686 grains = 44.436 mg.

The tenor of placer gravel is usually given in terms of 'dolya' per 100 'pood,' making the relation in weights as 1:36,864,000. In approximate calculation, 1 'dolya' of gold is valued at 5 'kopeks' = 2.5 cents, and 100 'pood' might be taken as the weight of 1 cu. yd. gravel (about 3600 lb.).

ALEXANDER J. HEINDL.

Berkeley, California, May 1.

The Mine-Owners' Liability for Accidents

The Editor:

Sir—Mr. F. J. Martin, of Angels Camp, whose recent article inspired this series of letters, is quite sure that the added cost of mining gold attendant upon requiring the mine-owner to compensate his injured workmen cannot be passed on to the ultimate consumer of gold because, "As everyone knows, *gold has a fixed value*." Therefore, he insists, the state at large should share this expense with the mine-owner, "since the whole state is benefited by the gold-mining industry." There have been those who have concerned themselves profoundly lest compensation should pauperize the hurt man, and they have characterized the Roseberry measure as one calculated to 'wet nurse' him into a position of dependence upon public bounty. If our experience with 'wet nursing' American industries may be taken as a guide, we should be duly cautious about 'wet nursing' anything into a condition of dependence upon public subsidy, and especially against a nursing bottle with a gold nipple. How those 'infant industries' of ours, like the United States Steel Corporation, the harvester trust, the sugar trust, and the rest, do squall when Congress makes a feint of proceeding to take the nursing bottle away!

Let it be clearly understood that the failure of each industry to take care of its own hurt men, and those dependent upon them, is, and always has been, a downright bonus to such industries paid into their treasuries by poverty and property; first, by the hurt man, who was denied the recompense for his hurt to which he always had a moral if not a legal right; by the dependent children of the hurt man, who were forced into orphanages or out into the world of industry while they should have been at school; by property, in that it has found, even in this young and rich state of California, the pauper problem one of the most exacting to be solved; and again by property, in that it has had to bear the cost of the criminality that indubitably grows out of poverty. Ever and always industry has enjoyed this bonus, and few there are among our industries that feel that they can live if this bonus is taken away.

That gold mining is of advantage to the state is true, but so is farming, and the California farmer is lying awake nights through fear that he may have to pay for the injuries that befall men who help him to grow his crop. And so on down the line! All admit the justice of compensation, for that cannot be denied, but each industry for itself protests that it can by no means bear the cost and that either the hurt man must bear the burdens as heretofore, or else that plethoric person known as the state at large. All want to 'let George do it.' Let me lay down a fundamental proposition: that industry which cannot survive except it receive a bonus of unrequited claims from mangled men, widowed women, and orphaned children, will best serve the state by winding up its affairs and quitting so unprofitable a business. That business which, after it has been boosted over a limited period of infancy, cannot make its own living, pay its own way, and leave nothing unpaid that it morally owes, has no right to exist, and surely gold mining is no infant industry in California. It is the oldest of all and the author of many.

It is not at all times easy to see when, and how, and where, in any industry, the ultimate consumer pays the compensation benefits that go to hurt men and women, and it is not always that the ultimate consumer will pay such compensation benefits, but, with few exceptions, he eventually must. Mr. Martin is fundamentally wrong when he declares that gold has a fixed value. Its value is as unfixed as the surface level of the sea. Its value ebbs and flows with every increase or diminution of output, with every new demand in commerce or the arts, and the worst of it is that in swashing around in its world-volume bed, gold fixes and unfixes the value of every other commodity known to human use. This is because gold is both a commodity and a world-measure of the value of all commodities, in which latter function it operates by contraries. Whatever invention or device decreases the cost of mining gold increases the output of gold and, to that extent, tends to cheapen gold and raise the gold price of everything else. *Per contra*, whatever increases the cost of mining gold, to that extent diminishes the supply of that metal and tends to raise its value. This is known by the token that the prices of all other commodities begin to tumble when gold goes up. Gold enjoys no exemption from the law of supply and demand that acts so potently with other commodities.

Now it is as certain as anything else of which the operation cannot be seen, as certain as that electricity exerts power, that the consumers of all products except gold foot the bills for the creation of those products, and gold is as much a product of industry as coal, and those laws that operate in fixing the price of coal operate just as certainly in fixing the price of gold, only the other side up. In Illinois, for instance, in order to enable the coal operators to pay a death benefit of $2250 for each miner killed, instead of $168, as has obtained for many years under the old order, will require the addition of 1.6c. per ton to the price of all coal mined in that state. I do not know just how much more an ounce of gold would be made worth if a similar increase in death benefits were required to be paid for all gold miners killed. The fraction might be infinitesimal, but it would be there, and the producer of all commodities, rather than the consumers, would pay the bill, because, as above explained, gold as a measure of commodities operates contrariwise. The point of all this is that the imposition upon the gold miner of California of the cost of indemnifying industrial accidents will, in so far as the gold product of California influences the value of the gold product of the world, be transferred from the gold miner to the producer of all other commodities, although when it is done and how it is done neither the miner nor anyone else will be able to detect in any concrete case. It should suffice to know that it is so. 'The buck' will be passed all right, but let us hope not in the form of a bonus to the mining industry assessed upon other property of the state as a state tax. Gold mining is in no need of passing the hat.

The crux of the whole problem of distribution of this added cost is insurance; and mining insurance comes high. It is so the world over, for mining is a hazardous industry, hazardous to health as well as to life and limb, and occupational diseases need insurance coverage as much and as certainly as industrial casualty. What interests me most is to learn if there is such a community of interest and parity of risk among gold mines as will make it a practical thing for mine-owners to come together and either inter-insure each other against the hazards of accident or form mutual insurance companies for mine-owners only, by which they

may carry their accident risks at what it is worth to insure against them. It is to this subject that, in my judgment, the mine owners of California should give attention rather than to suggestions for unloading the initial burden or any part of it upon the taxpayers of the state.

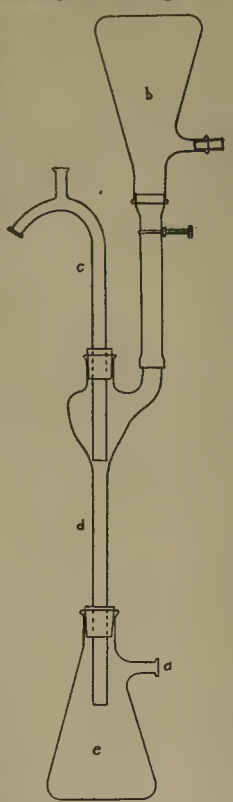
The law of liability in damages has, through the abrogation of old defenses, increased the liabilities of employers, mine-owners in common with others, three or four times over, and I cannot promise them that compensation, if elected, will cost them less. Ten years' experience will tell; nothing else can. Meantime, the hazard must somehow be carried. Insurance enables employers to bear one another's burdens and to make a first distribution of each loss over the industry in which the loss occurred, and all that any mine-owner has a present right to demand of the state is to have opened for him a way whereby he may, if he will, best in himself secure insurance coverage at what it is reasonably worth to furnish that coverage. Every industry should care for its own killed and wounded. This is a task which the Industrial Accident Board has in hand, and in its performance it wants and needs the counsel, coöperation, and practical knowledge of every mine-owner and mining engineer in California.

San Francisco, March 25. A. J. PILLSBURY.

Laboratory Classifiers

The Editor:

Sir—Elsewhere in this issue W. J. Sharwood describes a simple and cheap type of laboratory classifier, which he employed in the classification of zinc-dust. The apparatus there described has the great advantage of being constructed from material available in every laboratory, and served admirably the purpose for which Mr. Sharwood intended it, but if others were to employ it for general work faulty results would be obtained that might vitiate the conclusions reached. For classification of ores it is evident that the velocity of flow to be considered is that at the lip where the material is overflowing, rather than in the body of the tube, and it is likewise obvious that the amount of ore that can thus be classified is too small for convenience in experimental work, since if the ore present in the tube exceeds 1/10 of the volume of the ascending current of water it will give rise to interstitial currents which interfere with the separation.



MUNROE LABORATORY CLASSIFIER.

Since the present trend of ore-dressing practice is toward closer classification, and closer control of mill operations in the light of laboratory experiment, it may be worth while to call attention to the convenient laboratory classifier, shown by the accompanying illustration, which was devised by H. S. Munroe, professor of mining in Columbia University, and first described in the *School of Mines Quarterly*, April 1901, page 303. It consists essentially of two Erlenmeyer flasks of convenient size, a specially constructed feed tube, *d*, and a classification tube, *e*. These are connected as shown. In use, *a* is connected with a source of water supply of constant head, and by measuring the outflow from *c* for a given period and dividing by the area of *d*, previously determined, the rate of flow is computed. The ore, mixed with water, is placed in *b* and the pinch-cock opened sufficiently to allow the desired amount of feed, which should not exceed 1/10 the volume of the rising current in *d*. As the ore passes down the feed tube, water passes up into *b* to take its place, thus tending to prevent choking. A small quantity of air at the top of *b* aids in this, as by gently squeezing the rubber tube a pumping action is produced which will free the tube even when choked with quite coarse sand. By re-treating the sized product with successive currents of increasing velocity any number of classifications desired can be made. Both in ordinary ore-dressing and in cyanidation the screening tests which are commonly employed are not so significant as a determination of classification ratios would be. Furthermore, with screens it is impracticable to obtain a closer separation than, for example, through 150 mesh, on 200 mesh, through 200 mesh, while with a classifier any desired degree of accuracy can be obtained.

San Francisco, May 6. THOMAS T. READ.

Government Bureaus and Potash

The Editor:

Sir—I beg leave to approve of the editorial in your issue of March 30 entitled 'Government Bureaus and Potash.' Many of us who have lived in the West have known for twenty to thirty years that the beds of the dry lakes of the Great Basin region are rich in the various salts of soda, potash, lime, and magnesia. The deposits of many of them were thoroughly analyzed years ago by competent chemists without the aid of Government appropriations. Perhaps all the possible natural salts of soda are present, though the chloride, carbonate, and sulphate of sodium are the most prevalent and the greatest in amount. In certain localities biborate of soda, or borax, is rather common in lesser amounts. Next in order of magnitude in these ancient lake beds are usually salts of lime and magnesia as secondary deposits or recrystallizations; those of sulphates of lime and magnesia being perhaps the most common. In most of the lake-beds potash can be found as nitrate, chlorate, sulphate, or other forms, but in much less percentage than the soda salts. In any given lake-bed a given salt does not usually occur with any special uniformity, either as to areal or vertical distribution. Take Death Valley, for example. The only salt that has been commercially gathered from that locality is borax in the shape of the efflorescence called 'cotton-ball'; but in the deepest part of this 'sink' and over the larger part of its area, chloride, carbonate, and sulphate of sodium occur in much larger quantities. How futile, then, on the basis of analyses from a few shallow wells, to take a pencil and figure the tonnage of any one given salt in the whole lake basin, as has been done by the Government experts in the case of Searles lake. Furthermore, I, for one, do not know as yet that the salts found in the deposits and brines of ancient lake-beds can be isolated or segregated from each other on a commercial scale at a cost commensurate with the lack of transportation facilities which almost always exists. As you well say, "The function of Government bureaus is to disseminate accurate information, not to diffuse sensational statements."

One of the possible minor injuries resulting from ill-considered preliminary reports by members of the Government bureaus, is occurring now in this part of Nevada. Many of my neighbors are investing in potash locations in Railroad valley; and they are doing it largely because an alleged Government expert has spent a day or two there and has reported favorably in general terms. It is hoped that the yield of potash salts will be high in Railroad valley. The locality is certainly more promising than where the Government test-well was sunk near Fallon; but as yet there are not sufficient facts known to determine commercial possibilities.

The self-advertising methods of Government bureaus, and disinclination to give credit to earlier and capable workers in a private capacity in the same field, is shown by a little history of the Western phosphate deposits. Many years ago I was invited by a cowboy to see an outcrop of coal which he thought he had discovered in a certain

locality in southwest Wyoming. Before the outcrop was seen it was decided it could hardly be coal, as the nearby formations were much older and of a lower geological horizon than the Laramie formation of the Cretaceous in which most of the coals of the West occur. Samples of the dark outcrop were taken, and were shortly afterward determined to contain calcium phosphate. It did not occur to me, at the time, that there were commercial possibilities in the material, and I can hardly see it now unless the transportation facilities be greatly improved. Now it seems that at a later period, but unknown to me until a recent date, one Charles Colcock Jones, a good economic geologist, had examined the same formation in another locality. His observations and investigations were accurate and scientific as far as they went, and he reported his results to the Geological Survey. Not long after it was heralded in trumpet tones that the experts of the Survey had 'discovered' phosphate beds in Wyoming, Idaho, and Utah of vast extent, containing millions of tons of valuable phosphate. So far as I know, none but the most perfunctory allusion and credit to the excellent work of Mr. Jones has been made in the Government publications.

However, the object of this communication is to give information to those who may be interested, rather than to be critical. The purposes and objects of the bureaus investigating sources of fertilizers are excellent, and good will come of them to the country. Potash attracts much attention now on account of the well-known German monopoly. Phosphates are important. Are not nitrogenous fertilizers about equally as important? The largest known area of nitre beds in the United States, the upper portion of which beds is identical in character with the *caliche* of Chile, but of somewhat lower grade, are worth a word or two. Nitrate, chlorides, and phosphate of potash are found in the same beds, but, so far as known to me, only in small quantities. It is possible that in certain localities a high percentage of potash salts could be found by scientific exploration. The surface material was fully analyzed as long ago as 1883. For 30 years some of the lands embracing the beds have been located and relocated many times. Some of them are now held by people unknown to me. The locality is on both sides of the line between San Bernardino and Inyo counties, California, and within the drainage area of the Amargosa river. Some three miles south of Tecopa station of the T. & T. railway the river, which here flows toward the southeast, begins to curve southwesterly. Gradually turning, it then flows westerly for a considerable distance, and bending northwesterly and then northerly, finally empties into the south end of the present sink of Death Valley. The beds in question occupy a broad belt along this portion of the valley and extend out from the channel of the river for several miles on either side. Some four miles below, or south of, Tecopa station, Willow creek joins the drainage from the east, and about two miles up Willow creek from its mouth is the present ranch of 'Dave' Morrison, formerly known as the 'China' or Evans ranch. The easterly line of the belt commences some miles east of the Morrison ranch and extends thence westerly to a line perhaps 10 miles west from the northerly turn of the Amargosa—a distance of perhaps 45 miles. These beds are composed in the main of Eocene and perhaps later Tertiary clays and sediments, often several hundred feet in thickness, as shore-line and sea-bottom terraces and layers when the great sink of Death Valley was filled to its brim with a saline lake discharging its surplus waters southerly into the Mohave sink. Finally desiccation of the lake commenced, and continued at intermittent intervals, and the terrace form of the deposits increased. Toward the end of this period the Amargosa commenced to cut down into the bedded deposits, forming the canyon which, heading a few miles south of Tecopa, now extends at least 15 miles. While this action in the river bed was taking place, erosion was rapid and extensive elsewhere, and has continued to the present time, so that these deposits, in the main, now take the surface form of numerous low, round-topped hills, separated by ravines and gulches. The tops and sides of the hills are everywhere covered with a soft, pulverulent material, almost ash-like in weight and consistence, into which one sinks to the ankles or deeper in walking. This is similar to the *caliche* of Chile and consists of light silicious and aluminous dust permeated with crystals of nitre. From one to several feet beneath the surface are the firmer and more clearly stratified clays.

The nitre in crystals in the *caliche* as well as in the more amorphous form in the underlying clays, is in both places easily soluble, so that the scanty rains of this region have produced depressions and sink-holes in the tops and sides of the hills, connected with irregular caves, galleries, and tunnels deep beneath the surface. Analyses have given as high as 50% or more sodium nitrate in the *caliche* and equally as high in some of the underlying clays, though high results are not so common in the latter. The average of the nitre content is perhaps 30% less than the best Chilean deposits, though I am not well informed on recent results in that district. It has been noticed that in this the different salts segregate by themselves to a greater extent than elsewhere in the lake-beds of the desert, perhaps due to the unusual area and depth of this particular lake basin. Where nitrate of soda occurs in the *caliche* it is often quite free from other salts of soda, or even of all salts. Toward the middle of this belt of deposits are strata of rock-salt 12 ft. thick and 95% of chloride of sodium. It is possible by thorough exploration to find, in certain localities and certain horizons in the clays, nitrate of sodium of high grade. Similarly, good grades of nitrate, chloride, or sulphate of potash might be found. As the salts of this region are generally well separated from each other; as many of them are easily soluble, but differing in solubility at different water temperatures; as water is rather abundant in streams, springs, and wells; and as a railway now crosses the beds, may it not be a locality where profitable production can be had? It may be well to mention in this connection that I am not financially interested in nitre or other saline deposits in the United States, and have nothing to sell except my services and experience.

Manhattan, Nevada, April 10. J. D. KENNEDY.

Miners' Health

It is announced that an arrangement has been made with the Public Health and Marine-Hospital Service by which one or more surgeons connected with that service will carry on jointly for that service and for the Bureau of Mines investigations looking to the improvement of mine conditions. These inquiries and investigations have already shown the prevalence of tuberculosis and hookworm as miners' diseases in a number of different localities in the United States. It is important that this work should be extended more rapidly, because of the fact that the health conditions, as well as the risk of accidents, may be influenced by conditions susceptible of easy improvement. Furthermore, the large and continuous influx of foreigners into the mining regions of the United States will bring, to an increasing extent, the hookworm and other diseases that abound in mines in parts of certain European countries. Various questions that concern the health of workers in mines, quarries, and metallurgical plants cannot be answered finally without investigations and inquiries that are national in scope. Among such questions are the most efficient methods of preventing the diseases peculiar to certain industries, the most effective sanitary precautions to be observed in and about coal mines and metal mines, and the relative healthfulness of [illegible] pertaining to mining and metallurgical industries. The investigations and inquiries that are essential to the gathering of reliable information on these questions can be undertaken by the Bureau of Mines, in connection with its collection of accident statistics, in a prompt and efficient manner and at minimum expense.—*Report, Director U. S. Bureau of Mines.*

Special Correspondence

BOSTON

Copper Merger Again. Lake Mines. Presidential Politics and the Brokers. Tennessee Copper. Sulphuric Acid and Briquettes.

The recent visit of a large party of mining and banking men to the Butte district and to Bingham has revived the talk of a copper merger. No sooner was the report circulated to that effect than it was denied. John D. Ryan, who has shown ability as a diplomat and pacificator of conflicting interests, was in charge of the party. He delivered an optimistic speech in Butte as to the copper situation and announced that the bankers who accompanied him had decided to invest $12,000,000 in Montana during the next twelve months. The party was composed of men representing the Amalgamated, Guggenheim, and Calumet & Hecla interests. Its very composition gave rise and color to the rumor that the much-talked-of merger was again under serious consideration. R. L. Agassiz, vice-president of the Calumet & Hecla, and D. C. Jackling, general manager of Utah Copper, were members of the party. In the denial made it was pointed out that Mr. Ryan is an old Michigan man and has been accustomed to make Western trips frequently in company with Mr. Agassiz. It was further pointed out that Mr. Jackling's presence had no special significance since he had been to Butte recently to examine the Butte & Superior company's property preliminary to new financing by Hayden, Stone & Co., of this city. While there the Anaconda management invited him to examine the Anaconda and affiliated properties. It is believed here, however, that federal or state laws and public sentiment permitting, the copper merger may yet be effected. It is not dead, only sleeping. John D. Ryan has much ability as an executive. The formation of a copper merger under his direction would be quite another thing from the ambitious, pyrotechnic attempt made by Rogers, Rockefeller, Burrage, and Lawson, when Amalgamated was launched as a stock-jobbing project.

The question arises, Why cannot a copper merger be formed abroad? It would doubtless be a last resort, since over half the world's copper is produced in the United States, and the merger should be formed here. London is a great copper market. It fixes copper quotations with practically the same absoluteness as Liverpool does the quotations on cotton. If it be true that the day of $1,000,000,000 corporations has passed in this country, the copper merger might as well be abandoned. If not, it will undoubtedly come to a head before long, as the coming event continues to cast its shadow before.

The tenth annual report of Copper Range Consolidated has been made. It gives support to the idea that this company has reached the meridian of its career. For several years Copper Range has been looked upon in the Lake country as the ideal copper-mining investment. It now shows earnings of $2.04 per share for 1911 as compared with $3.38 per share in 1910. It shows a lower yield per ton and higher costs. Last year the company reduced its dividend, and there is no immediate prospect of a resumption of the old rate. Copper Range has in the past year acquired the Atlantic M. Co. property, where no operation is being done at present, though the Atlantic railroad and mill is handling the output of the Superior Copper Co. The Atlantic acquisition gave Copper Range about 4800 acres of timber land and 2110 acres of miscellaneous lands. The latter include two miles of frontage on Lake Superior suitable for millsites and a deep-water frontage on Portage lake. The deal included the Atlantic & Lake Superior railroad, with 15 miles of standard track, a stamp-mill, a half interest in the Salmon Trout river dam, which furnishes the water-supply for the Baltic and Atlantic mills, 250 houses, $40,000 in stock in the Michigan Smelting Co., and cash and supplies amounting to about $135,000. The mineralized part of the Atlantic property consists of about 1400 acres. The Copper Range management has the confidence of Boston and New England interests practically to the same extent that Calumet & Hecla does. The company owns a railroad which traverses the South Range country, being practically in position to serve all the developing mines of that section. The old Copper Range has perhaps seen its best days, but with additional territory and a continuance of its wise management it may renew its former strength.

With the coming of May, Boston is advised of the opening of navigation in Lake Superior. This year this means that production will be rushed there more than ever. Record shipments of copper are reported from the district. The rail rate on copper shipments from Houghton to Boston is 30½c. per 100 lb., while the rate to New York is 28½c. The rate to Waterbury, Connecticut, where much copper is shipped to the wire and specialty manufacturers, is the same as the Boston rate. The water rate materially scales the shipping costs, being 10c. per 100 lb, from Houghton to Buffalo, with about 5c. added as the rail rate from Buffalo to New York. This makes about 15c. per 100 lb. by water and rail to New York, as against the through rail-rate of 28½ cents.

A few weeks ago stock market sentiment was almost a unit in favor of the President against Theodore Roosevelt for the presidential nomination. Mr. Roosevelt has gained upon his opponent to such an extent as to break even in the recent primary. It is likely that similar gains have been made among the brokerage organizations. The heads of the firms have usually stood with Mr. Taft, but a great many of the clerks, younger men, came out for Mr. Roosevelt. There was an exception in the case of a prominent banker here who said that, while a personal friend and frequently a host of Mr. Taft, he favored Mr. Roosevelt because he thought him better fitted for the presidency. He stated that Mr. Roosevelt's prompt action in allowing the United States Steel Corporation to take over the Tennessee Coal & Iron Co. averted one of the worst panics this country has ever seen. He believed that under similar circumstances Mr. Taft would have failed to take the initiative as Mr. Roosevelt did. The belief among the soberer elements of financiers is that the presidential campaign this year will exert less influence in checking the improving market which is under way than is usually the case with presidental years.

Boston is always interested in the doings of the Tennessee Copper Co., of Ducktown, Tennessee. The Tennessee company has made a good showing for the first quarter of 1912 and is producing now nearly 1,250,000 lb. of copper per month and 600 tons of sulphuric acid per day. As the summer comes on, the acid production decreases somewhat, due to the delay necessary in cooling the solution. Some improvements have been made in this process which, it is believed, will enable the company to maintain its average rate throughout the hot season. Tennessee is an especially interesting company in that it converts sulphur fumes into sulphuric acid for the fertilizer trade. Being the largest copper mine in the East, Tennessee is sufficiently near the big markets to manufacture sulphuric acid. Its output is taken up several years ahead, assuring it stability of profits for the sulphuric acid department. Recently I was shown sulphite waste pulp which is now used in the process of briquetting coal. It is claimed that this mixture, chiefly of sulphite waste, makes a binding material in every way superior to the tar and pitch heretofore used. It is said that the pulp waste briquette gives forth no odor, while the old briquette is very objectionable for that reason. If sulphite waste can be used as a cohesive material in briquetting the coal-dust which has accumulated in such quantities in the mines of Pennsylvania and elsewhere, the demand for it should be materially increased. Stranger things have happened than that smelter-fume litigation may be disposed of forever and the objectionable sulphur be gathered and bottled up for the trade. As a fertilizer and as a briquetting binder for coal, two large channels are opened for profitable use.

JOHANNESBURG, TRANSVAAL

East Rand Proprietary Again.—Simmer Deep Affairs.—Need for Low-Cost Development.

The East Rand Proprietary Mines continues to attract attention, and naturally the policy inaugurated by the new administration of eliminating as far as possible all ore of an unprofitable grade, even should working costs advance, will be watched with interest. From the accounts already published it appears that the yield under the new policy has been increased from 25s. per ton as the average for 1911 to 33s. per ton for the month of February, while working costs have advanced during the same period from 16s. 4d. to 22s. 8d. per ton, without, however, bringing the total monthly profits up to the level of 1911. It is understood, however, that the profit for March probably will be brought to the 1911 average. If so, it will be interesting to see how these results have been achieved. The superintending engineer, in his report on the 1911 operations, says that under the new policy the yield of the ore milled should approximate the content of the profitable ore reserve. Now, according to the same report, the profitable ore reserve on December 31 was estimated at 6,716,605 tons of an estimated assay value of 6.9 dwt. over a width of 55 in., but according to the report for February the ore going to the mill must have assayed at least on an average 8 dwt. per ton, which cannot be considered close to the assay value of the profitable ore reserves. If the same policy has been extended during March so as to increase the profits by an additional £20,000, there must be a still further divergence between the average screen assays and the ore reserves, and it becomes clear that this is hardly a policy that ought to be allowed. Taking the whole of the Rand, there are only about half a dozen mines capable of maintaining a screen average of 8 dwt. without injury being done to the profit earning abilities of the mine, and the East Rand Proprietary is certainly not one of these favored properties. In two of the mines belonging to this company it is quite possible to obtain such a yield by careful selective mining, but the amount of such ore is limited and fixing the pay limit at the February cost of 22s. 8d. per ton would leave about a third to the developed ore as profitable and available for future working on such restricted lines. If the new policy as disclosed by February results was adopted at the deep-level mines of the Rand it would mean that large areas now being worked at a profit would be quite unprofitable, and it would not require many years of similar policy at the East Rand Proprietary Mines to bring about the same unsatisfactory results. It may, of course, be that this new policy will be only in use for a limited time, and that as soon as possible the sounder policy of obtaining the desired results from treating ore more in keeping with the average assay value of the profitable ore reserves will again be adopted.

Among the more important company meetings held during the week has been that of the Simmer Deep, where conditions illustrate in a striking way the need that exists on the Rand in the immediate future for the exercise of greater economy in the working costs. The Simmer Deep is a property of about 1500 acres, where over half a million sterling has been spent on shaft sinking, and a similar amount stands in the books of the company for unredeemed development. In addition, over a million sterling has been spent on the equipment, but up to the present not a single dividend has been paid to the ordinary shareholders, and at the time of writing it cannot be said that such a dividend is in sight. The chairman, in reviewing the past twelve months of the company's operations, laid stress on the fact that the ore sent to the mill during the year had not exceeded in grade the average of the ore reserves as disclosed by the development. At the same time, he pointed out that it was quite possible to increase the profit for a time by encroaching on the ore of higher grade than the average of the reserves, but it could only be a matter of time before disaster could be expected to follow such a practice.

The position of affairs at the Simmer Deep may be best summed up by stating that at the end of December the ore reserves consisted of 1,312,000 tons of an average grade of 4.9 dwt. per ton. This may seem a low grade, but there are huge areas of similar low-grade ore on the Rand which must be worked and which cannot be expected to give a recovery of more than from 17 to 18s. per ton. It is clear, therefore, that working costs must be kept very low if losses are to be avoided, and if profits are to be made working costs will have to be materially reduced. At the Simmer Deep the only hope of increasing the profits will be by keeping the mill fully employed, and on the Rand, with the mine labor so erratic, this can be attained only by the use of an increased number of small stoping drills, the value of which has been established on the Rand largely by the efforts of the Consolidated Gold Fields. While the new policy at the East Rand Proprietary is to improve the grade by selective mining, the other low-grade properties on the Rand find it necessary to go in for large outputs and low working costs, and there can be little doubt about which is the best policy to pursue in the long run.

KALGOORLIE, WESTERN AUSTRALIA

February Development.—Short Month and Cyclone Cause Small Yield.—Production Report.

February was a quiet month. The Sons of Gwalia has announced that its reserves are only 14,000 tons in excess of 1910, and of lower assay-value, and that the profits and dividends will be reduced accordingly. The Horse-Shoe, in the cross-cut from the main shaft of the Great Boulder, at 2650-ft. depth, has cut No. 4 lode 240 ft. from the Ivanhoe boundary, and 15 ft. from the Boulder boundary. The lode is well defined, contains free gold, and for over 7 ft. assays $25. The Boulder reserves are announced as 698,000 tons, valued at $14.86 per ton, against 760,000 tons value at $15.32 for the previous year. Change in the bottom levels is the cause of this decrease, together with the losing of the lode to the Horse-Shoe. The South Kalgurli has reserves of 173,200 tons assaying $6.16 per ton, against 171,877 tons averaging $6.30 last year. Regular dividends are paid on this amount. The Oroyo Links' Eclipse lease is showing well at the 7th level, where from 180 to 193 in the south drift the average is $10.56, over 68 in. The north drift shows $11.25 ore over 68-in. width. The lessees were working on the Oroya North block, crushed 4742 tons of oxidized ore for a return of $173,000. After deducting $37,000 for royalty, and charges for mining, carting, and treatment, there remained $110,000 to be divided among 5 men for 6 months. An old prospector named Dunn, who located the famous Wealth of Nations mine, near Coolgardie, some 18 years ago, died during the month. He took out some $100,000 in specimens. The property later was sold for $750,000 to English capitalists, who produced very little. That was a time when any pot-hole showing a few specimens was bought without proper investigation. Coolgardie is still quiet. A move is being made out at Tindals to work an adjoining mine, but success is doubtful. At Southern Cross, the Bullfinch is proceeding with development and the erection of its plant. Prospecting is still going on in the district, and the Mountain Queen has just published its first return. The mill consists of two Holman pneumatic stamps driven by a gas engine. There is no treatment-plant working yet. During the month 3347 tons was crushed for bullion worth $13,800. No data are at hand on the actual performance of these new stamps.

In the annual reports of the Inspectors of Mines for the various districts much information is given about the mines; but reviewing those from Coolgardie, North Coolgardie, and Mt. Margaret fields, the general results are somewhat disappointing. It is interesting to note the number of prospects which have suction gas plants and Huntington mills at work on the oxidized ores. The new plant for the Associated Northern at Ora Banda is being rushed, and record work is likely to be done here before long. The country is soft, likewise the ore, and a party on the Gimlet South sunk on the lode, dipping 23°, and a shaft 375 ft.

deep in 30 days, of three shifts each. The shaft is 8 by 13 ft., of arched section, with no timber. This was good work. The death of G. Edwards, of furnace fame, has to be noted. His duplex furnace seems to be almost perfection mechanically, for good roasting. There are many in use in Western Australia, and they are being used in other districts, the latest, perhaps, being at the Goldfield Consolidated. The iron and brass molders engaged in the mine and town foundries have walked out, demanding an increase of pay from $3.60 to $4 per day, besides other

changes. They have no chance of getting their demands, and the Chamber of Mines is firm. After many months of heat, we have had one-half inch of rain.

The February gold yield from all mines is valued at $2,175,000, while the yields from the most important were as follows:

Name.	Tonnage.	Value.	Profit.
Associated	9,900	$ 63,900	$ 400
Associated Northern	1,541	23,000	.....
Burbanks Main Lode	1,432	17,000	.....
Golden Horse-Shoe	22,778	144,000	†3,000
Golden Ridge	2,720	25,700	8,500
Great Boulder Perseverance	*9,687	56,500	†8,500
Great Boulder Proprietary	*16,250	217,500	114,500
Great Fingall	5,994	64,000	6,100
Hainault	4,148	24,500	†5,000
Ivanhoe	18,373	201,000	90,000
Kalgurli	*7,385	68,500	22,500
Lake View & Star	*15,411	92,500	15,000
Oroyo Black Range	4,340	43,500	15,000
Oroyo Links	10,500	61,500	11,300
Sons of Gwalia	12,420	107,500	30,500
Sons of Gwalia South	2,230	14,000	3,000
South Kalgurli	*7,186	47,400	8,500

*Reduced tonnage, on account of cyclone cutting off power from power-house for a week.

†Loss due to various causes.

All returns low on account of short month.

TORONTO, CANADA

DOME MILL DIFFICULTIES. DEVELOPMENT NOTES. COBALT

The Dome mill at Porcupine is operating under difficulties, owing to the trouble with the electric pumps and consequent shortage of water, the lift from Simpson lake, the source of supply, being a heavy one. During April not over 20 stamps were running at once, so that the output of gold was not up to expectations. During the last week of the month gold bars, weighing 130 lb., representing the clean-up from the plates alone for the time the mill has been running, were shipped to New York, the mint at Ottawa not being ready to receive gold. The Hollinger mill is expected to be in operation about the end of the month. It has been delayed considerably by the non-delivery of machinery, owing to litigation in the American courts over alleged infringement of patents. Underground development is increasing satisfactorily. No. 4 vein, when first sampled at the 200-ft. level, assayed only $8 per ton and is now yielding $32. No. 2 vein at the same level, which in the report was estimated on a basis of $4 per ton, runs $24 in the southern and $10 in the northern adit. The winze being sunk on the main vein from the 100-ft. level is in rich ore about 70 ft. down. At the Dome Extension cross-cutting continues on the extensive orebody found on the first level from No. 4 shaft. Drills have penetrated 125 ft. of quartz, the width of which is yet undetermined. A good find has been made on the North Dome. In cross-cutting on the 50-ft. level from B shaft, a lens of quartz showing much visible gold has been cut. Another vein of promising character has been intersected from the same shaft. The total gold production from the McIntyre 10-stamp mill, from March 2 to 15 and March 27 to April 18, based on a trifle over 75% extraction, is $20,000. The free-milling plan is stated to be working well and an extraction of 76½% is being secured from plates and tables. The 5-stamp mill now being installed at the Little Pet is expected to be completed in about two weeks. It will have a capacity of 20 tons per day. The ore is principally free-milling, with coarse gold occurring in the quartz stringers, which are plentiful in the mineralized area and are rich in spots. The Crown Chartered has made the last payment on the Davidson property, on which development is being pushed with a six-drill compressor. A station has been cut at the 400-ft. level. At the Three Nations development on the 100-ft. level has intersected numerous narrow quartz stringers carrying coarse gold. The fate of the Scottish Ontario shortly will be decided by an inspection by a representative of the British syndicate controlling the property, who, after examination, will determine whether any further development will be undertaken. Results from a test of 4700 lb. of ore sent by the Dome Lake to the Kingston School of Mines being satisfactory, the management has decided to erect a 6-drill compressor. The Jowsey claims, having an area of 260 acres, have been taken over by the Gold Peak M. Co. The Pearl Lake has made an assignment, with liabilities of about $75,000. It is hoped that some arrangement can be made to put it on its feet again, in view of the satisfactory results shown by diamond-drilling at depth. The Plenaurum has cut two veins which show good width and promise well. The Moneta has found rich ore on the 200-ft. level. Ernest Yorke succeeds Mowry Bates as manager of the Hughes.

The bullion shipments from Cobalt since the beginning of the year to the end of April amount to 2,801,358 oz., valued at $1,625,342. Nearly one-half came from the Nipissing, which shipped 1,243,313 oz. The Kerr Lake and Crown Reserve, which formerly had their ore treated at the Nova Scotia mill, now closed, will in future ship their output to the Northern Customs mill. The financial statement of the Nipissing as of April 1, shows $1,091,826 cash in bank, $254,936 ore in transit and at smelters, and $203,650 ore sacked for shipment, making a total of $1,550,412. La Rose, as of the same date, reported $1,619,476 cash in bank and ore in transit and at smelters, and $89,841 ore sacked for shipment, making a total of $1,709,318.

SALT LAKE CITY, UTAH

DETAILS OF THE COPPER 'LOVE-FEAST.'

A 'love-feast,' at large expense, at which gathered representatives of the Amalgamated and Utah Copper interests, together with a number of other leading financiers, has been causing a large amount of comment as to its significance—if it has any at all. D. C. Jackling, general manager of the Utah Copper and Ray Consolidated, was the host at a banquet last week in Salt Lake City, at which were present John D. Ryan, president of the Amalgamated Copper Co., together with other Amalgamated officials; W. E. Corey, former president of the United States Steel Corporation; C. H. Sabin, vice-president of the Guaranty Trust Co. of New York; J. W. Harriman, president of the Harriman National Bank of New York; D. E. Pomroy, president of the Bankers' Trust Co.; A. Monell, president of the International Nickel Corporation; S. L. Fuller, of Kissel, Kinnecut & Co., New York; P. L. Foster, of the London Exploration Co.; R. L. Agassiz, of Boston, vice-president, and James McNaughton, general manager, of the Calumet & Hecla, together with other men prominently identified with the copper mines of Michigan, Montana, Utah, and Arizona. The party arrived at Salt Lake City from Butte, visited the plant of the International S. & R. Co., at Tooele, one afternoon, and put in the next day inspecting the mines of the Utah Copper Co. at Bingham, the Bingham & Garfield railroad, and the concentrators and smelter at Garfield. At the elaborate banquet on the first evening of their stay, the members of the party said various nice things about each other, Mr. Ryan praising Mr. Jackling and Mr. Jackling commending Mr. Ryan. While the members of the party officially deny that the trip signifies that the long-promised copper merger is actually about to take place, it is the general belief that the trip of inspection of the great copper mines of the country presages still closer relationship between the leading producers, whether the anti-trust laws will be braved by interlocking ownership or not.

BUTTE, MONTANA

J. D. RYAN ON THE PROPOSED GREAT FALLS SMELTER.—W. F. M. LOCAL ENTERS CONTRACT.

J. D. Ryan, on his recent visit here, said that the time had come when it is necessary to provide more smelter facilities, and that with this end in view it had been decided by the Anaconda Copper M. Co. to practically build a new smelter at Great Falls at an estimated cost of $2,500,000. This work will be commenced as soon as the material can be supplied and the work will be finished in about one year. In the meantime the old smelter will be operated to about its capacity, and the new plant, while occupying the ground on which the old one stands, with large additional ground, will be so constructed that the old works will be kept in commission until the new plant is ready to start. It is the intention of the Anaconda company to make the new works the most modern smelting plant in the world, as well as the most economical.

The Eastern capitalists who accompanied Mr. Ryan to this city were so much impressed with the opportunities offered for investing their capital that they became interested in projects amounting to about twelve millions of dollars, which include the erection on an up-to-date flour mill at Great Falls and the opening up of some promising iron claims which W. E. Corey, the steel magnate, pronounced of a probable value. A. J. Earling, president of the Chicago, Milwaukee & Puget Sound Railroad Co., did not have anything to say concerning the electrification of portions of the road in this state, but he did state that there would be some extensions, and that work would be commenced at once. It is believed that quite a portion of the twelve million dollars which it was stated would be spent in this state in the next twelve months will be for railroad extension, although there is no doubt the building of the new smelter at Great Falls is included in the amount named.

The first union connected with the Western Federation of Miners to take action in regard to the entering into a contract with the Anaconda company in regard to the wages is the Great Falls Mill and Smeltermen's Union, which, by referendum vote, decided to make such a contract, notwithstanding the action of the Western Federation convention a couple of years ago in repudiating any contracts so entered into in the future. There was another vote taken on the question as to whether there should be a demand for an increase in wages, and this was carried, it being decided to ask for an increase of 50c. per day. In the course of a few days the question of a contract and the increase will be taken up with C. F. Kelley, vice-president and resident director of the Anaconda company, but no intimation can be secured as to the intention of the company in regard to the increase. While, of course, the determination of the Mill and Smeltermen to ask for the increase in wages carried by a large majority, the cordial relations existing between the men and the company are such that there is no danger of trouble.

JOPLIN, MISSOURI

RECORD PRICES FOR ZINCBLENDE CAUSE HURRIED MINING.—NOVEL MEANS OF VENTILATION.

Mention was made in the *Mining and Scientific Press*, of March 30, of the high prices for zincblende prevailing in the month of March, when the basis for lots carrying 60% metallic zinc reached $55.50 per ton, or within $1.50 of the record basis figure of 1905. April saw the price advanced to $57, the 1905 record, and throughout the month prices remained unusually strong, with a healthy indication that the demand would continue good for some time to come. While the high offerings are a great boon to producers, especially those of thin sheet ground ores that cannot be mined at a profit when the demand is weak, a bad feature has developed in the tendency of the operators to produce the maximum tonnage regardless of underground conditions. As the great bulk of ore comes from comparatively shallow levels, 20 to 300 ft. in depth, the danger of surface cave-ins is ever present when precautionary measures are not observed. At the Weaver mine, on the Anderson farm, north of Carl Junction, the company, already turning out a large tonnage of high-grade concentrate, endeavored to still further increase the output by cutting into a rich pocket immediately beneath the public highway. A cave-in, that took place in ground to the surface, resulted. W. S. Brown, State Mine Inspector, was forced to notify the company to discontinue work in this drift. Mr. Brown has found similar conditions in various portions of the district. The soft pocket mines are far more troublesome than the harder sheet ground properties. As a result of the great amount of rush work now being done in order to turn out the concentrate while prices are at a record figure, the life of many properties will be materially shortened through the inability of the operators to handle much of the ground that is now being recklessly cut.

At the Morsman-Sly mine, on the Riseling property, adjoining the Joplin city limits on the west, a bad air condition has been overcome by utilizing a drill-hole as a medium of ventilation. At times the gaseous condition would become so bad that miners would be hoisted unconscious from the ground. Efforts to blow fresh air into the drifts proved useless. The company started an air drift toward a shaft several hundred feet toward the west, but before this shaft could be reached it became evident that workmen could no longer stand the foul atmosphere. The drill-hole was then sunk into the air drift and this affords ample ventilation. So strong is the upward current of air at the lower end of the hole that a lighted torch, held in the draft, is immediately extinguished. This company is working a thin deposit, the mill recovery of which is less than 4%. The concentrate averages better than 61% metallic zinc.

General Mining News

ALASKA

Juneau

The Alaska Mexican G. M. Co. in March made a production of free gold and concentrate valued at $57,348. Operating expense amounted to $30,752, and construction expense to $2510, leaving a net profit of $24,286. The company crushed 19,215 tons of ore, which yielded an average of $3.01. The concentrate saved amounted to about 458 tons. During the month 306 ft. of development work was done, of which, on the 1320-ft. level, 54 ft. was in an orebody assaying about $2.66 per ton. The other work was on the 1460 and 1570-ft. levels, and through 'waste.' The stock of broken ore was increased 14,070 tons.

The Alaska United G. M. Co.'s report for March has been received in San Francisco. The Ready Bullion claim produced free gold and concentrate valued at $50,304. Operating expense amounted to $26,474, and construction expense to $651, leaving a net profit for the month of $23,179. The 700 Foot Claim produced free gold and concentrate valued at $40,514. Deducting $29,713 for operating and $1173 for construction expense, the net profit for the month was $9628. The Ready Bullion 120-stamp mill crushed 18,004 tons of ore, from which 506 tons of concentrate was saved. The 700 Foot Claim 120-stamp mill crushed 18,879 tons of ore, from which 362 tons of concentrate was saved. On the 700 Foot Claim 512 ft. of development work was done and the stock of broken ore increased 1696 tons. Of the development on the 1210-ft. level, 117 ft. was through an orebody assaying $3.76 per ton, and, on the 1320-ft. level, 123 ft. in an orebody assaying about $3.79 per ton. On the Ready Bullion property 96 ft. of development was done through waste. The stock of broken ore was increased 5826 tons.

ARIZONA

Cochise County

The Shattuck-Arizona Copper Co. has decided to build a 400-ton smelter. It is reported that the smelter may be built at Douglas. Development is being rushed on the property, where a force of 60 men is employed.

Mohave County

It is reported that Barney McCall has discovered rich ore on his property between the Gold Hill mine and the Dandy group of claims. S. W. Mudd recently inspected the tungsten ore properties in the Big Sandy district. The O. & C. Mining & Development Co.'s mill is about ready for dropping the stamps. The company is operating the Last Chance property in the Wallapai Springs district. The Tom Reed Gold Mines Co. recently held its annual meeting. The board of directors was re-elected, with Charles Grimes as president. During the year dividends amounted to 3% on the present capitalization of the company. The dividends in some instances amounted to more than was paid for the stock, it is said. There is over $100,000 in the sinking fund.

Yavapai County

B. P. Miller, representing Boston investors, has bought the Big Pine M. Co.'s property in the Hassayampa district, including three patented and one unpatented claim, a mill, and other buildings. A partial payment has been made, the price being reported as $80,000. Richard A. Parker, of Denver, will be temporarily in charge of the mine. It is reported that the Arizona State M. Co., having straightened out its financial affairs, will resume development of the Tom Boy mine, in the Castle Creek district. Mark Bradley will be in charge for the company. Work is to be resumed soon at the Lincoln property.

John Kniffen and associates of El Paso have made the first payment under the bond and lease they secured several months ago on the Apache Box Canyon gold property. It is reported that Kniffen and his associates have transferred their interest to Boston capitalists for a consideration of $500,000. The board of directors of the Bisbee Coalition M. Co., it is reported, recently ratified an agreement with New York capitalists who are to furnish $500,000 for development of the property, which is in the Warren district. S. S. Badger is consulting engineer to the company. The Arizona Copper Co. has awarded a contract for two electric cranes to the Morgan Engineering Co. of Kansas City. The contracts were let at the office of Repath & McGregor. The cranes will be used at the new smelter at Clifton. A similar contract, to the same firm, has been awarded for a crane for the Calumet & Arizona plant at Douglas. Each of the cranes is to have a main hoist capacity of 40 tons and an auxiliary hoist capacity of 15 tons.

Yuma County

D. T. Jackson and associates, who recently purchased the mill near Daggett, in the Copper Basin district, have acquired a Huntington mill. C. W. Mitchell and J. H. Watson have found a large deposit of milling-grade ore on the Arizona Empire property, it is reported.

CALIFORNIA

Amador County

The East Eureka 20-stamp mill was started May 2. It is reported that enough ore has been uncovered to run the mill for two years. L. Poundstone is in charge of the property.

Press despatches state that B. W. Pitts has discovered rich ore 100 ft. north of the old Mountain King shaft.

Calaveras County

(Special Correspondence.)—An important find has been made at the Tulloch mine, three miles south of Angels Camp. A shoot, understood to be 14 in. wide, has been opened 180 ft. from the surface. Samples are reported to assay $100 to $2000 per ton. The property is operated under bond by Joseph F. Curtis and associates of Los Angeles. The Lightner 3-compartment shaft is rapidly nearing the 900-ft. point. With the gaining of the 1000-ft. level, lateral development will be started. Owners of the Hamby announce that all indebtedness has been settled and that operation will be shortly resumed. The erection of a mill at the Big Fraction, Rail Road Flat district, is under way. Rich ore has been recently opened. With the exception of driving for the Yellow Metal oreshoot, no work is being done at the North Star mine. The shoot in the western part of that estate, and its intersection at depth would prove important.

Angels Camp, May 5.

Work has been resumed at the Petticoat mine, Rail Road Flat, after a shut-down of two years. A. T. Copley, of Los Angeles, is manager, and J. E. King superintendent of the property. The former indebtedness has been wiped out. Sinking will be started soon at both the Kennedy and Afterthought shafts. It is announced that F. W. Boire will build a modern plant at the Boire Brothers' placer mine. The Star mill, at Angels, has closed.

John L. Whitney has obtained a bond on the Rising Star placer mine at Central Hill from D. Cassinelli.

Inyo County

(Special Correspondence.)—The Skidoo Mines Co. in March produced bullion valued at $11,957, and cyanide bullion valued at $2451; a total output of $14,408. Development and operation for the month cost $9542, leaving a net profit of $4866. The company treated 1175 tons of ore.

Skidoo, May 6.

Kern County

J. B. Thornton, representing the Western Asbestos Co. of Chicago, recently inspected several tracts of land near Randsburg, said to have rich deposits of asbestos. He is quoted as saying that within a year the company would start operation in that district.

Los Angeles County

A meeting of the Mining Engineers Society of Southern

California has been called for the evening of May 14 at the Sierra Madre club rooms. F. J. H. Merrill, chairman of the committee on organization, has requested those unable to come to notify him.

Modoc County

(Special Correspondence.)—Men are flocking into the High Grade district, and it is evident the place will be given much attention during the summer months. Deep snow still prevents exploration or development to any extent, but a number of deals have been made recently. Mining men from outside districts, particularly those from Colorado, appear to think well of the ore showings, but little actual work has been accomplished, and everything is in a prospect stage. J. F. Bassler, operating a lease on the Big Four, reports opening a shoot two feet wide, in an adit. The ore is said to average about $90 per ton. The Modoc Mines Co., composed of Chicago people, reports a 3-ft. vein in the 35-ft. shaft. About 18 in. is said to average $40 per ton. Narrow seams of quartz in the Sunshine contain ore ranging from low-grade up to ore assaying $1000 per ton. It should be remembered that only small quantities of ore have been produced, not tons. The Conniemac Mining & Realty Co., of Denver, has taken a lease and bond on the Huckleberry group, adjoining the Big Four. It is rumored that San Francisco and Oakland people have decided to start development of the Seven Lakes claims on Yellow mountain. J. F. Branley is manager. Harry Millpaugh and J. A. Adams, of San Francisco, announce they have secured an option on two-thirds of the Fort Bidwell Consolidated property. It is stated that work will start as soon as weather permits. Numerous deals of minor importance have been announced, but it is doubtful if much money has changed hands, although capitalists are showing eagerness to secure options. It is expected that weather conditions will permit mining throughout the district early in June. It is stated that cyanidation will be required in most instances.

Fort Bidwell, May 4.

Placer County

Serious shortage of water is feared by miners here. The Big Dipper company is about to start sinking a shaft to bedrock, about 60 ft. below the surface. E. H. Lowell is foreman of the property.

Tuolumne County

Daniel Jones has taken an option on the Laura and North Star properties, near Tuolumne, from James M. Ashton of Tacoma, Washington. The price announced is $22,500.

COLORADO

Denver County

Press reports from Denver state that sand assaying $45.80 per ton was removed from the excavation for the Oxford hotel addition in that city. An unusually deep subbasement was dug for the structure, which, it is said, rests on the old Cherry creek bed.

Gunnison County

Placer miners are unusually active in Washington gulch. The gold is fine, and few nuggets have been found, but it is rumored that the results obtained would make a dredge profitable.

Lake County

Recent development on the Fairplay property, Adelaide Park district, is said to have proved the orebody to be 40 ft. wide, and the largest in that part of the district. The Winthrop G. M. Co. has been incorporated to operate in the Big and Little English gulches. The company has about 1000 acres in all under lease. J. M. Moore, of Leadville, is president of the company.

Ouray County

It is reported that rich deposits of nitrate and phosphate have been discovered near Ouray.

San Miguel County

The Nellie mill, according to recent reports, will be ready for operation in a short time. Part of the plant was caved in by a snow-slide. George Hall, superintendent, is having the mill repaired. The Wild Boy Huntington mill and tables will be erected soon. The plant was purchased late last season. The property will be operated throughout the summer. The Lake Superior-Ophir company, operating the old Calumet-Telluride property, has intersected the Black Cloud vein at a depth of 1500 ft. The ore is of milling grade and contains some free gold. The mill will be started soon, under the managership of Charles H. Sandquist. James Belisle and C. H. and Richard McKeever have started development of property purchased from H. J. Turner, in the Long Park district. The property is said to have uranium-vanadium ore.

Teller County (Cripple Creek)

In April the mills of the Cripple Creek district treated about 30,000 tons of low-grade ore, averaging $3.50 per ton, taken from the tailing dumps. The Rogers brothers have started treatment of tailing at the Isabella Mines Co.

CONCENTRATOR ROOM AT STRATTON'S INDEPENDENCE.

mill. The Blue Flag company's mill is being overhauled. The Happy Year M. Co. is planning to build a plant for low-grade ore. Edwin Gaylord, lessee at the Jo Dandy mine, Bull hill, is moving the Jerry Johnson mill to the Jo Dandy.

The production of the Cripple Creek district in April was as follows:

Plant.	Tonnage.	Gross value.
Golden Cycle (Colorado City).....	33,000	$660,000
Portland (Colorado City).....	10,000	220,000
Smelters (Denver and Pueblo).....	3,750	243,750
Portland (Cripple Creek district)...	13,440	44,083
Stratton's Independence	10,491	35,038
Colburn Mill (Ajax mine).....	4,000	12,000
Wild Horse	1,100	3,520
Cavanaugh mill (Jo Dandy mine)...	400	2,000
Total	76,181	$1,220,391

NEVADA

Elko County

A small force of men is at work on the Bluster and working in ore in three faces. The snow is melting rapidly and several companies are preparing to start work, over in the Crater section, early in May. There is a prospect that the Bourne or Fletcher-Clark debts may be settled, but affairs at the Pavlak look very uncertain. There is plenty of ore in the Bourne, and the small mill can be easily remodeled to effect a profitable saving. The big mill at the Pavlak is of little account for any purpose. It would probably be cheaper to ignore it entirely and put up a modern five-stamp mill, if any attempt at all should be made to start up there again.

Esmeralda County

(Special Correspondence.)—The estimated production of the Goldfield Con. Mines Co. for April was 28,317 tons of

ore, valued at $580,000. Operating expenses amounted to $195,000, leaving a net profit of $385,000. The company on April 30 paid its regular quarterly dividend of 30c. per share, and customary extra dividend of 20c. per share.

The company's report of production and earnings for the first quarter of 1912 is as follows:

Month.	Tons treated.	Value recovery.	Costs.	Net operating realization.
January	28,870	$696,875	$225,735	$471,140
February	27,641	693,212	205,950	487,261
March (approx)	30,132	685,000	200,000	485,000
Total	86,643	$2,075,087	$631,685	$1,443,401

Goldfield, May 4.

The Goldfield Granite Mountain M. Co., in the Gold Mountain district, has cut a 6-in. seam of ore assaying $95 to $130 gold per ton. The Jumbo Extension company is conducting tests at the Nevada Goldfield 20-stamp mill. If the tests are satisfactory the Jumbo Extension may secure the mill for treating exclusively its own ore.

Lincoln County

Supplementing the Prince Consolidated report recently published, George C. Kirby has issued the following statement regarding ore developed in the mine: tons, 870,893; gold, 0.01 oz.; silver, 2.86 oz.; lead, 3.95%; zinc, 4.7%; iron, 31.30%; manganese, 12.96%; lime, 4.95%; silica, 14.26%. Excess iron-manganese and lime over silica, 34.95 per cent.

In a report to the Home Run management, E. R. Zalinsky says that a 90-ft. incline shaft has been driven. On the 40-ft. level an orebody several inches to 17 ft. wide, and assaying 15 to 30% copper, he reports, has been opened. The ore is chrysocolla and malachite and contains some silver. A plan for development is outlined in the report, which it is said the company will follow.

Nye County

It is reported that silver-sulphide ore assaying $300 to $1000 per ton was found recently in the cross-cut on the 535-ft. level. The production of the Tonopah district for the week ended May 4 is summarized by the *Tonopah Miner* as follows:

The Tonopah M. Co. shipped 3200 tons, the Tonopah-Belmont 2050 tons, the Montana Tonopah 1052 tons, the Tonopah Extension 1012 tons, the West End 845 tons, and the MacNamara 458 tons, making the total production for the week 8617 tons, valued at $215,425.

Storey County

A decision of the Supreme Court last Saturday reversed the ruling of the trial court in the Silver Peak case, which is decided in favor of the company. The lower court ruled that B. A. Gamble, F. S. Chadbourn, and the heirs of J. B. Wright were entitled to enter the property for the purpose of deciding whether or not they would exercise a right to purchase an eleven-sixteenths share in the property under an option given by the Silver Peak Mines Co. to J. L. Hanchett in September 1895, which, with an extension, expired August 1, 1896. The plaintiffs, Gamble and Chadbourn, contended that Hanchett merely was the agent of a partnership between Gamble, Chadbourn, and J. B. Wright, and that he took the option for this partnership, but later claimed it for himself.

The Pittsburg Silver Peak 120-stamp mill, according to W. A. Bradley, general manager for the company, is treating about 15,500 tons of ore per month. The ore is low grade, but the saving is excellent.

White Pine County

The Nevada Con. Copper Co.'s report for the quarter ended March 31, shows a production by the company of 17,578,450 lb. copper, of which 6,309,228 lb. was produced in January, 4,888,790 lb. in February, and 6,380,432 lb. was produced in March. The low production in February was due to the shortage of water caused by the dry season and insufficient snowfall. Additional reservoirs, as has been noted before, will be provided to prevent a recurrence of such conditions. The ore treated amounted to 728,572 tons, of which 75,547 tons was mined by underground methods at the Veteran. The ore averaged 1.87% copper. After deducting $145,762 paid to the Steptoe plant for depreciation, $125,754 for 'ore extinguishment,' and paying the tenth quarterly dividend, amounting to $749,773, the undivided profit account showed a net credit of $212,479. The net surplus for the quarter was $483,995, and the gross income from mine, investment, and other sources was $1,233,768. A change was made in including the 'ore extinguishment' item in the quarterly report, instead of at the end of the year. The old practice caused misunderstanding among some of the stockholders. The company has entered into a contract permitting the Steptoe Valley S. & M. Co. to concentrate the sulphide ore of the Giroux Con. Mines Company.

NEW MEXICO

Socorro County

The Ernestine M. Co.'s first ten-day clean-up in April yielded 8470 oz. of gold and silver bullion and five tons of high-grade concentrate. During the week 742 tons of ore was treated. The Oaks Co. reports a total of 35 ft. of development in the Pacific mine during the week, from which 42 tons of ore was sent to the Deadwood mill. Work continues in the main drainage and transportation adit. An excess of 5000 tons was treated by the Socorro Mines in March. About 93% of the gross value of the ore is being recovered by concentration and cyanidation. The Treasure M. & R. Co. reports that the mill on Whitewater creek treated 400 tons during the week.

OKLAHOMA

Rogers County

The Bartlesville Zinc Co., Collinsville, will add to its present plant one 100-kw. turbo-generator set, one 25-kw. motor generator set, two 50-hp. motors, one 25-hp. motor, one 75-hp. motor, and a switchboard, furnished by the General Electric Company.

OREGON

Baker County

Development will be resumed soon at the Blue Mountain M. Co.'s property in the Cable Cove district. The property includes the Last Chance and Baby McKee groups of claims. Snow, at last reports, is delaying the starting of the work. Calvin Haines will be manager.

SOUTH DAKOTA

Lawrence County

The Homestake M. Co. surface plant soon will be operated exclusively by electricity from the $1,250,000 hydro-electric plant recently completed. The Amicus mill now is being operated by electricity. The hydro-electric plant has a capacity of 10,000 hp., and is said to be practically paid for, from current earnings, as the company has a cash surplus of about $50,000. The mills affected by the change of power are arranged in 24 units of 10 stamps each. Each unit will be operated by 25 hp., and an auxiliary plant will be equipped with machinery taken from the mills using electricity. The company will dispense with coal, and it is believed that the plant will pay for itself in eight years. For the seven months ended December 1, 1911, the company's profit showed a rate of $11 per share of outstanding stock.

UTAH

Juab County

According to a prearranged plan, a drift on the 500-ft. level of the Crown Point mine has penetrated the Colorado company's property, crossing the dividing line last week. The drift still is in lime formation, but it is expected that the work will open ore later on. The Black Jack hoist is in commission, and prospecting is being done on the 300 and 600-ft. levels. E. R. Higgenson is in charge of the Black Jack property. In the week ended May 3, ore shipments from the Tintic district amounted to 164 cars.

SALT LAKE COUNTY

Foreign laborers at the A. S. & R. Co. plant at Murray walked out May 1, demanding a raise of 25c. per day. They were receiving $1.75. C. W. Whitley, general manager, was East. J. M. Bidwell, acting manager, stated that the company did not feel justified in meeting the demands. Whether or not American laborers at the plant are in sympathy with the foreigners is not known.

SUMMIT COUNTY

During April 284 cars of ore was shipped from the Park City district, the tonnage being 9766. The companies shipping were the Silver King Coalition, 3747 tons; the Daly West, 3266; the Daly-Judge, 2437; Grasselli Chemical Co., 334; Ontario lessees, 138; Daly company, 22; and Charles Moore, 22 tons.

TOOELE COUNTY

E. P. Mathewson has submitted plans for an additional lead furnace for the smelter at Tooele to the officials of the International company at New York. The plant, although designed for a capacity of 250 tons of ore, is treating about 300 tons per day.

WASHINGTON

FERRY COUNTY

The North Washington Power & Reduction Co. will build a power line from Grand Forks, British Columbia, to Republic, according to J. L. Harper, general manager, who has just returned from the East. He also said the cyanide plant will be enlarged to a capacity of 5000 tons per day. The Chicago Title & Trust Co. has been named trustee for a bond issue of $1,600,000 recently authorized by the power company. The mill will start within a few days. James W. Turner, manager for the San Poil Consolidated M. Co., announced in Spokane that the new mill at Republic will be in operation within two weeks. He said that recent developments in the Republic district have been important. The discovery of free-milling gold ore on the Knob Hill property was particularly noteworthy. The details of the find have not been made public. Workmen on the San Poil mine are still mining high-grade ore, he said. The incline shaft in the Surprise mine, which is being sunk below the 600-ft. level, has reached a depth of 80 ft., where was cut the highest grade ore which has been found on the property.

WASHINGTON, D. C.

(Telegraphic Correspondence.)—An attempt to abolish the mints at San Francisco, New Orleans, and Carson, and the assay offices at Boise, Deadwood, Helena, Seattle, and Salt Lake City, was defeated in the House today by a vote of 92 to 61.

Washington, May 9.

CANADA

ONTARIO

(Special Correspondence.)—The Dome mill extraction continues to give good satisfaction. Two shipments per month from the clean-ups of the amalgam and one shipment per month from the clean-up of the cyanide mill are expected. About three-quarters of a mile of driving and cross-cutting has been done on the Dome property. The deepest shaft is 220 ft. deep and No. 2 shaft is being sunk to the 300-ft. level. Two more diamond-drills have been taken from the Dome property, leaving one at work to do what testing may be required in the future. Over thirty holes have been drilled on the Dome orebody, so far, and the hole now being put down in the eastern end of the property, near the Dome Extension, is in remarkably rich ore. The West Dome is driving on a promising orebody reached by cross-cutting from the No. 3 shaft at the 100-ft. level. The Dome Extension is cross-cutting N.35° W. to cut the main vein at the 200-ft. level. This cross-cut has been driven 330 ft., while the cross-cut northeast to cut the large orebody in No. 4 shaft is in 250 ft. The North Dome is connecting the two shafts at the 50-ft. level. About 20 veins have been uncovered on the Success property, and show fairly high assays in places. Ernest Yorke has taken charge of the Hughes, vice Mowry Bates resigned. The managements of several properties are taking special precautions to guard against fire. A customs house has been opened at Golden City, with G. S. Rogers as custom's officer. There is prospect of an early resumption of mining at the Pearl Lake, as matters are in a fair way for an early and satisfactory adjustment. The refinancing of the Wa-wai-a-tin Falls Power plan, by D. Lorne McGibbon and associates, has infused new life into that district.

Petitions are being circulated asking the Ontario Provincial Government that Mountjoy or Foolham river be made navigable to where it enters McArthur, thus providing a good boat route to the southern part of the mining division, where some discoveries of free gold have been made. Large deposits of nickeliferous pyrrhotite have been discovered in Bartlett and Geikie townships, west of McArthur, and also east of Frederickhouse lake, northeast of Porcupine.

South Porcupine, May 2.

The Crown Chartered company has made the final payment on the Davidson property in the Porcupine district. The property includes five claims. The main shaft is down 215 ft., and a station has been cut at the 200-ft. level.

Plans for the Swastika mill are in the hands of the management for consideration. The plant will cost about $25,000. The Lucky Cross company, in the Swastika district, has cut a 12-ft. orebody in its east adit. The Nipissing company, on April 29, shipped to New York 23 bars of bullion, containing 27,020 oz. silver, valued at $16,381. On April 27 the same company shipped 23 bars, containing 25,945 oz., valued at $15,761.

MEXICO

DURANGO

(Special Correspondence.)—The Compania Minera y Exploradora de Ventanas, S. A., property has suffered from the revolution. Rebels from Sinaloa, where a state of anarchy is reported, have attacked Ventanas twice, and in both cases were repulsed by a small garrison. The company has machinery there which it is unable to transport to the mines on account of bandits in the mountains.

Practically all of the isolated properties in this state are closed, owing to difficulty in transportation. Railroad and mail communication recently was restored. Much inconvenience has been experienced on account of the cutting of telegraph wires. Anti-foreign feeling, fostered by the recent note by the United States Government, is high. Strict censorship prevents knowledge here of the situation in Chihuahua. Even if federal troops gain a victory soon, it is improbable that much good will result, as there are not enough soldiers available to crush the mountain bandits. Unless a speedy settlement is effected there will be little planting of crops.

Durango, April 29.

The Tominil M. Co., Ltd., in March earned a profit of £1270, from 1012 tons of ore crushed. While the property has not been damaged, and no interruption of work in the mine or mill is expected, the presence of bands of armed men nearby, and numerous depredations have made operation difficult. Costs in March amounted to about 50s. per ton, as against the usual rate of £1 per ton. The yield was 81s. per ton, while the gross value of the ore reserves is estimated at 42s. 7d. per ton.

JAPAN

(Special Correspondence.)—The Japan Petroleum Oil Co. has purchased from the International Oil Co. its lease at Hachinosana Hokkaido. One well is yielding 30 to 40 bbl. per day from a depth of 1030 ft. A small refinery is to be built at Raisatsu. The drilling machinery recently purchased in California has been sent to Echigo and a well will be drilled near Kashiwazaki.

Kashiwazaki, April 29.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

W. A. Scott is at Seattle.

W. C. Howard has returned from Mexico.

Reese Llewellyn was here during the week.

S. E. Bretherton has gone to Shasta county.

F. L. Lowell has returned from Amador county.

J. E. Callahan, of Ely, Nevada, is in San Francisco.

J. F. Gurney is at San Francisco on his way to Colombia.

H. W. Reeth has sailed for Europe from Auburn, Massachusetts.

Charles Janin was expected to arrive in New York yesterday.

D. H. Steinmetz has returned to San Francisco from Sonora.

Ricketts & Banks have removed to 80 Maiden Lane, New York.

W. H. Aldridge was at Globe recently and has returned to Los Angeles.

W. de L. Benedict has removed his office to 19 Cedar street, New York.

E. Z. Burns is in Colorado on professional business and will go to Nevada.

J. R. Farrell is at Battle Mountain, Nevada, preparing to reopen the Dean mine.

W. L. Cobb is developing the Pleasant View drift mine near Comptonville, California.

H. V. Winchell has returned to Minneapolis, and expects to leave soon for Europe.

C. W. Purington has been appointed chief engineer for the Pioneer Company of Siberia, Ltd.

J. R. Finlay will deliver the commencement address at the Missouri School of Mines, May 31.

F. H. Probert is at Salt Lake City to consult with D. C. Jackling in regard to Ray Central affairs.

Bradley Stoughton, L. D. Huntoon, and A. H. Elliott have opened offices at 165 Broadway, New York.

J. C. Ward, general manager for Edgar Allen & Co., Ltd., of Sheffield, was in San Francisco, on his way to Japan.

E. M. Wilkinson has returned from the Pis Pis district of Nicaragua, where he spent the past winter in examination work.

A. Newman and R. L. Beals have opened offices as consulting mining and metallurgical engineers in the Mills building, San Francisco.

Obituary

Saburosuke Mitsui, who died at his villa at Kamakura, Japan, April 5, was the head of the Mitsui Mining Co., the mining branch of Mitsui & Co., Ltd. The family is one that can be traced back to Takayusu Mitsui, a feudal lord of the sixteenth century, and it was one of the great commercial institutions of Japan even before the restoration. Saburosuke Mitsui was born in 1850 and was a clerk in the Kyoto office of the firm when the shogunate was abolished. Like many other young Japanese of that time, he threw in his lot with the progressives. He spent two years in the United States studying and returned to take a position in the mining department, of which he subsequently became the head. Under his administration the Miike colliery and other mines belonging to the company were equipped with the most modern machinery, and a large and efficient organization was built up. He was one of the men who contributed to the making of modern Japan and of the little but influential group that formed a link between his home country and America.

Market Reports

LOCAL METAL PRICES

San Francisco, May 9.

Antimony	11—11½c	Quicksilver (flask)	$41.00
Electrolytic Copper	16½—16¾c	Tin	47—48½c
Pig Lead	4.05—4.10c	Spelter	7¼—7⅜c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $8.50—8.75; large $7.60—8.00

METAL PRICES

(By wire from New York.)

NEW YORK, May 9. The copper market was nominal this week, business being done mainly by second-hand producers and prices remaining unchanged. Lead was weak and Missouri lead was pressed for sale. In spelter there was a greater business than last week, but at lower prices. Average daily prices in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
May 2	15.70	4.18	6.65	61
" 3	15.70	4.18	6.65	60⅞
" 4	15.65	4.18	6.60	60⅞
" 5	Sunday.	No market.		
" 6	15.65	4.18	6.60	60⅛
" 7	15.60	4.18	6.54	60⅛
" 8	15.60	4.18	6.55	60⅛

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	May 9.
Camp Bird Ltd	$ 7
El Oro	4
Esperanza	7⅛
Oroville Dredging	1⅛
Santa Gertrudis	7
Tomboy	5¼

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, May 9.		Closing Prices May 9.
Adventure	$ 9¼	Mohawk	$ 62
Allouez	43½	North Butte	28
Calumet & Arizona	70⅜	Old Dominion	53
Calumet & Hecla	480	Osceola	116
Centennial	24	Quincy	89
Copper Range	57½	Shannon	13¾
Daly West	5⅜	Superior & Boston	2⅜
Franklin	13	Tamarack	43
Granby	64¾	Trinity	6¼
Greene Cananea, ctf.	8½	Utah Con	13½
Isle-Royale	26	Victoria	4
La Salle	6⅜	Winona	6⅜
Mass Copper	7	Wolverine	109

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, May 9.

Atlanta	$ .26	Mayflower	$ .05
Belcher	.57	Mexican	2.90
Belmont	10.20	Midway	.56
B. & B.	.08	Montana-Tonopah	3.40
Booth	.10	Nevada Hills	1.95
Chollar	.07	Ophir	1.45
Combination Fraction	.12	Pittsburg Silver Peak	1.32
Con. Virgina	.74	Round Mountain	.49
Florence	.70	Savage	.13
Goldfield Con.	4.00	Tonopah Extension	2.20
Gould & Curry	.07	Tonopah of Nevada	7.50
Jim Butler	.61	Union	1.20
Jumbo Extension	.45	Vernal	.15
MacNamara	.25	West End	2.17

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. May 9.		Closing Prices. May 9.
Amalgamated Copper	$ 82	Miami Copper	$ 24¾
A. S. & R. Co.	85	Mines Co. of America	3
Braden Copper	5⅜	Nevada Con	21¾
B. C. Copper Co.	5½	Nipissing	7¾
Chino	29	Ohio Copper	1⅛
First National	2⅜	Ray Con	19
Giroux	6⅝	Tenn. Copper	42
Goldfield Con.	4	Tonopah Belmont	9⅞
Greene-Cananea	8¾	Tonopah Ex.	2¾
Hollinger	12¼	Tonopah Mining	6¼
Inspiration	18⅜	Trinity	6
Kerr Lake	2¾	Tuolumne Copper	3⅜
La Rose	3⅜	Utah Copper	62¾
Mason Valley	11⅝	West End	2¼
McKinley-Darragh.	1⅜	Yukon Gold	3

Company Reports

CHINO COPPER CO.

The properties of this New Mexican porphyry copper mine were described in the *Mining and Scientific Press*, March 30. Below is given the income account for the year ended December 31 last, and covering the first period of production. Further details regarding the operation of the company will be printed later.

INCOME ACCOUNT FOR THE YEAR ENDED DECEMBER 31, 1911

Operating revenue:		
Copper produced (986,375 lb. at 13.3c.)		$131,231.77
Operating expenses:		
Mining	$ 7,632.55	
Freight on ore	4,546.40	
Milling	53,171.79	
Treatment, refining, and freight	31,319.25	
Selling commission	1,312.32	
		97,982.31
Net operating profit		$ 33,249.46
Net miscellaneous income, dividends, rentals, royalties, etc.		85,223.29
Net income for year		$118,472.75

SUMMARY OF PROFIT AND LOSS

Balance to credit of profit and loss, Dec. 31, 1910	$165,972.97
Net income for year ended Dec. 31, 1911 (as above)	118,472.75
Balance, Dec. 31, 1911	$284,445.72

UTAH COPPER CO.

Details of the operation of this company for the past year, as reported by D. C. Jackling, general manager, are given on another page of this issue. During the year 93,514,419 lb. of copper was produced at a cost of 7.85c. per pound, yielding a net profit of $6,237,928. The ore reserves were increased by exploration to a total of 301,500,000 tons of fully and partly developed ore of an average copper content of 1.532%. The extraction of copper was increased from 20.51 lb. per ton to 21.03 lb. per ton. Below is presented the income account for the year ended December 31, 1911.

INCOME ACCOUNT FOR THE YEAR ENDED DECEMBER 31, 1911

Operating revenue:		
Copper produced (93,514,419 lb. at 12.6463c.)	$11,826,164.58	
Gold produced (40,202,916 oz. at $20)	804,058.32	
Silver produced (366,906.96 oz. at 53.3c.)	195,561.36	
Miscellaneous	165.56	
		$12,825,952.82
*Operating expenses:		
Mining	$1,529,275.62	
Stripping ore	351,060.07	
Mine development	216,125.51	
Total for mining and development	$2,096,461.20	
Freight on ore	$1,440,748.55	
Milling	1,950,988.83	
Treatment, refining, and freight	2,717,592.85	
Selling commission	118,261.64	
		8,324,053.07
Net operating profit		$4,501,899.75
Miscellaneous income:		
Dividends on investments	$1,720,750.00	
Interest received	3,124.83	
Rentals	32,293.28	
Royalties on lessees ore	10,827.00	
		1,766,995.11
Total income		$6,268,894.86
Less:		
Interest paid		30,966.42
Net profits for year		$6,237,928.44

UNDIVIDED PROFITS

Balance to credit undivided profits, December 31, 1910		$3,696,539.06
Net profit for year ended December 31, 1911 (as above)		6,237,928.44
Total		$9,934,467.50
Dividends paid during year	$4,703,022.00	
Part of prepaid ore account (stripping expense) written off	2,500,000.00	
		7,203,022.00
Balance, December 31, 1911		$2,731,445.50

*Note.—The operating expenses shown include the sum of $149,440.83 paid in taxes

RAY CONSOLIDATED COPPER CO.

The essential features of the first year's work of this company, which is one of the Arizona porphyry copper mines, were presented last week. The properties of the company were described in detail in the *Mining and Scientific Press*, September 2, 1911. The profit and loss account for the year ended December 31, last, is given below, and further details of operations will be printed later.

Operating revenue:		
Copper produced (14,935,047 lb., at 13.08c.	$1,953,627.06	
Silver produced (1,733,534 oz., at 53.46c.)	926.71	
		$1,954,553.77
Operating expenses:		
Mining	$556,397.68	
Freight on ore	247,856.12	
Milling	405,166.49	
Freight, treatment, and refining	564,019.57	
Selling commission	19,706.10	
Bullion tax	13,862.71	
		1,807,008.67
Net operating profit		$ 147,545.10
Miscellaneous income:		
Dividends on investments	$191,875.00	
Net income from rentals, telephone, light, power, etc.	25,628.17	
		217,503.17
Total income		$ 365,048.27
Less interest		66,407.83
Net profit for year		$ 298,640.44

NEVADA CONSOLIDATED COPPER CO.

This company has capital stock outstanding to the value of $9,996,700 and bonds to the value of $500. The net profit for the 15 months ended December 31, 1911, was $4,336,217. Of this, $633,347 was written off for the initial cost of ore extracted during the period. The deferred charge for stripping in excess of the amount charged to operating expenses was $938,249. During the 15-months period 3,338,242 tons of ore of an average copper content of 1.80% was milled, with an average extraction of 67.59%, yielding 78,541,270 lb. copper at an average cost per pound of 6.97c. Five quarterly dividends amounting to $3,746,894 were paid. The profit and loss account for the 15 months ended December 31, 1911, is as follows:

Gross revenue:		
Copper produced (78,541,270 lb. at 12.50c.)	$9,818,261.98	
Gold and silver produced	595,185.09	
		$10,413,447.07
Operating expenses:		
Mining, including proportion of stripping expense	$1,072,121.76	
Freight on ore	893,310.50	
Milling	1,531,859.17	
Smelting	1,485,634.90	
Rent of Steptoe plant (including depreciation)	1,467,610.24	
Freight and refining	1,145,810.90	
Selling commission	97,144.70	
		7,693,492.17
Net operating profit		$ 2,719,954.90
Miscellaneous income:		
Dividends on investments	$1,537,160.02	
Interest on bonds	62,500.00	
Interest and discount	14,241.44	
Rents and miscellaneous income	10,260.81	
		1,624,162.27
Total income		$ 4,344,117.17
Less maintenance Cumberland-Ely property		7,900.55
Net profit for the 15 months available for dividends		$ 4,336,216.62

MICA is being mined in the Charleston district, near Westport, New Zealand, by a private syndicate, whose headquarters are in Christchurch. The first shipment of a ton was recently made to London, and a further consignment will be ready soon. It is understood that there is an increased demand for mica for electrical and other purposes, and it is calculated that the quality and accessibility of the Charleston product will make mica-mining there profitable. The mica deposits at Charleston are fairly extensive.

JAPAN'S consumption of Chilean nitrate increased from 5892 tons in 1907 to 28,000 tons in 1911, and it is expected that 40,000 tons will be required for 1912.

Production of Copper in 1911

By B. S. Butler

*The smelter production of primary copper in the United States in 1911 was 1,097,232,749 lb., as compared with 1,080,159,509 lb. in 1910, an increase of about 1.5%. The production for 1911 is the largest in the history of the industry. In the following table the production for 1911 is apportioned to the states in which the copper was mined. The total is made up of the fine copper content of blister produced and of the smelter output of ingot and anode copper from Michigan. The production of 1910 is given for comparison. This report is based on returns from every known company which treated copper-bearing material in 1911.

Production of Copper in the United States in 1910 and 1911

(Smelter output, in pounds fine.)

	1910.	1911.
Alaska	4,311,026	22,314,889
Arizona	297,250,538	303,202,532
California	45,760,200	35,835,651
Colorado	9,307,497	9,791,861
Georgia	724	.....
Idaho	6,877,515	4,514,116
Maryland	.....	23,555
Michigan	221,462,984	218,185,236
Missouri	.....	640,411
Montana	283,078,473	271,814,491
Nevada	64,494,640	65,561,015
New Hampshire	12,409	.....
New Mexico	3,784,609	2,860,400
North Carolina	181,263	13,699
Oregon	22,022	125,943
Pennsylvania	740,626	661,621
Philippine Islands	1,781	9,612
South Dakota	43	1,607
Tennessee	16,691,777	18,965,143
Texas	2,961	105
Utah	125,185,455	142,340,215
Vermont	1,935	.....
Virginia	105,313	.....
Washington	65,021	195,503
Wyoming	217,127	130,499
Undistributed	603,570	44,645
	1,080,159,509	1,097,232,749

*Includes Missouri.

Refined Copper.—The total production of new refined copper in 1911 was 1,433,875,026 lb. This was the largest output in the history of the industry, exceeding that of 1910 by 11,835,893 lb. The production of electrolytic, Lake, casting, and pig copper from primary sources and the production of secondary copper by the regular refining plants in 1911 is shown in the following table:

Production of Primary and Secondary Copper, 1911, in Pounds

PRIMARY

1911.	Domestic.	Foreign.
Electrolytic	823,507,764	332,604,223
Lake	218,185,236	.....
Casting	22,977,534	.....
Pig	36,600,269	.....
	1,101,270,803	332,604,223
	1,433,875,026	

SECONDARY

Electrolytic	19,093,622
Casting	8,803,105
Total secondary	27,896,727
Total output	1,461,771,753

The figures for Lake copper include the Michigan copper that was electrolytically treated. In addition to the secondary material treated by the regular refining companies, plants treating secondary material exclusively, produced a total of 186,311,000[1] lb. of copper as copper and in brass and other alloys of copper, making a total production of 214,207,727 lb. from secondary sources. Of this, at least 62,000,000 lb. was produced by remelting clean scrap produced in the process of manufacture of copper and brass articles. If the output of plants treating purely secondary material is added to the production of the regular refining companies, the contribution of the United States to the world's supply of copper for 1911 is found to be 1,648,082,753 pounds.

Stocks.—Returns from all smelting and refining companies show that he following stocks of electrolytic, Lake, casting, and pig copper were on hand at the beginning and end of the year 1911, in pounds:

January 1, 1911	122,803,656
January 1, 1912	88,372,195
Decrease during 1911	34,431,461

In addition to the stocks of refined copper, there were reported as at the smelters, in transit to the refineries, and at the refineries, blister copper and material in process of refining to the amount of 219,864,749 lb January 1, 1912, as compared with 245,218,530 lb. January 1, 1911.

Consumption.—The apparent consumption of refined new copper in the United States in 1911 was about 681,700,000 lb. In 1910 it was about 732,400,000 lb. The method employed in determining the quantity of copper retained for domestic consumption is shown in the following table. It does not take into consideration stocks of copper held by consumers.

Apparent Domestic Consumption of Refined New Copper in 1910 and 1911, in Pounds

	1910.	1911.
Total refinery output of new copper	1,422,039,135	1,433,875,026
Stock at beginning of year	141,486,244	122,803,656
Total available supply	1,563,525,379	1,556,678,682
Refined copper exported	*708,316,543	*786,553,208
Stocks at end of year	122,803,656	88,372,195
Total withdrawn from supply	831,120,199	874,925,403
Apparent consumption	732,405,180	†681,753,279

*Exports of pigs, bars, ingots, plates, etc., reported by the Bureau of Statistics.

†The apparent consumption as here calculated differs considerably from the domestic deliveries reported by the Copper Producers' Association. This difference is accounted for chiefly by the difference in export figures as reported by the Bureau of Statistics and the Copper Producers' Association, owing to the fact that the two sets of export figures are based on a slightly different period and therefore may show considerable difference for any one year.

If to the 681,700,000 lb. of new refined copper is added the 214,207,000 lb. of secondary copper and copper in alloys produced during the year, it is found that a total of 895,900,000 lb. of new and old copper was available for domestic consumption. A more comprehensive report is being prepared and will soon be published. Copies can be obtained upon request to the Director of the U. S. Geological Survey.

*Advance statement by the U. S. Geological Survey.

[1]Subject to revision.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

IN the Guerrero mill at Pachuca, tailing from the Wilfley tables is conveyed in a launder having a 3% grade. It is necessary to mechanically shake the launder in order to get a regular flow.

TO cement iron to stone make a putty-like substance of finely ground brick-dust stirred into melted rosin. Set the iron into the hole in the stone and pour the hot putty around it. Push bits of heated brick into the mass, smooth off, and let cool. This cement is not affected by the weather and does not injure the iron, but holds it firmly.

FEEDING conveyor-belts by means of a steam-shovel involves the difficulty of converting an intermittent into a continuous supply. If the belt be large enough, 42 to 48 inches, the difficulty is easily met, and in the coal-yards 5-yard clam-shell buckets deliver to conveyor-belts and work smoothly. With wet sticky material of irregular size there would be more trouble, and yet in certain situations the combination of belt and shovel is better than the usual system of tracks and cars.

A SOLDERING fluid which will not rust or corrode the soldered parts can be made by dissolving as much zinc in hydrochloric acid as the acid will take up, and then adding water, glycerine, and alcohol. To one part of glycerine add one part of alcohol and one part of water, then add two parts of the zinc chloride solution. This fluid can be used for all kinds of soldering and has been found especially desirable for greasy or dirty work as well as for soldering to iron. It is claimed that the glycerine prevents rust, which plays havoc with soldering fluids which contain hydrochloric acid.

LOSS of cattle because of pollution of streams by cyanide waste is occasionally reported, but facts are hard to obtain. At the El Tigre mine when the mill first started there was trouble from this source, but the cause of the difficulty was promptly detected and a remedy applied. Such loss is not apt to occur in the course of regular work. It is only where, because of leakage or some temporary accident, solutions of unusual strength get away, that there is complaint. In the case in point, the company was protected against damage suits through owning absolutely the land on both sides of the stream for fourteen miles below the mill.

PUMPS often give trouble because of an unequal pressure within the steam-chest acting on the area of the steam-valve, or the valve-stem. As the valve-stem extends through only one side of the steam-chest there is a constant tendency to blow it out. To overcome this trouble the use of a coil spring between the bracket and collar has been recommended. This spring should be given sufficient tension to counterbalance the action of the steam acting on the area of the valve-stem. While the action of the steam is to force the valve-stem out of the chest, the spring forces it in again and, therefore, the forces are neutralized and the valve-stem stays where it is left by the tappet arm.

WOOD-FIRED reverberatory furnaces of large size have been used in Australia for many years, according to Edgar Hall. At the Silverspur mine, Queensland, they have been used in sizes ranging from 17 to 40 ft. from bridge-wall to skimming door, 40 ft. being the largest size now in use. Furnaces wider than 15 ft. have not been used at Silverspur, but at Burraga, N. S. W., a furnace 50 ft. long is used. No difficulty is experienced in heating these furnaces with wood; no other fuel is used, and a longer furnace could be built if conditions should make it desirable to do so. The ore is not easy to smelt, and the matte fall is only 3.5%. The 40-ft. furnace smelts 40 tons per 24 hours, nearly all of which has to be slagged.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

MINING CLAIMS—ADVERSE POSSESSION

The claimant to mineral lands of the United States who has been in their open, exclusive, adverse possession for a continuous period equal to that required by the local statute of limitations governing adverse possession of real estate, is relieved of the necessity of making proof of posting and recording a notice of location, but he must be able to show, in a quiet-title suit, that he has complied with the requirements of a discovery and annual assessment work.

Humphreys *v.* Idaho Gold Mines Development Co., (Idaho) 120 Pacific, 823. January 8, 1912.

PLACER MINES—ENJOINING DISCHARGE OF DEBRIS

A person who has located and is operating a placer mine along or across a stream of water, is entitled to a reasonable and proper channel and the water. However, such miner has no legal right to dump his mining debris into the channel or stream and allow it to be carried down by the water to the land of a lower proprietor, or to fill up the channel to the injury of such proprietor. In order to avoid such threatened injury, the miners may be enjoined from continuing to so discharge such débris.

Provilt *v.* Bailey, (Oregon) 121 Pacific, 861. March 19, 1912.

LODE CLAIMS—DISCOVERY AND EXPLORATORY WORK

One who, not having actual possession of mineral land of the United States, seeks to recover it from another, must show a prior valid location. Such a location can be held valid only where the locator has complied with the requirements of the state law as to discovery work, and has, within the time by law allowed, made a discovery of a "vein or deposit of rock in place." He cannot leave his claim, allow another person to make a location thereon, and then eject the junior locator by completing his own discovery work and rendering nugatory the work already done by the junior locator.

Ferris *v.* McNally, (Montana) 121 Pacific, 889. February 15, 1912.

MINERS LIENS—NOTICE OF NON-RESPONSIBILITY

Where, as in Colorado, it is provided that in order to relieve a mine-owner from liability for mechanics' liens filed by employees of his lessee or vendee, notices of non-responsibility for labor or materials furnished at the request of such lessee or vendee must be posted on the claim, a mine-owner cannot escape such liability by merely providing in a working contract of sale that the purchaser shall post such notices. If the purchaser fails to do so, the laborers or material-men may enforce their liens upon the claim in the manner authorized by law.

Pike *v.* Empfield, (Colorado) 120 Pacific, 1055. January 8, 1912.

STATUTE OF LIMITATIONS—MEASURE OF DAMAGES

Where an underground trespass was committed and ore secretly and fraudulently taken from another's property, the statute of limitations runs from the date that the true owner of the ore discovered the trespass and not from the date at which it was committed. The measure of damages in such a case is the value of the ore in the mine at the date of taking, with interest from that date, where the taking was without oppression, fraud, or malice. If there was oppression, fraud, or malice in the taking, then the value of the ore as finally mined and milled would be the measure, the cost of mining and milling being added as punitive or exemplary damages.

Lightner Mining Co. *v.* Lane et al, (California) 120 Pacific, 771. January 22, 1912.

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EDITORIAL

THE first annual report of the Director of the United States Bureau of Mines is a consistent record of good work, justifying the hopes of those who insisted on the establishment of the Bureau.

SEVERAL parties of prospectors have left San Francisco recently for Bolivia, where placers north of La Paz are attracting attention. One party of American miners cleaned up 240 ounces of gold from a single bar last season, and reported colors for some distance higher up the stream.

STIRRING up race prejudice to carry elections is a disreputable kind of politics that usually indicates loss of hope. In California the attempt to make capital for Mr. Taft by exploiting Mr. Roosevelt's message relative to the Japanese at the time of the school troubles in San Francisco was a reminder of back-woods politics in the South.

HIGH GRADE, the new name for an old district in Modoc county, California, continues to attract prospectors and promoters despite the fact that the ground is covered with snow and fully staked. For reasons given in our editorial April 6, and by Mr. W. H. Storms elsewhere, we see no reason as yet for getting excited. There are small erratic streaks of rich ore in the district and, as always, a stampede into such an area may result in the discovery of important deposits. We hope it may in this case, but till the snow melts there will be more money made, and lost, in trading locations than in prospecting.

JAPANESE authorities promulgated April 10 a new customs tariff for Korea. According to the new schedule, metal manufactures and hardware in general must pay a duty of 7½ per cent *ad valorem* based on the value of the articles at the port of entry. An exception is made in favor of tools, instruments, machinery, explosives, and chemicals necessary to the digging or mining of gold, silver, and copper which are imported by persons engaged in mining work for their own use, provided that such articles are recognized as reasonable by the customs officials. Owing to the large American mining interests in Korea this exception is especially important.

OUR New York correspondent, in writing of the Miami Copper Company recently, stated that the annual report did not show the cost of copper laid down in New York. This is an error, the figure, 9.103 cents per pound, being given in the table showing the copper account. The price 5.80 cents used in Mr. Gottsberger's report is merely the cost at the mine less the credit for silver and house rentals. Mr. J. Parke Channing, in discussing the report, calls attention to the fact that the percentage of extraction, 73.37, is not a true index of what may be expected when the interior and unoxidized mass of ore is reached. The mining cost, $1.21 per ton, may also be expected to be reduced after the top layer of ore has been removed and regular caving begun.

AUSTRALIANS are already beginning to plan for an exposition at Perth to signalize the completion of their first transcontinental railway, construction of which has just begun. It is especially appropriate that the celebration be held at the western end of the line, since the coming of the rails will make Fremantle the first port of call for European boats and establish a new Golden Gate in the south seas.

A UNIQUE company recently organized is the Research Corporation, with offices at 63 Wall street, New York, and of which the following well known gentlemen are directors: Messrs. William L. Dudley, T. Coleman du Pont, Frederick A. Goetze, Elon H. Hooker, Hennen Jennings, Charles Kirchhoff, Benjamin B. Lawrence, Arthur D. Little, John B. Pine, Lloyd N. Scott, Charles A. Stone, James J. Storrow, Elihu Thomson, Charles D. Walcott, and Mark S. Reardon. The project is primarily due to the unselfish initiative of Mr. F. G. Cottrell, ably seconded by those named, and others. These gentlemen have joined together and propose to devote time and money to the development by research and commercial methods of inventions to which patent rights are to be acquired by purchase or otherwise. The peculiar feature of the enterprise is that there can be no profit to any one concerned, all funds realized being dedicated to "the advancement and extension of technical and scientific investigation" under the auspices of the Smithsonian Institution and such other scientific or educational institutions as the directors may select. In other words, the plan involves endowment of research through the profits of invention, and it is big with possibilities. Already valuable patent rights have been assigned to the corporation, and others have been offered. Apparently inventors are as willing to aid the enterprise as are the business men concerned, and the whole project affords a grateful contrast to the mercenary side of human nature that is too frequently in evidence.

RUSSIA proposes to close to prospecting the "manifestly gold-bearing" lands that belong to the Crown and to dispose of them by auction. There is no objection to this in principle, but it is doubtful whether in Russia the territory has been sufficiently prospected to warrant such action. Unless the lands are manifestly gold bearing in fact, no one can afford to bid, and also, unless the Government provide other means for stimulating prospecting, development will stop. On another page Mr. T. F. Van Wagenen takes strong ground against any interference with the prospector, who, he states, does not exist in Mexico and Canada. The rapid growth and manifest prosperity of the mineral industry in these countries, and especially in Canada, seems to indicate that there are other methods of stimulating the finding of ore deposits, than the particular ones adopted in the United States. Mr. Van Wagenen thinks that development in both Canada and Mexico has been checked by the failure to give a fee title and the absence of extralateral rights. This opinion in the matter is entitled to the greatest respect; but prospecting is equally inactive in many parts of the United States under conditions exactly the reverse, and mineral development has, on the whole, been as rapid in the Joplin, Missouri, district as anywhere—and there are not only no extralateral rights, but high royalties must be paid. The problem of securing economical development of the mineral wealth of a country is by no means simple. If the experience of the world counts for anything, there are various methods of approach, and it may be that no method is inherently bad or in itself good, that the choice of system must be determined by the particular conditions obtaining at any given time and place. Pragmatism may well be a working rule as well as a closet philosophy.

THE FIGHT made at Washington to convert the San Francisco mint into a mere assay office calls attention to one of the peculiarities in the rules of the House of Representatives, one which gives large power to the ruling clique of the moment in the Appropriations Committee. A bill framed by this committee is based upon the work of sub-committees, and neither the recommendation of a sub-committee nor of the committee is made public, even to members of the House not on the committee, until the bill as a whole is printed and laid before the House. Since bills covering hundreds of items are rushed through in a few days, at times a few hours, it practically results that the continuation, expansion, or cutting down, of any branch of the public service is decided in 'star chamber' session of three to five men. The opportunity for reversing the action of a committee is so limited as practically not to exist in most instances.

An International Dictionary

A correspondent writes to suggest that an enormous field for translators of American textbooks on technical subjects lies open in the Spanish-American countries to the south of us. That we have been remiss in cultivating our Latin friends in the field of ideas as well as of trade, is indubitable; of this we are often reminded. Part of the blame unquestionably lies in American preoccupation with home affairs; we are so tremendously busy trying to comprehend ourselves and do all that is necessary to our own rapid expansion, with its necessary readjustments, that there is little time and less opportunity for cultivating our foreign friends. But part of the difficulty is a fundamental one that is commonly overlooked. Many persons suppose that to translate a book into a foreign language requires only a working knowledge of the language and a few weeks work with a lexicon. Nothing could be further from the truth, and in many cases it is almost as easy to write a new book as to make a really good translation of a foreign text. Part of this is due to the fact that in many cases no exact synonyms exist for words of a foreign language, and the situation of the translator is much like that of the pianist who, playing by ear, vainly sought to pick out an accompaniment for a singer whose notes were of uncertain pitch. Giving up in despair, he remarked, "It is no use; I've tried it on the white keys and on the black keys—it must be in the cracks."

Even more serious in the translation of technical works is the fact that often the ideas represented do not exist in the foreign country, so that it is impossible to attempt translation without first creating a vocabulary. This is not so true of Spanish, but is especially the case with Oriental languages, where translation involves the introduction of so many new words as to present almost insuperable difficulties. If the resourceful translator invents words the natural result is that several words become current for the same thing and the final outcome is compound confusion. In such cases, clearly the situation must be met from within; if the people of any country wish to assimulate the knowledge and culture of another they must do so gradually by building up an equivalent knowledge and culture of their own. Learning must be acquired in homeopathic doses, not *en bloc*. The schools and universities must be leaders in the movement, seconded by journalism. Translation of technical English into Spanish is possible and may be made profitable. The preparation of a really good technological dictionary covering all the principal languages, something equally needed, would be the greatest possible aid to inter-

national intellectual cooperation. The latter venture holds out so little hope of monetary profit and involves so great preparatory effort and expense that it cannot be expected to result from private initiative. But in these days it should be possible to secure a gift of sufficient funds to undertake a task of this magnitude and importance, which would serve as a worthy memorial. We commend, to wealthy citizens who desire to be of service, the compilation of an international dictionary as a more effective agency for securing international comprehension and good-will than the creation of any number of peace prizes.

Recent Copper Smelting

We are fortunate enough to be able to present this week a brief account of copper smelting practice at the plant of the Compagnie du Boleo, written by a well-informed engineer. This is interesting, both because the company does not follow the common American custom of allowing engineers free access to the plant and its records, and because the working conditions are so exceptional. The slag analysis, given by our correspondent, is unusual in its composition, though not in its character. Assuming that the alumina acts entirely as a base, and that manganese is equivalent to iron (the statement of manganese as MnO evidently being merely for analytical purposes), and computing the oxygen ratios, we find SiO_2, 27.55; Al_2O_3, 8.45; FeO.MnO, 2.67; CaO, 3.14; or an oxygen ratio of acid to base of 27.55 to 14.26. The slag is evidently slightly more basic than bisilicate, and since Mr. H. O. Hofman, in his admirable work upon the formation temperatures of silicates, has shown that the substitution of MnO for FeO slightly raises the temperature of slag formation, while Al_2O_3, when substituted for FeO and CaO, lowers the temperature of slag formation until three-eighths of those bases has been replaced, and then raises it rapidly, it is not remarkable that the furnaces run with a high temperature in the zone of fusion, a considerable degree of fluidity, and the rapid separation of the high specific gravity matte. Slags high in manganese are not uncommon, and Mr. J. A. Church has recorded his experience in smelting silver-lead concentrate in Arizona, with the formation of a satisfactory slag containing over 40 per cent manganese. Our correspondent employs a loose expression common among metallurgists in speaking of slag containing a high percentage of SiO_2, as being necessarily an acid slag. Percentages depend upon weight, while the acid or basic character of the slag depends upon the molecular ratio of the acid to the basic constituents. If the basic constituents have small atomic weights the same percentage of silica which represents an acid slag would, with bases of large atomic weights, represent a very basic slag.

The use of narrow long furnaces at this plant may be contrasted with recent development of smelting practice at the Great Falls plant of the Anaconda Copper Mining Company, where Messrs. A. E. Wheeler, superintendent, and M. W. Krecji, metallurgist, under the management of Mr. C. W. Goodale, have developed furnaces 84 inches wide, the necessary blast penetration being secured, as in the iron blast-furnace, by so proportioning the cross-section of the furnace as to obtain a throttling action near the top of the shaft, thus causing the blast to spread throughout the smelting zone by pressure, rather than by depending on the initial velocity of the blast to secure penetration. The use of this design has permitted a lowering of the blast-pressure to 20 or 25 ounces, with campaigns a week long without barring off crusts at the tuyeres. The wide furnace offers less radiating surface than a long one, and where it is operated so that barring down is minimized the resulting economy in heat requirement is worth securing, and construction costs are lessened.

Even more notable are the converter records which have been made at the Great Falls plant. The converters now in use are of the Anaconda type, 12 feet in diameter and provided with 26 tuyeres, using blast at 11 or 12 pounds per square inch. These are lined with magnesia brick, and one converter has made over 7000 tons of copper without relining, while an earlier type of converter, of the same size but with only 15 tuyeres, has been in continuous operation since March 9, 1910, and has made over 12,000 tons of copper from a 28.9 per cent copper matte. Including cold seconds, about one ton of cold material has been handled per ton of matte converted, so that this converter has treated some 60,000 tons of material with the one lining. This is a record of which the able metallurgists who have made it may well be proud, and technical men generally may share in their pride, since it is undoubtedly to a considerable degree secured by the employment of a staff of technically trained young men as investigators to study every operation and to plot records and collect data, so that each day's experience may serve as an infallible guide to the solution of the problems of tomorrow. There is no waste so regrettable as the waste of experience, and employment of trained minds is cheaper in the end than the cut and try method with structural steel, labor, fuel, and valuable ore. We hope later to be able to present details of some of the results thus secured, and we take this opportunity to congratulate the metallurgists concerned as highly upon the methods employed as upon the results obtained.

The Oldest Fossils

Archean rocks were at one time supposed to represent the original crust of the earth, and in consonance with then prevalent ideas were considered to be necessarily of igneous origin. When sedimentary rocks were found in what had been considered to be Archean, the Algonkian system was proposed, to include all the rocks lying upon the original crust and antedating the oldest fossiliferous strata. In time the Algonkian came to include a number of series of rocks occupying a definite place in the stratigraphic column, and in time fossils were found in some of the Algonkian rocks, notably the Belt series of Montana. Also indubitable sedimentaries had been discovered in the redefined Archean, and it became evident that *a priori* definition of pre-Cambrian formations would lead to constant readjustment of boundary lines and endless confusion. Accordingly the attempt to adhere to the old definitions has been tacitly abandoned, and in America, at least, Archean and Algonkian have come to mean certain systems of ancient rocks classified on ordinary stratigraphic grounds. If this conclusion had not already been reached it would have been forced by the recently announced discovery by Mr. A. C. Lawson of fossils in the Steeprock series of western Ontario. This series, first described by Mr. H. L. Smyth, lies certainly in the Archean. It includes a massive limestone that is in part "almost an aggregate of fossils." Mr. C. D. Walcott, who has studied the new forms, finds them to be closely related to the sponges, and states that if the stratigraphic position were not well determined he would be inclined to consider the fossils as of lower Cambrian age. This recalls the fact that in the Lake Superior region, so far as paleontologic evidence goes, the great series of Algonkian and Archean rocks are only certainly known to be older than the upper Cambrian. The various changes in the definition of Archean in that region suggests the advisability of one of the geologists interested paraphrasing Mr. Champ Clark's campaign song about the 'dawg.'

Types of Porphyry Copper Deposits

By W. L. Tovote

The present prominence of the porphyritic copper deposits as factors in the world's copper market has brought forth an ample and varied literature. Globe, Clifton-Morenci, Bisbee, and Bingham have been described in monographs of the United States Geological Survey. Other information is scattered through the professional publications of the past few years. While much material has been collected, it has not so far been attempted to classify these deposits, point out their common prominent characteristics, and draw conclusions from the observed facts in some as to possibilities in others.

Though knowing that there are better men than myself to attempt this, I wish to try to develop certain deductions from the geological conditions as they appear to me, and hope this may give rise to discussion and establish the possibilities of these deposits and their future.

The porphyritic copper deposits may be divided into four main types, not because these are considered as genetically different, but only to bring out their chief characteristics, show their common features, and prove that all of them are only different facies of one group of deposits. Their genesis is uniform and their variations are due only to development in different country rocks and to different depths of exposure. The four types are:

1. Braden, Chile, and Nacozari, Sonora; volcanic and semi-volcanic facies.
2. Morenci, Arizona, and Bingham, Utah, contact and metasomatic deposits; disseminated deposits limited to the intrusive.
3. Miami and Ray, Arizona, disseminated deposits, mainly in the rock intruded.
4. Bisbee, Arizona, irregular bodies in limestone.

This subdivision is not meant to be a classification, as I consider all these types as belonging to one group. Most of them, in fact, grade into each other, and in several districts two or more of these types are represented, one of which gave rise to local operations. Another may hold the main interest at present, and to a third the future may belong. I could perhaps add to these four types still a fifth one, namely, the type of vein formation represented by the Old Dominion of Globe, but since other processes helped to shape this deposit, I shall only casually mention it.

1*a*. *Braden.*—Braden has been described by Pope Yeatman. According to his description and information kindly given, the deposit is an extinct volcano. Rhyolitic lavas and tuffs fill an old crater in andesite country rock. The andesite is brecciated and partly re-cemented, as are also the tuffs, by the acidic eruptive. The ore (chalcopyrite, pyrite, and zincblende and their secondary derivatives) occurs at the contact between andesite and tuff, preferably in the former, and also in a central channel in the tuff itself. Exceptional and not recurring in the other deposits is tourmaline, but that is not surprising in view of the exceptionally strong fumarolic action.

1*b*. *Nacozari.*—Nacozari is similar to Braden, except that the volcanic action was probably less forceful and instantaneous. Here, as there, an andesitic lava-flow is intruded by rhyolite. But the rhyolite probably followed a pre-existing fault-plane, along which it formed roughly elliptical columns. One of these is the Pilares, that practically forms the Nacozari mine. A second one is the San Juan, where ore has been proved, and still more is indicated by promising outcrops. The rhyolite is brecciated, but tuff has not been developed. Chalcopyrite and pyrite, cementing and replacing this breccia, constitute the ore. The ore-shoots occur at the contact between andesite and rhyolite, but preferably in the latter. There are also central orebodies, roughly columnar in shape, in the central part of the rhyolite.

2. *Morenci and Bingham.*—The ore is connected with intrusion of acidic porphyries; monzonite and granite-porphyry at Morenci, monzonite at Bingham. It occurs at the contact of porphyry and sediments, preferably in limestone and shale, in the immediate vicinity of porphyry dikes and sills, and also disseminated through the mass of the porphyry. While the porphyry at Bingham is uniformly mineralized and shows only slightly increased content where fissuring is more pronounced, the ore is more concentrated along intersecting systems of veins or lodes at Morenci. The mass of the porphyry shows also a general mineralization away from the lodes, but this is usually of too low a grade to constitute ore. Furthermore, the workable ore deposits are localized in the vicinity of great east-west faults, that apparently antedate the mineralization, even if they do not antedate the porphyry intrusion. One of these faults, the Coronado, constitutes a tremendous vein deposit, of related character, away from the porphyry. The ores are chalcopyrite, pyrite, and zincblende and their secondary derivatives in the contact deposits, while in the porphyry is found pyrite replaced or partly replaced by chalcocite.

3. *Miami and Ray.*—These are contact zones between granite-porphyries and crystalline schists. These schists are similar to porphyries in chemical composition. The ore is pyrite and chalcocite, corresponding to the Bingham-Morenci porphyry ore, and occurs both in schist and granite, but preferably in the schist.

4. *Bisbee.*—The Bisbee ore deposit is practically the same as the contact deposits at Morenci and Bingham. The ore occurs as irregular masses in sediments directly connected with porphyry sills and dikes, in the Shattuck porphyry dike, and in the contact zone of the main intrusive mass of Sacramento hill. The primary ore is chalcopyrite and pyrite. Chalcocite has been found in the central part of the Sacramento hill porphyry stock.

To sum up the common properties of these different ore deposits:

1. *Porphyry.*—All are connected with porphyry intrusions. The porphyry is apparently everywhere the source of the metals and the cause of their deposition. All the porphyries are acidic or ultra-acidic. All are rather recent intrusions, ranging from late Cretaceous to Tertiary.

2. *Metallic Contents.*—Pyrite and chalcopyrite (sometimes also zincblende) are the only primary sulphides, disregarding Miami and Ray.

3. *Distribution.*—All show an outer or contact zone of ore and another one in the central part of the intrusive, again disregarding Miami and Ray.

4. *Silicification.*—All show, besides the deposition of metallic sulphides, a more or less intense silicification both in the contact zone and in the intrusive.

At Braden and Nacozari practically only primary ores occur. There is some secondary ore developed, but that is of very little importance. An insignificant chalcocite horizon at Nacozari is underlain by a lean pyrite zone, which soon gives way to normal chalcopyrite ore. Braden has been opened for a vertical distance of 2500 ft., Nacozari for over 1000 ft. from the top of the ore in both cases. Nacozari is proving richer in depth. Braden shows no indication of impoverishment. As both deposits contain, below the slight oxidized zone, exclusively primary sulphides, due to a porphyry intrusion from deep-seated magmatic sources, the ore may be expected to go down to the *ewige tiefe*. At the same time, this is, I presume, an indication of the deep facies and the primary type of all porphyritic copper deposits.

I have neglected to mention the secondary orebodies of Bisbee. These were of almost unparalleled richness and firmly established the district. But secondary alterations

are always to some extent due to local and casual conditions, they have practically no bearing upon genetic classification and are a dominant factor in economic considerations only if the primary ore is of no commercial value. But at Bisbee primary ore is gaining in importance every day, and the time may not be so far distant when it will be the main factor. Of course, there are some primary orebodies that are not of commercial grade and others that are workable only on account of incipient secondary enrichment, represented by a penetration or coating of the primary sulphides by chalcocite. But some orebodies have been and are mined only on their strength of their primary constituents, pyrite and chalcopyrite.

How Bisbee deposits will do in depth is left to future development to decide. There has been a more intense differentiation and rearrangement of the metallic masses than in most other places. Besides, the ore deposits in the limestone represent only one phase of the ore-depositing activity of the porphyry, and the second part of the mineralizing action of the porphyry has been thus far only established, not tested. I have intentionally refrained from mentioning bornite among the primary sulphides. Bornite forms, with chalcopyrite, extremely rich orebodies, especially in the Sacramento hill contact zone. But while some authorities regard bornite as a primary contact mineral, others consider it as purely secondary. I might point out lastly that, as at Bisbee, where the orebodies follow the intricate system of porphyry dikes, and especially sills, through limestone, at Morenci also the orebodies of this type seem practically limited to porphyry dikes that show a pronounced tendency to form sills between the sediments, as seen in the Longfellow and Detroit-Manganese Blue mines and on a smaller scale in the West-Thompson.

The disseminated chalcocite deposits in the porphyries and schists are only secondary as far as their ore reserves are now computed. They form a limited belt, seldom more than 300 ft. thick and frequently considerably less. They are usually overlain by an entirely barren capping from 35 to over 1000 ft. thick; the Southwestern Miami, with over 1000 ft. of cap-rock, is probably the deepest, but I do not know whether that is due to natural conditions or later overthrusts. Exceptionally there are preserved in this oxidized capping some secondary copper bodies, and in Morenci some pyrite also. At the bottom of the chalcocite zone there is an abrupt change to lean pyrite and sometimes marcasite. The chalcocite zone, as shown at Morenci, is richest near its upper limit, where it consists of almost pure chalcocite. Farther down the chalcocite contains increasing amounts of pyrite.

Genesis of the Porphyritic Copper Deposits

The ore deposition can be divided in two processes that blend into each other:

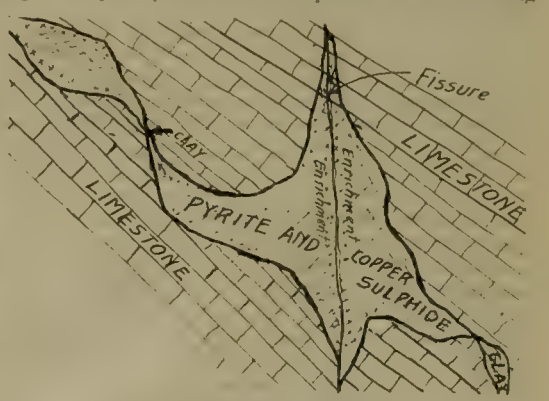
1. Contact action.
2. Eruptive after-effects.

1. *Contact action.* In the copper deposits of the contact zone more or less pronounced contact action occurs in limestone country rock. There appears recrystallization (marble), silicification, and development of heavy silicates such as garnet (andradite and grossularite), tremolite, diopside, sillimanite, and others. The metallic sulphides are intergrown with these silicates and indicate sometimes contemporaneous development. In country rock other than limestone silicification and recrystallization occur as a rule. Sometimes epidote appears, especially in shale. Hence it follows that the intrusive contained excessive amounts of silica and heavy metals such as iron, copper, and zinc. These were more or less concentrated in the contact zone, where a rapid chemical exchange, perhaps induced by the water contained in the intruded rocks, caused their deposition. The metallic sulphides formed were pyrite, chalcopyrite, and zincblende.

2. *Eruptive after-effects.* While the upper part of the intrusive was probably drained of its metallic contents by this process, the same accessory substances remained dissolved in the lower, still molten, part of the magma and in the deep-seated hearth of the intrusion. Therefore a continuance of deposition was possible and is proved by the later silicification and dissemination of metallic sulphides throughout the intrusive itself. Contraction fissures are filled by quartz that contained fluid, gaseous, and solid inclusions, probably mostly sodium-chloride, carbon dioxide, and iron and titanium oxides. Metallic sulphides penetrate the cooling rock as disseminations or as fissure fillings.

In Braden and Nacozari the sulphides fill central channels in the intrusive, channels that gave rise to hot waters or vapors, or both. The mineralization is the same as in both places. And why should it not be so, since the condition in the volcanic vent remained probably the same, even if the action retracted more and more toward its source. Of course, in these two cases everything is reduced to the simplest type, and at the same time is on a compact and small scale. The diameter of the Braden volcano is only 4000 ft. and the long axis of the Pilares ellipse is about 2500 ft. But even in great intrusive masses, where the porphyry body is measured in miles, the occurrences should be on similar lines, even if modified.

Since in Braden and Nacozari the mineralization remained the same throughout both phases of the ore-depositing activity, why should the eruptive after-effect change



IDEAL SECTION AT BISBEE.

suddenly from chalcopyrite and pyrite to lean pyrite in the other porphyritic deposits? Assuming that it did not, and that the after-action deposited chalcopyrite, as in the contact mineralization, then oxidation would cause a breaking up of the chalcopyrite into the chalcocite and pyrite molecules, disregarding the transition stages as sulphates and so on. Pyrite would migrate farther down than the chalcocite, as the latter is able to replace the former in descending reactions.

An extended repetition of this process would produce in the end a more or less solid chalcocite horizon and below it one of nearly solid pyrite. The pyrite might ultimately be concentrated to such a degree that, according to the law of mass action, it might force the copper molecule out of the remaining chalcopyrite and in that way produce a zone of secondary impoverishment below the zone of secondary enrichment. The sudden and abrupt change from chalcocite ore to lean pyrite and marcasite I regard as a zone of this character.

Proof that commercial ore reappears below the lean pyrite is found in Nacozari. Indications in the same direction, even if still very indistinct, begin to appear in the vein deposit of the Old Dominion. I regard the complete disappearance of the zinc content of the Morenci porphyry, that apparently once constituted a considerable part of the metallic mineralization there, and in the fresh porphyry exceeds the copper content, as a further proof of this. Therefore I believe that at Morenci primary sulphides will not be reached before passing through a zone of sphalerite enrichment. Naturally I do not suppose that these primary sulphides could constitute commercial ore, if they occurred thinly disseminated, as for instance in the Ray-Miami contact zone, but I presume that these primary sulphides will occur mainly in trunk channels, fissure veins, or columnar ore-shoots.

The Prospector and the Mining Law

By T. F. Van Wagenen

As the agitation for a revision of the mining law is being revived in certain quarters, it may not be amiss to examine the subject from a point of view somewhat different from that usually taken by the mining engineer or investor, and yet one which perhaps is worthy of very careful consideration.

The two principal ends to be secured by a mining law may be stated as follows: (1) to induce exploration and discovery by the prospector, so that the mineral resources of the country may become known; and (2) to give such reasonable legal security in the matter of titles as will encourage the investment of capital in the business of mining. As mines cannot be worked until they are discovered, it is plain that the occupation of the prospector is a fundamental one. Affairs must be so arranged that there are inducements for him to go out into the field and explore. What must these inducements be? I list them as follows:

1. He must be able to acquire title to a discovery at a very small cash outlay, for he is generally a man of small means.

2. The method of initiating title must be extremely simple, for he rarely possesses business habits or clerkly ability.

3. His claim, when staked, must possess merits merely as a surface area, in addition to those it may be found to have later on as a mine, to attract a buyer, for the real prospector is only a finder and seller, and never a developer.

Consider the nature of the occupation of prospecting. It must not be confused with that of the claim locator or miner. The prospector is a pioneer pure and simple, a natural wanderer over the face of the earth, a genial and valuable variety of the genus tramp and hobo. Not one in a thousand of the class has any reserve funds, possess more than the rudiments of an education in the ordinary sense of the word, or habits of thrift. They could not follow the business if the conditions were otherwise, for it is one requiring a temperament at once careless of the future, and yet highly optimistic. Men of such characteristics are the only ones who will go out into the hills on long tramps, and examine them minutely for indications of mineral wealth. Nearly all known mines have been found by them, or by accident. Can an instance be cited of a discovery by a mining engineer or geologist, or by a business man of any kind? How absurd then it is to penalize the absolutely necessary occupation of the prospector by requiring him to take out a licence before starting on his summer tour of exploration, as is done in all countries except Spanish America and the United States, or to make the process of location one requiring anything but the simplest acts.

Again, remembering that the sole ambition of the prospector is to sell his claim on its *undeveloped* merits, how necessary it is that this claim should possess speculative attraction in itself, in addition to the lure of a promising outcrop. This special feature is provided by the theory of extralateral rights; which, coupled with free prospecting privileges, and extremely simple processes of initiating title, are the distinctive features of the American mining law, a law which has caused those parts of the continent where it is in force to become, in a half century, the best explored and the most broadly active mining region on the globe. Enacted by Congress more by accident than by foresight, yet an everlasting credit to the sterling common sense of the man most concerned in its adoption (W. M. Stewart, senator from Nevada), it embodies the three principles that are absolutely necessary for the establishment and maintenance of this class of prospectors. In fact, the prospector did not exist until this law came into being. The very name of the occupation is American, and cannot be found in any dictionary of the English language published prior to the year 1850. The prospector himself, as we know him, is not found outside of the region where that law is in force. There can be no reasonable warrant therefore for the abrogation of its peculiar features until it is clearly evident that the country has been thoroughly explored, and all its mineral resources discovered. Of course no one will consider this condition to have yet been reached.

The value to the prospector of extralateral rights is simply this. Having made a discovery of an outcrop more or less promising as the case may be, and covered it to the best of his ability with one claim, the title to which he has acquired at very low cash cost, and by processes within the ability of even a total illiterate, he has something that he can sell, to provide the means to continue his work. Why? Because, if the outcrop is well marked, the buyer acquires in the act of transfer the right to follow it downward indefinitely, no matter where it goes. The seller is not compelled to locate one or more adjoining claims at large additional cost to himself (and with faked discovery shafts) to protect his dip. All he needs to cover is the outcrop, and if the buyer is not satisfied that this has been properly done, there is nothing to prevent him from making as many more locations as he thinks wise. All this is very obvious when the subject is considered from the prospector's point of view. That the position taken is a correct one seems to me to be confirmed by examining the history of mining districts the world over. In the western United States and Alaska, where the American law applies, there are thousands of prospectors in the field continuously, moving southward or into the lowlands in the fall and winter, and northward or into the highlands in the spring and summer. But when the international boundaries are reached in either direction, where the American law gives place to that of Mexican or Canadian, they stop, as if at a dead line. I have wandered through the former country for the better parts of five years, from the Rio Grande to the Isthmus of Tehuantepec, and have never yet seen or heard of an individual of the class. British America may be searched from Labrador to the Pacific with little better results. There was a time when the province of British Columbia had an apex law, and while it was in force the rugged region hummed with explorers. When it was repealed they faded away like snow before a chinook. In Alaska, buried in snow and ice during nine months of the year, the prospector is in evidence everywhere. Across the boundary in the Yukon Territory of the Dominion, under even more favorable climatic conditions, he is conspicuously absent. Consider the effect of the line that separates New Mexico from Texas. West of it the American law prevails and explorers are abundant. East of it the Texas state law governs, with square locations and no extralateral rights, and though there are numerous well known and promising mineral areas which were discovered before the exact position of this line was known, yet you will be unable to find a prospector in the field. In fact the situation in this respect is so discouraging in the Lone Star state that its legislature has had under consideration for several sessions the payment of bonuses for new discoveries, and the offer of other inducements to attract the class of men it needs to search over its vast unoccupied and unproductive areas.

Take the case of Africa, a continent rich in minerals, as proved by the innumerable ancient workings existing. When Egypt was in its prime great quantities of gold came from the Abysinnian highlands and the Rhodesian plateau. In the days of the Carthagenians and Romans the Atlas mountain chain was the source of much silver and lead. Anterior perhaps to both of these the great mineral field on the Congo Zambesi divide was known and worked by the natives. Yet in all this vast region, from the Mediterranean to the Cape, much of which is now far more accessible than was our own West in the days of 1850-60, not a prospector exists, and none have existed in modern times except in the province of Rhodesia. Here, because it was thrown open as a mineral field under regulations suggested by an American engineer, and with a law conferring extralateral rights, a number of American prospectors of the better class migrated when the country was opened. But they found themselves on arrival confronted with restrictions in exploring, and regulations for initiating and maintaining

title so burdensome, complex, and costly that in a few years all disappeared.

Consider the situation in Scandinavia, Siberia, Spain, Asia Minor, Italy, and Greece, all regions known to be rich in mineral resources, because of discoveries made by accident centuries ago when prospecting was free. All these lands have elaborate mining laws of the old-fashioned kind, yet one never hears of a new discovery, for prospectors are unknown. The laws do not provide for them. In Australia, on the other hand, the laws offer extraordinary inducements in the way of bonuses and governmental assistance to explorers, yet are without the extralateral rights feature. As a consequence, little more than the fringes of the continent have been looked over, and the type of prospector developed there is one totally different from the vigorous and independent individual known to us.

The conditions in Spanish America are equally to the point. When those lands were first occupied by Europeans, prospecting was free (as indeed it remains today), and practically no laws existed governing the initiation and maintenance of mining titles, beyond the grant of vast concession to explore, to favored individuals, who passed on these rights intact to their subordinates and followers. And no burdens were laid upon the industry beyond royalties on gross production. Under this system the tropical and semi-tropical portions of the two continents were overrun by searchers for the metals, with results that were enormously to the advantage of the whole commercial world of the day. Later, as political states were organized, Old World mining laws were placed upon the statute books, and immediately the prospector disappeared and the mining industry began to languish. Today, not a mineral explorer can be found in the field, and if we look into the history of the many wonderful mining districts that are known to exist in these territories, we find that nearly all the mines in operation are *antiguas*, and that almost no new discoveries have been made in modern times except in northern Mexico, into which, for a few seasons about thirty years ago, the American prospector ventured and remained until driven away by the complexity of the laws and the costs of maintaining the titles to the discoveries he made.

To come down from continents to localities, consider the instance of Zacatecas, a Mexican mining district first opened about the year 1540. Here there has been a recorded output in ounces of silver nearly double that of either Leadville or the Comstock to date, yet only a beginning has been made in uncovering its wealth. If the group of hills in which it lies could be picked up bodily and dropped in any one of our mountain states so as to open to the prospector under the provision of our Federal law, a stampede would ensue for the new locality that would recall the early days of Butte, Leadville, the Coeur d'Alene, Cripple Creek, Tonopah, and a host of other famous American mining camps. Within a few weeks thereafter hundreds of little prospect dumps would begin to blossom out on its hillsides, and within a few months dozens of new shafts would be started. But being where it is, it is one of the deadest of known mineral regions. The very nature of the trade of the prospector is unknown to its citizens, and no work is in progress anywhere except upon half-gutted *antiquas*. Of course, some allowance must be made for the difference between Mexicans and Anglo-Saxons, but this will not explain the difference in results. However, the true causes of the universal stagnation becomes clear as soon as one comes into actual relation with the Mexican mining law. There are those, it is true, who claim it to be the best yet devised. It surely has good points for the capitalist, and for the company that can keep the parish priest and the *jefe politico* on the pay-roll, but not, I maintain, for the prospector and the country itself.

As for the second object to be accomplished in the construction of a mining law, while our code is far from being all that it might be, I have no sympathy with those who are clamoring for the abrogation of the extralateral rights feature under the plea of securing better protection to purchasers and investors. Let the latter, in this matter, protect themselves or take the consequences of their own neglect or carelessness. That is the American way, and in this case the only right way. Who buys a piece of city or agricultural land without calling for an abstract of title and having it examined by a specialist in such documents? But mines are purchased daily without this simple precaution, and when trouble ensues the industry and the law are blamed when really the fault lies with the hasty or too enthusiastic buyer. Moreover, no investor should accept title to a mining claim without having its surface aspects as well as its underground condition passed upon by a competent mining engineer. If he reports that the apex of the deposit is not safely included within the boundaries as shown by the monuments, what more easy than to call on the vendor to file an amended location certificate, or locate additional ground along the side-line? Or for the buyer to perform these acts himself? Or, if the adjoining ground is already occupied and such precautions are impossible, the claim is plainly defective and must be frankly accepted as such or left alone. Plenty of real estate of the ordinary kind bears the label *caveat emptor* among conveyancers, yet no one blames the land laws for the fact.

Beyond question, the apex law has in the past caused much aggravating and expensive litigation. But practically all legal questions that can arise under it have by this time been settled by decisions of our highest courts, and nothing but questions of fact remain to give further trouble. These belong properly to the domain of the engineer, who should be adequately prepared to advise his client by having passed a rigid examination in mining jurisprudence at the institution where his degree was obtained. There is room for improvement in this branch of study in the curricula of all our mining schools.

Much has been written of late as to the large amount of mineral land held under possessory or patent title which is said to be unused by the owners and unobtainable by others who would be glad to develop and operate. So far as my experience goes, I have yet to find a promising claim that the owner will not sell or lease at some price, and on some terms, and generally the conditions asked were reasonable. But are there not millions of city lots and thousands of acres of agricultural land still unimproved and unused by their possessors? Of course, as a general proposition, it may be well in due time to compel the holders of real estate of all kinds either to use the land they own or pass it back to the public, but there seems to be no particular reason to expect the miner alone to lead the way in such a reform.

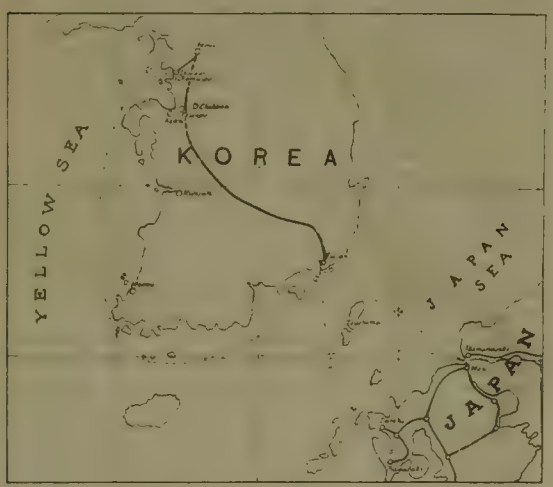
Some of the advocates of amendment have called attention to the fact that in a few localities the peculiar features of the law have been condemned and set aside by the miners themselves. This is true. Let it be admitted that there are some camps where, owing to very unusual geological conditions, the apex law, if enforced to the letter, would probably result in more harm than good. Leadville furnishes the best example. There many excellent apexes were developed, but upon exploration the ore zone proved to be so nearly horizontal that the prospector himself was the first to recognize the injustice of extralateral rights. Consequently, after the mineral area was well covered by locations, and after a few years of litigation to permit of a thorough understanding of the conditions, the law was quietly ignored by common consent of the entire community. By that time it had done its good work in giving the prospector his proper era of activity, and that individual had sold out and obtained his reward. The time had come to give the developer and capitalist their chance. This was done and the subject dismissed. It will be difficult to find in history a better example of the ability of the plain people of this country to do the right thing when left to themselves. The same story will doubtless be repeated if another Leadville is ever found on the continent. There may be some, however, who, in spite of such an exhibition of orderly and common-sense lawlessness, will deplore as unnecessary even the moderate amount of litigation that disturbed that camp in its early days, but after all a mining suit advertises a camp.

Prospecting Gold Placers in Korea

By J. J. Martin

The following description of prospecting work at the Chiksan mines, 50 miles south of Seoul, Korea, may be of interest because of the methods employed and the costs realized. This work was carried on toward the end of 1911 and early in 1912 with two Empire prospecting drills, with a view to determining the gold content of the placer ground under investigation. This ground was easy drilling compared with some other areas with which I have had experience. But notwithstanding this fact, the casing had to be driven with the ram for fully one-half of the footage drilled and the sling-chain was broken on several occasions. So that while the ground was easy drilling, inasmuch as no large boulders were found, yet it offered considerable difficulty.

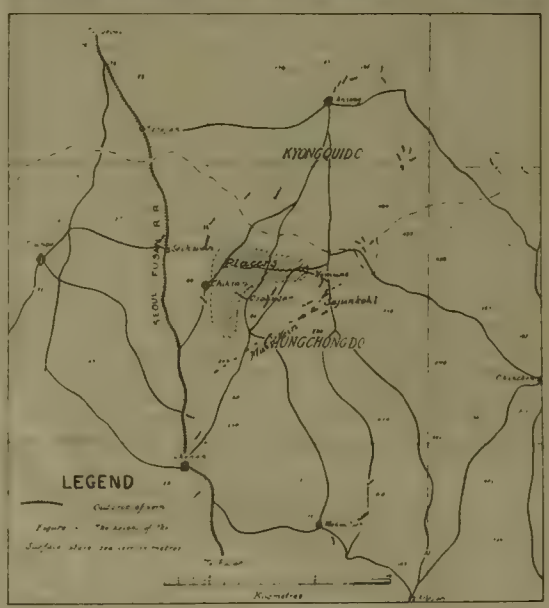
The area being drilled is in valleys where rice cultivation has been the means of clearing the land of all timber, and the surface has been made into little ponds. At the time I commenced work (November 15, 1911) a rice crop was just being cut and the water had only recently been



MAP OF SOUTHERN KOREA.

turned out of the fields. As a result they were simply pools of mud several inches deep. A horse could not be used for rotating the casing without laying in brush to give him a footing; and as the forest has been cut and burned for fuel in this part of Korea years ago, there was no brush available for this purpose. Labor is cheap. I secured some two-inch planks, 8 to 10 in. wide and 6 ft. long, and placed them about 3 ft. apart, radiating from where the hole was to be drilled. On top of this I placed smaller planks in a circle, two boards wide, for the coolies to walk on. Then I fastened to the platform of the drill two poles about 4 in. diameter on the large end, tapering to about 3 in. at the other end, and 100 ft. long. These were made fast to the platform on opposite sides by four clevices or yokes 4 in. wide and 5 in. long with clip and nuts underneath to fasten them firmly. These did not have to be removed in shifting the drill to the next hole. In fact, the arrangement made it quite handy to shift to the next hole, as two coolies (one ahead and one behind) simply took the poles on their shoulders with the platform swinging between. A pole of this length gives sufficient leverage to enable four or five men to rotate the casing to a depth of 25 to 30 ft. in fairly tight ground without exhausting their strength before the day is over. The rotating coolies change work with the drill-men on the platform each time a new section of casing is added. This change rests the men and the work proceeds more rapidly than with a horse and only four men constantly on the platform. The extra men also facilitate the moving to the next hole, getting started more quickly than if a horse were used. I do not claim that this is the cheaper method where high-priced labor is to be employed. But it will be found inexpensive where wages do not exceed 75c. or $1 per day for unskilled labor, as in many foreign countries.

In drilling, the principal tool used is the drilling pump. There are two to each drilling outfit with the spring drilling rig attached. The string of tools is quickly lowered without the use of the rod wrench, except that for every 15 or 20 ft. of depth as the last section of drill rod is sliding down the casing, a wrench is slipped on. By the time it has come to a stop, the next section, in the hands



SKETCH MAP, CHIKSAN MINES.

of one of the men on the platform, is in a position to screw on. Another man has the second wrench slipped over the rod to be attached, and a couple of hard jerks with the heavy wrench tightens the joint. The winch operator meantime has hoisted the string of tools, freeing the lower wrench, which, with a push of the foot, frees the rod; and the tools are on the way to the bottom of the hole in less time than it takes to tell about it. When the drill pump is hoisted, as many sections of the rod are hoisted as can be handled on the platform before disconnecting. If I am going to continue with the drill pump, I hoist four sections (20 ft. if down that depth or more) before disconnecting. When the pump is taken off to be emptied, the other pump is immediately screwed on and the tools are on the way down again almost before the filled pump has reached the washing-box. But if I am through pumping for that foot of drilling and the casing has to be rammed, I disconnect in three-section lengths (15 ft.); and these are set upright along the 2-in. pipe column of the spring drilling rig and tied there with a rope to keep them from dancing around too freely while the casing is being driven.

I never drive more than 1 ft. in depth without drilling, except in running ground, for two reasons. If in stiff ground and I have driven one foot and left a safety core from the previous drilling of 3 in. or more, I have a core of 15 in. in the casing; and continuing to drive,

there would be a tendency to force aside material that properly belongs to the sample. The other reason is that any greater depth causes the handles on the drill-rod to be too high for effective working and there is consequent loss of time in adjusting them. When bedrock is reached and is found to be soft, I drive the casing a foot or more into it, drilling and pumping 6 in. or more if the washing still shows colors. If not, I put in the vacuum-pump (not on the drill-rod, but attached to the drilling rope), and let it down with a rush so that the stem or piston will go to the bottom. Then one man takes hold of the rope and with a quick uplift of 5 ft., the suction-stem and piston is drawn up the length of the pump-barrel and creates the desired vacuum. During this time the winchman is rapidly winding up the slack with the spring drilling rig and soon the pump is up and emptied. This is repeated about three times.

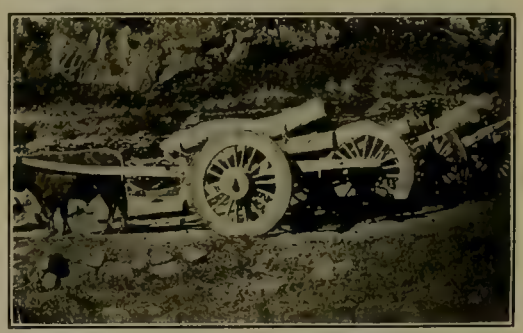
Many times during the past year I have proved that the vacuum-pump removes all of the fine gold in the hole.

WASHING THE SAMPLE.

I have proved this by driving the casing into the bedrock (after having removed all the loose material with the vacuum-pump) until a core of 10 or 12 in. was obtained, then the casing was pulled and the core extracted and panned; seldom more than one or two fine colors are found, and many times there are none. If bedrock proves too hard to drive the casing sufficiently to pull the core, I should be quite satisfied with the vacuum-pump cleaning.

For washing the sample I made a box 18 by 26 in., with sides 6 in. high. The last 8 in. of the 26 in. is sloped to the centre, leaving an opening 8 in. wide for the sludge water to flow out into a 6-ft. sluice-box set below. This box has legs 18 in. high, which makes the right height to stand the pump on end and to dump the contents into the gold-pan, which has been punched full of holes about such as a 20-penny nail would make. This will screen off all the coarse rock. The pump is set on end in the screen pan, which protected the lower pan from being dented. Then a little pressure with the thumb on the ball-valve, or if it is too tight a few blows with a stick, will loosen the valve. With a dipper I pour water in the valve end of the pump and the contents are quickly emptied into the screen pan. The screw end of the pump is given a final dip into the washing tub to clean any sand off the threads. With another dipper of water added to the screen pan (which is raised an inch or so to allow about a half inch of water in the bottom), a few quick shakes will pass all the fine material with the gold into the lower pan. But care should be taken to look over the coarse material to see whether any nuggets have been picked up and learn what kind of material is being passed through, so as to enter it in the log-book with the result of each foot of panning, giving number of colors and size.

As the pump is emptied, the overflow from the pans passes from the pan box into a 6-ft. sluice-box which is made 11 in. wide at the upper end, $8\frac{1}{2}$ in. wide at the lower end, and the sides 6 in. high. This taper allows the small end to enter an inch or so into another such box if more than one is needed. The riffles are made Hungarian style; that is, a 1-in. square stick is beveled to $\frac{1}{2}$ in. on the bottom, with the beveled slope down grade. Riffles are spaced $\frac{1}{2}$ in. apart and held in place by a 1-in. strip on each side, with a $\frac{1}{4}$-in. mortise for the end of each riffle, which is held securely in place with a 3-penny nail in the end. I make these riffles in two sections so that they can be easily and safely removed without breaking. The panning is done in a tub which is placed within easy reach of the washing-box. When the hole is finished and while the casing is being pulled, the pan box is washed clean into the riffle-box; the riffles are taken out and the material caught is panned to see if any fine colors have been washed over in the sludge. When the casing is up and the core is taken out and panned, then all the tailing is in the tub. The water is then poured off, having ready another tub of clear water; and I rock the tailing as a check on the panner. One tub will easily hold the pannings from a 20 or 25-ft. hole.



PRIMITIVE TRANSPORTATION METHODS, KOREA.

A small rocker is a handy thing with a drill outfit, not only for rocking the tailing, but for other purposes. If, as is sometimes the case, it is necessary to dig a hole in order to start on an examination, the rocker serves to determine whether the gravel on the surface carries gold, as it is quite a task to attempt to pan a cubic yard of such material. The result of each hole is now put into a wide-mouthed bottle, like a small vaseline jar, with a good stopper. On each bottle is pasted a piece of paper on which is written the number of the hole. These are put away until there are enough to spend several hours in retorting (with nitric acid), weighing, computing the gold content, and entering on the record-sheet ready to be copied on the map, which is kept up with the work.

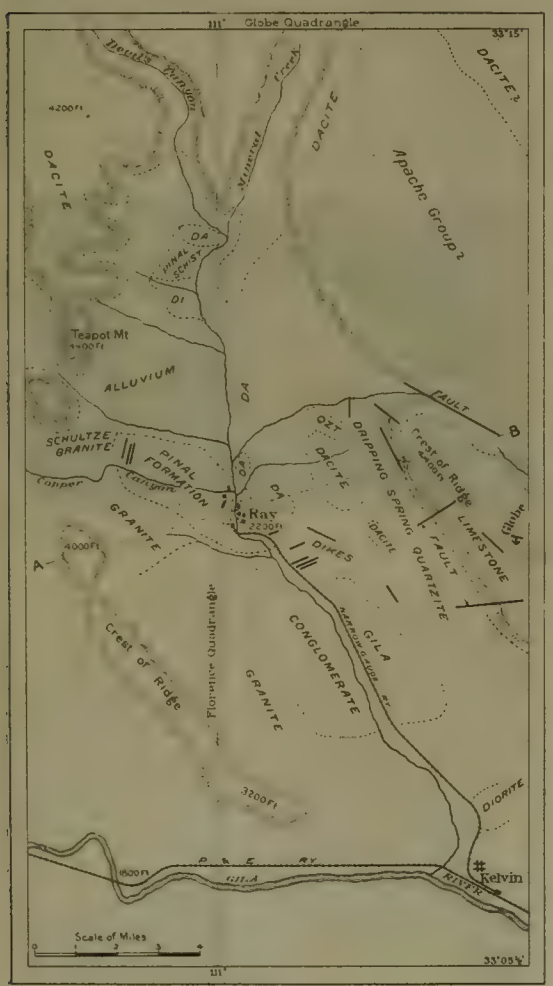
The following is a summary of my work with two Empire drills from November 15 to January 31: No. 1 drill worked 77 days. No. 2 drill, being late in arriving, worked only 50 days. This makes a total of 127 drilling days, covering 203 holes. The total depth drilled was 4112 ft., or an average depth of 20.25 ft. per hole. The average footage per day was 32.37 ft. The total cost for labor outside of my salary was $357.92, making an average drilling cost of $0.087 per foot. The rate of wages paid was as follows: boss of No. 1 drill-crew (Korean speaking English and keeping log-book), 50c. per day; coolie operating the spring drilling winch, 25c.; panner (coolie), 22½c. per day. All other coolies got 17½c. per day until they worked with the drill one month, when they were raised to 20c. per day. The only difference in the crew of the No. 2 drill was that the boss is a Japanese who speaks some English and is paid 75c. per day. My interpreter is a Korean with a good English education; he assists with the surveying, retorting, and other work, and receives 75c. per day.

Work of the Ray Consolidated

By D. C. Jackling

Property

*The total area of mining land at Ray, Arizona, approximates 1950 acres, and, with the exception of a few unimportant claims, the entire group is patented. In addition to this, the company controls, under long-time lease, certain surface areas adjacent to the settlement of Mexican employees known as Sonora Town. At Hayden, where the mill and smelter are, the area of land owned and controlled amounts to about 4000 acres and constitutes all the surface that is necessary or desirable in that vicinity. Of this area, approximately 3750 acres is owned, the remainder being



MAP OF RAY DISTRICT.

leased from the state. The company also owns a considerable acreage in the vicinity of Kelvin which is used to good advantage in connection with the terminals of the Ray & Gila Valley railway and the junction of it with the Arizona Eastern railroad at that point. The company owns in the vicinity of Ray certain water rights and an interest in the Ray Development Co.'s pipe-line and water-works, which, together, insure a plentiful supply of water for domestic and other purposes. Water rights are also owned and controlled in the vicinity of Hayden, ample to provide the full requirements of water at that point.

*From annual report as general manager for the Ray Con. Copper Co., for period ended December 31, 1911.

The Mine

Surface Improvements.—The hoisting plants at both No. 1 and No. 2 shafts are complete. As former reports have shown, these are equipped with skips of 12½ tons capacity operating at a speed of 300 ft. per minute. At the No. 1 shaft, where sufficient tonnage has at times been available, this equipment has demonstrated a hoisting capacity of 600 tons per hour, which is greater than will ever be regularly required. The hoists of both shafts and the shafts themselves are exactly alike, but the No. 2 shaft has for the time being been equipped with only one-half the crushing machinery that has been provided at No. 1.

The main compressor plant, which now consists of two electrically-driven units of a capacity of 300 cu. ft. each, is at the No. 1 shaft. Another compressor of 5000 cu. ft. capacity is now being installed there and all the pipe-lines and connections between this plant and the No. 2 shaft have been completed. This total plant capacity of 11,000 cu. ft. of free air per minute is expected to be ample for the maximum production now contemplated.

The shops, warehouses, etc., to serve the entire mine and the Ray & Gila Valley railroad, are at the No. 1 shaft. The office and officers' quarters and the principal settlement of the company's English-speaking employees are also in this vicinity, although a considerable settlement of American employees has been built up around the No. 2 shaft. The company owns all the buildings occupied by employees near the No. 1 shaft and a few of them in the settlement in the vicinity of the No. 2 shaft. A settlement known as Sonora Town, composed almost wholly of Mexican employees, has been built up on the westerly edge of the company's mining property. This town, which is a little less than two years old, now contains some 4000 inhabitants, and all the buildings, generally speaking, are owned by those occupying them, the ground upon which they are built being leased from the company.

Churn-Drilling.—In my interim report of April 1, 1911, I stated that churn-drilling for development purposes was entirely discontinued in the month of November 1910. Since that time no drilling has been done, excepting where necessary to gain information of value in underground development near the edges of those portions of the ore deposit which are now being worked. Such drilling has resulted in some unimportant changes in tonnages from that stated in my report of April 1, 1911. As the drilling development now stands, the total tonnage calculated is 77,314,470 tons averaging 2.17% copper. Of this quantity, 64,700,000 tons, having an average grade of 2.16% copper, is classed as fully developed, the remainder being classed as partly developed and having an average grade of 2.23% copper. As has been explained in previous reports, the ore classed as fully developed is in deposits that have been drilled regularly and completely in 200-ft. squares, and the partly developed exists in areas that in places have not been drilled at intervals of greater frequency than 400 ft. The total area containing these developments is 183.4 acres. The total number of drill-holes drilled to date is 353, and the total feet of drilling 147,449, the average depth of holes being 417.7 ft. The number of holes showing commercial ore is 277, comprising a total of 121,953 ft. of drilling, and the average depth of these holes is 440 ft. The average thickness of capping, or overburden, is 252 ft., and the average thickness of ore 101 ft. All of the holes containing ore are not considered in the calculations of tonnage, only 238 of them being so used, and representing a total footage of drilling of 106,971. In the area represented by the holes entering into the calculation of ore reserves, the average thickness of ore is 121 ft. Of the total tonnage above stated, about 30,000,000 tons exists in what is known as the East section, or in the vicinity of

the No. 1 shaft, the remainder, about 47,000,000 tons, lying in the West section. Developments by drilling in the East section are practically complete, but in the West section it is known that substantial extensions to the orebody and greatly increased tonnages will result from further development. This is indicated to some extent by the fact that there are 39 drill-holes having ore which have not been used in the calculation of stated ore reserves at all. It is also known that, in many places, existing drill-holes were not driven deep enough to penetrate the orebody, and consequently, that there is ore below the bottom of them. Taking all of the information available, it is not unreasonable to expect that the tonnages stated at present will be increased by 25%, or more, when the ore deposits are fully developed.

Underground Development.—The total amount of underground development on January 1, 1912, was 158,898 ft., or a little over 30 miles. This is an increase for the 18 months of 122,000 ft., or at the rate of nearly 7000 ft. per month, and approximately this rate is being maintained at the present time. The areas adjacent to both shafts have been, and are now being, developed on two principal levels, although in both cases auxiliary levels are being worked above the No. 1 or main upper levels. The No. 2 levels in both cases are at such elevations that they will eventually be joined and form one connected working covering the entire property.

All of the ore mined up to date, excepting small quantities coming out of development work, has come from above the No. 1 level. It will not be long, however, until some mining can be done tributary to the No. 2 level at either shaft, and no extensions of these shafts have been made below that level, excepting such as are necessary to accommodate pumping stations to take care of the small amount of water produced.

The grade of the orebodies, as determined by churn-drilling, has been checked satisfactorily by the underground development as it progressed. The copper content of all the ores mined has varied only slightly from what was expected from calculations of drill-hole results in the areas and zones from which these ores came. The underground work, both as to development and mining, has up to date satisfactorly checked the drill-hole averages.

The system of mining employed, which is commonly known as the 'shrinkage stope' system, has been applied to sufficiently large areas in two portions of the eastern section to demonstrate its adaptability, both as to economy and safety. In the western section, the extent to which stopes have been developed is not so great, but the ground there has proved equally favorable for the use of this plan of mining, and the work done in both sections has shown the system to be entirely satisfactory.

No mining was done, except in the way of development, until late in March 1911, when the first section of the mill at Hayden was started. During the remainder of the year the mine produced approximately 700,000 tons of ore. The amount is stated approximately, as no account is taken of ore broken in stopes, in storage at the mine-bins, or in transit to the mills, the basis upon which the mine is credited with production being the weights at Hayden. The total amount of ore with which the mine was given credit at the mill was 681,000 tons containing 1.83% copper. Of this quantity, about 150,000 tons, or something over 20%, came from storage ore previously produced in development, so that only about 530,000 tons of ore was actually mined from underground during the period, and of this amount about 350,000 tons came from stopes and the balance from development.

CENTRAL PORTION OF RAY DISTRICT.

The actual cost for the period, including coarse crushing of the ore, as well as all general and fixed charges, was 81.6c. per ton. This cost includes many extraordinary expenses incident to starting up and a higher ratio of fixed charges than would apply on a greater tonnage, and is correspondingly higher than it will be when additional areas are opened and a larger tonnage can be conveniently produced. In fact, the cost for the last quarter of the year, as stated in a previous report, was 76c. per ton, and it is not expected that the cost of mining for the current year will exceed the estimate of 75c. per ton made in my quarterly report dated October 25, 1911. This figure is believed to be sufficient to cover not only current operating costs, but also a charge sufficient to retire all the investment we have expended, or will expend, in the underground development of the property. At the time of writing this report, the mine is producing from underground approximately 3600 tons per day, and it is expected that the output will be increased to 5000 tons per day by or shortly after the middle of the current year.

The grade of the ore is still lower than normal, somewhat lower, in fact, than the average applying up to the end of 1911, and this condition will continue to some extent until we have mined out the orebodies near the surface on which we are now working in the west portion of the area tributary to the No. 1 shaft. Our largest increase in tonnage in the immediate future will come from areas tributary to the No. 2 shaft, where the grade is better and some improvement in average value will follow, but we do not expect to maintain a normal grade at the average of the mine until we can derive some tonnage from the No. 2 level of the eastern section, and no considerable amount can be so derived until the upper zone in that section has been further removed. As has been stated, the grade of the ores we are producing checks with the grade indicated both by drill-hole and underground development in the areas from which it is coming.

The Hayden Plant

Construction.—The mill is constructed in eight sections having a normal capacity of 1000 tons per day each, as described in previous reports, and no changes in design of material consequence have been made. The first section of the mill was completed and put in operation in March 1911. Subsequent to that time, additional sections were completed until, at the end of the year, five sections had been finished, and four of them have been practically in continuous operation since completion. The three uncompleted sections are so well advanced that they can be finished at about the rate of one section each thirty days as required, all the necessary machinery for their completion being on the ground.

The power plant is complete, although its full capacity will not be required until the entire mill is in operation. The transmission line from this plant to Ray is in continuous and satisfactory commission furnishing all the power used at the mines. The pumping station for main water supply, machine shops, warehouse, and all accessories to the plant are completed and in satisfactory operation. Office buildings and quarters for officers and employees have also been provided adequate for present needs, and it will not be necessary to add extensively to these for the future. The company owns all the buildings adjacent to the plant excepting those occupied by Mexican employees to the west. The A. S. & R. Co. is rapidly completing its smelter, and it is expected that smelting operations will begin about May 1.

Operation of the Mill.—The first section of the mill was started about the middle of March 1911, but did not operate continuously until after April 1. Another section was started in April, and since that time three additional sections have been completed, as previously stated, although it has not been necessary to operate more than four of them at any one time to accommodate all the tonnage available. It was found desirable immediately after beginning operations to modify somewhat the arrangement of machinery and distribution of products in order to get satisfactory results. These alterations required the installation of only a limited amount of additional machinery, principally classifiers, and were not expensive in point of direct cost, but they required some time and correspondingly delayed the accomplishment of high recoveries, so that the company did not commence to secure the results that had been anticipated until during the last quarter of the year. During that period the extraction percentages increased regularly and rapidly, and at the end of it were all we had expected. The work of the plant is now entirely satisfactory in every respect, the recoveries being 70% on a grade of ore which is nearly ½% lower than the average for the property. All of the five sections now ready for operation have been rearranged, and; so far as now known, no further modifications are necessary to insure regularly the extractions now prevailing aud substantially higher percentages as the grade of the ore improves.

The total ore treated for the year was 681,519 tons of an average grade of 1.83%, resulting in a gross output of copper contained in concentrates of 15,721,520 lb., and corresponding to an average extraction for the entire period of 63.1%. For the last quarter of the year the extraction was 66.27% on an ore assaying 1.73% copper, and for the month of December the extraction was 67.38% on an ore containing 1.86% copper, resulting in as great a recovery in terms of pounds per ton of ore on this lower grade ore as was experienced for the entire period on a considerably higher grade of material, and indicating clearly improved conditions. During the month of February just closed, the recovery was 70.32% on an ore averaging 1.68% copper, and at times during that month the rate of treatment per section averaged over 1100 tons per day, or at the rate of about 9000 tons for the completed plant of eight sections. There is no question but that equally good results will be regularly maintained hereafter.

The net cost of producing copper for the year, after crediting dividends from the Ray & Gila Valley railroad, was 10¾c. per pound. This cost was incurred, however, in connection with shipping all of the concentrate produced to El Paso at a freight and smelting expense of approximately 1½c. per pound greater than is now resulting through the delivery of concentrate to the A. S. & R. Co.'s new plant at Hayden under contract with that company. Had the management been able during the period under discussion to have delivered concentrate to Hayden, under the contract which is now in effect, the average cost per pound for the year would have been 9.33c., and on the same average grade of ore the actual cost at the present time is about 9c. per pound. The average assay of concentrate produced for the period was 22.4%, this feature as well as others of concentrate analysis being almost exactly what had been expected as a result of early experiments. As it becomes possible to increase tonnage, all factors of operating costs will decrease correspondingly. This will apply especially to the cost of power, as it will not be necessary to employ any additional operating force to supply power for the entire mill. Fixed and general charges will also be decreased by distributing them over a greater tonnage, and, as stated in the discussion of mining conditions, the cost of mining will in the future be lower. Taking all these factors into consideration, there appears no question whatever, about the ability of the property to produce copper at 8c. per pound, when running at full tonnage and on a normal grade of ore. As a matter of fact, if the mill were now running on a 2% ore and making no greater percentage of recovery than at present, and experiencing the same costs per ton that now apply to operation at less than one-half the mill capacity, the cost per pound would be less than 8¼c. Summing up the whole situation, every factor pertaining to the Hayden plant and its operation, including those of water supply and the transportation and delivery of ores, is entirely satisfactory.

Ray & Gila Valley Railroad

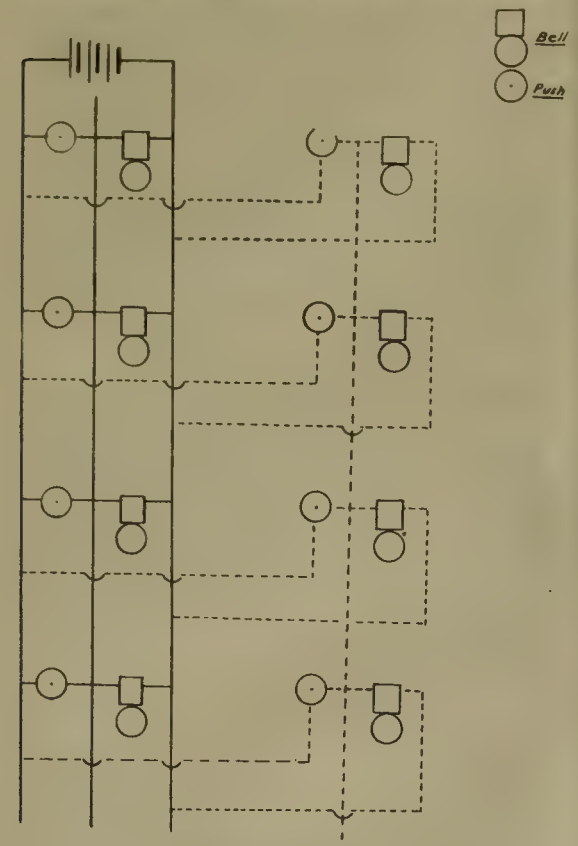
The Ray & Gila Valley railroad, which is owned by the company, connects the town of Ray with Kelvin and Ray Junction, the latter being the point at which it joins the Arizona Eastern, a branch of the Southern Pacific railroad. During the year the line was extended to the No. 2 shaft and a permanent station established near that point for the convenience of the town of Ray. Another branch extends from a point on the Arizona Eastern line to the mill at Hayden, a distance of about three miles. The total trackage, including sidings, is about sixteen miles, the total length of the main line in the two branches being about ten miles. The distance via the Ray & Gila Valley and Arizona Eastern between Ray and Hayden is about twenty miles.

The present equipment of the line consists of three locomotives, one hundred and twenty 60-ton steel ore cars, and the small amount of equipment necessary for passenger and commercial freight business. Up to the present time the management has been able to handle the entire main line business with one locomotive, although an additional locomotive is at times used for switching or emergency service, leaving a third locomotive constantly in reserve. The road and its equipment is in excellent physical condition and its operation is resulting in substantial profits.

Bell Signaling and Cable Systems in Shafts at the Crown Mines, Limited

The following detailed account of the signaling system was prepared by Mr. Curtiss, electrical engineer for the Crown Mines, Ltd., and is published through the courtesy of W. W. Mein.

Signaling System. This allows the interchange of signals between any station and the engine-driver, such signals sounding at all stations. In its simplest form it consists of a battery preferably of accumulators, a bell and pull at each station and at surface, and three wires connecting all stations with the surface. Our battery wire is connected to a terminal of every bell, the other to a terminal of every pull, and the third wire forms a common



CROWN MINES SIGNAL SYSTEM.

connection between the other terminals of both bells and pulls. The arrangement is shown in the attached sketch. The two battery wires may, and in practice generally do, feed a number of systems, though, of course, there must be a separate 'common' wire for each system. The dotted lines in the sketch show a second system fed in this way.

Bell Cable.—Where any trouble from moisture is likely to be experienced, bell cable is used. This consists of a number of rubber-insulated wires incased in a lead covering which in turn is covered with jute and armored with steel wires. There is a final covering of jute over all to prevent corrosion. The standard cables are 4-core and 7-core, but special cables may be made up as desired. The copper in each core generally consists of seven No. 20 S.W.G. wires, equivalent to about 9000 circular mils.

Junction Boxes.—At each station where bells are desired the main cable is taken in and out of a 'T' junction box. A branch cable from this box is run to the bells and pulls in the station. In the junction box is a marble terminal board with binding post passing through it. Each of the wires of the incoming and outgoing and branch cables is connected to the bottom of a binding post, and the box is then filled with paraffin wax or compound, level with the top of terminal board, thus sealing all cable ends. The connections between the upper parts of the binding post are made with copper straps which may be easily removed when testing for faults. The box is provided with a lid which when bolted down makes the box quite water-tight. It is not customary to use these boxes in situations where trouble from moisture need not be feared.

Bells.—Any water-tight bell may be used, but probably the most satisfactory type is that manufactured by Siemens, Limited. This has the mechanism enclosed in a water-tight metal box, on the side of which is soldered a metal diaphragm. The armature is attached to the inside of the diaphragm and the bell-hammer to the outside of the same. This allows the parts damageable by moisture to be hermetically sealed.

Pulls.—There are many satisfactory forms of pulls and push-buttons. If used in very wet places, it is well to fill the pulls with vaseline.

Distance Between Junction Boxes.—If no tappings are required, there is nothing to limit the length of bell cable between boxes except for the convenience in replacing a damaged portion. In the case of the South Rand shaft, where no bells are required between the surface and a depth of 2000 ft., pockets are cut in the rock to provide dry places for junction boxes at depths of about 800 and 1000 ft., so that in case of a failure it will probably not be necessary to replace a greater length than 800 feet.

Power Cables in Shafts.—The power cables at the Crown Mines are 2200-volt, 3-phase, 3-core, paper insulated, lead covered, steel-wire armored, and jute-covered cables. The cross-section of each copper core is from 0.1 to 0.2 square inch, depending on the load to be taken care of. Where the larger size is not sufficient to carry the load, additional cables are installed, as it is not economical to increase the size of such a cable much above 0.2 sq. in. These cables are specially made for shaft work and do not contain any free oil, otherwise the lead might be ruptured by the static pressure of the oil. Here again the length between the boxes is determined largely by the idea of replacement in case of failure. The longest length on Crown Mines is about 1000 feet.

Installation.—Neither the bell nor power cables referred to above are able to carry their own weight for any great length. They are lashed or clamped about every 70 ft. to a wire rope when being lowered into place. The lashings or clamps are gradually removed as the cables are cleated to the shaft timbers.

In the northern part of Minnesota there is a great area of land so flat that its waters sometimes flow into Hudson bay and sometimes into the Gulf of Mexico. This area contains the headwaters of the Mississippi river. There are times when certain lakes discharge at both ends, the northern outlet taking the flow through Red river or Rainy river into Lake Winnipeg, and thence into Hudson bay; while the southern outlet leads to the Mississippi. Therefore the dividing line between the Mississippi drainage basin and that of Hudson bay is indefinite and in many places cannot be determined, and the consideration of these two basins in connection with their water supplies and the uses that can be made thereof must logically be taken up together.

Placer deposits of great richness have been found on the Chukat peninsula, Kamtchatka, according to a recent report by a Russian engineer. In the northern part of Kamtchatka, on the Anadyr river, rich placers also occur. The Anadir Mining Co. (Russian) has sent an expedition to this area and a number of Danish engineers have also started in behalf of Danish capitalists. The Russian ministry has approved of a scheme for allotting the land to private individuals and will first investigate its value.

The Los Burros Mining District

By Charles H. Davis

The Los Burros mining district is in the extreme southern part of Monterey county, California, mostly in township 23 S.; range 5 E.; and township 24 S.; range 5 E., Mt. Diablo meridian. The largest mine in operation, the Buclimo, and the old townsite of Los Burros are on a north gulch of Alder creek, township 24 S.; range 5 E.; section 2. The two important placer workings are on Willow and Dogvine creeks in township 23 S.; range 5 E. Plaskett's find of May 1911 is near the latter creek. The official map of Monterey county, compiled in 1898 by Lou G. Hare, county surveyor, has been used as a basis for work.

The principal deep mine, the Buclimo, J. C. White superintendent, is owned by Messrs. Burnham, Clinton, and Mory, of San Francisco. The Plaskett property is owned by old residents of that name. They have both placer and deep mining claims. The Gorda Gold Mining Co. works the placer deposits on Willow creek during the rainy season and early summer.

Geologic Relations

Igneous Rocks.—Serpentine, probably altered from a gabbro, occupies a considerable area in the district. Thin sections of the rock show no olivine remaining, but do show bastite, a pseudomorph of an orthorhombic-pyroxene, the presence of which is indicative of the igneous origin of the serpentine. The rock in hand specimen is fine and even in texture, and almost glassy in appearance at times, especially where it is sheared. In color the rock is dark green, not mottled but of even color. Along the Jolon trail the serpentine is bluish green and purple.

The serpentine occurs in the form of dikes extending irregularly along the coast from the ocean at Gorda southeasterly through San Luis Obispo county. These dikes occur, to my knowledge, as far north as Gamboa's, on Big creek, and eastward they are exposed nearly to the Nacimiento river, where in the first ridge the Miocene sandstone lies upon them unconformably, so far as could be determined. This would make the age of the intrusions pre-Miocene and probably pre-Tertiary, yet the exact age can only be determined by fixing that of the older sandstones and shales intruded.

Sedimentary and Metamorphic Rocks.—The country rock in the mining district varies from a distinct sandstone of fine even grain, to a shale which is so metamorphosed near the mineral veins that it is properly termed slate. Conglomerate beds are rarely found, and are so fine in texture that they are hardly worthy of the name. In thin section the slates from the Buclimo exhibit the characters of a microscopically-fine arkose—if such an expression may be used. The small grains of quartz, feldspar, and chalcedony are sub-angular, a fact which, added to the presence of the feldspars, shows that the rock materials were transported only short distances. Carbonaceous material (graphite in the metamorphosed areas) gives the rock its deep gray or black color. The slates are infiltrated with fine quartz and calcite veins, especially in the immediate mining district. Several beds of white quartzite occur near the Buclimo and also about a quarter of a mile to the east. These beds appear to be sedimentary in origin.

Just south of the Buclimo workings is a small area of rock which has the character of a greenstone. It contains principally the quartz, feldspar, chalcedony, calcite, and chlorite. In appearance the outcropping rock is a dark olive-green, weathering brownish green; it has been irregularly fractured to quite an extent, and the fractures filled with calcite. Its metamorphic character and its position near the slates suggest local metamorphism in the mining district. The extent of the metamorphosed area has not been worked out. The age of the sandstones and slates is probably Franciscan (Jurassic). Jurassic fossils have been found in the slates at Slate Springs, to the north, where the formation is the same as in the Los Burros district.

Structure.—The structure, upon reconnaissance, seems to be monoclinal; dip generally steeply to the east; strike 40 to 45° west of north; texture of beds uniform; bedding not prominent; structure regular. The structure agrees with the direction of the valleys of the Nacimiento and Burro creeks to the east of the territory and with the trend of the coast line. The weathering is slight and is limited mostly to staining and discoloration.

Ore Deposits

Outcrop.—The outcroppings of the gold-bearing veins yield placers which are richest in the canyons and gulches leading to the Pacific. Deposits also exist in the gravels of the San Antonio and Nacimiento valleys to the east. The latter deposits are of little economic value, although they were worked for several years by Chinese. The mineral veins fill fissures which are nearly identical with the bedding of the country rock. These veins run through slates, sandstones, and serpentines alike, but the ore seems to vary in richness with each of these formations. The following are some of the minerals found in the vein and wall-rock: free gold, sulphides carrying gold, chromite, pyrite, and mariposite, the last being a rare mineral found mostly in the Mother Lode district.

Conditions Affecting Mining

Topography.—The Los Burros mining district is just west of the crest of the Santa Lucia range, with summits at this point about 3500 ft. above sea-level. The top of the Buclimo shaft is 2800 ft. above sea-level, and this elevation represents the general level of the outcrops of the vein. The mines and prospects, therefore, are at the heads of the deep gulches which open into Alder, Spruce, Willow, and other creeks flowing into the Pacific. The Pacific slope of the Santa Lucia range is steep, having a descent of 3000 ft. or more in three miles. The creeks have attained an even, though steep, gradient from their heads to the ocean, in most cases. The ocean is bordered by bluffs which rise steeply from the beach at an angle of nearly 30° to an elevation of about 1800 ft. To the north of this district, the trail leading to Gamboa's sometimes skirts the foot of the bluffs and is passable only at low tide. To reach the district from the railroad, one must travel from King City, on the Southern Pacific railroad, to Jolon, a distance of nineteen miles, by stage, and then twenty-one miles by trail to the mines. Of this twenty-one miles, the first ten, as far as the Nacimiento river, may be traveled by wagon. The remainder of the trail is narrow and steep, so that all provisions and supplies for the mines must be carried on pack animals. Trails approach the district from both the north and south along the coast, but the one from Jolon is the best and most used for provisions, mail, ore, and by prospectors.

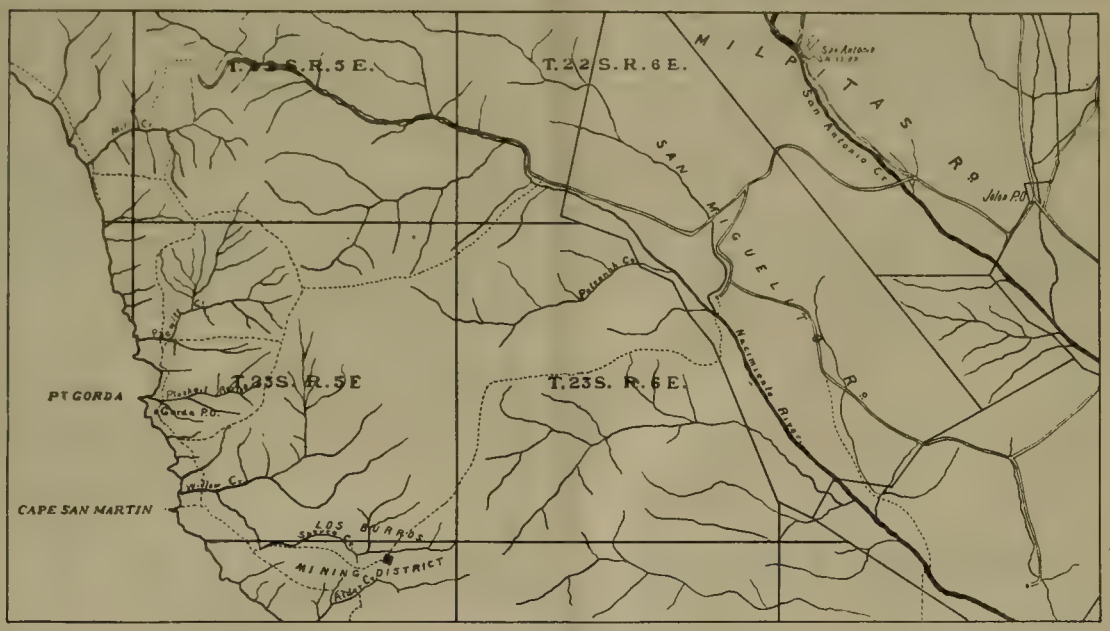
The transportation facilities, aside from those of the Jolon trail, are meagre. At intervals, usually once a year, a boat is chartered to bring provisions, lumber, machinery, and various supplies to the landing near the mouth of Willow creek. The few inhabitants along the coast share in the cost of the enterprise, and send back in the boat the products of the region, which consist of redwood timber, lime, cattle, and hides. There is often considerable difficulty in landing supplies on account of the heavy surf and the lack of protection from the open sea. The old Los Burros townsite was plotted upon a fairly level piece of ground sloping into a gulch opening into Alder creek. This area is just below the old Last Chance mine (now the Buclimo) and is at an elevation of 2500 ft. above the sea. Two or three acres of this land are tillable, but the rest is sloping and brushy. The customary building sites, and the best of the region, are those at an elevation of about 1800 ft., at the crest of the bluffs overlooking the sea. Here

is often found a strip of open grazing or farming land. The sides of the sea bluffs are too steep for building purposes. Waste and tailing is dumped into the steep-sided gulches.

There is no timber on any of the most promising properties. Redwood trees are abundant on the sides of the coast canyons to an elevation of about 250 ft.; oaks, including some tan bark oaks, grow at the lower elevations; and sugar pines and the Santa Lucia fir are scattered among the redwoods at the higher altitudes. Some of the timber land is homesteaded, but much of it is in the Monterey National Forest and is cut under the supervision of the forester and sold to the mines. The only fuel supply at hand is that derived from the timber described above—oak, pine, fir, and redwood.

Water cannot be stored with any facility above the main workings. The chief supply is from springs and, in the case of the Buclimo, from the pumpings of the mines and from a spring connected with the mill by 1800 ft. of pipeline. Work in this mine has been prevented by an excess of water in winter and at times by drought in summer. Work in the new Plaskett mine, however, has been delayed on account of lack of water, since the mill was built upon the hillside. The placer deposits are worked on a large scale only after the rainy season has started in January, and from then till summer. Power is not directly available at the mines except from wood fuel, but electrical power could be developed on Willow, Prewitt, and Mill creeks. Fifteen miles to the north is Big creek, a stream which could probably furnish over a thousand horse-power throughout the year.

Extremes of climate are not suffered, although the ground freezes slightly at times in December and January. In summer the thermometer rises to 100°F. or more, but the elevation aids in making living quite comfortable. The rainfall is very heavy; for a period of over ten years the average year rainfall was between fifty and sixty inches at a station, in the heart of the district, kept by James Krenkel. The rain falls mostly in January and February.



MAP OF LOS BURROS MINING DISTRICT, CALIFORNIA.

Development

The entire mining district, which is about three by nine miles, is staked out in claims upon which assessment work has been or is being done. The only mill (until the fall of 1911) was upon the Buclimo property. Therefore, since that mine is the only one extensively developed, a report upon it will be given.

Buclimo Mine.—The Buclimo mine is situated near the head of a steep-sided gulch opening into a north branch of Alder creek. The main entrance to the mine is through an adit 750 ft. long opening upon the first level. The first level is 97 ft. below the surface and has a 600 ft. ore-shoot. The second level, 197 ft. below the surface, has now a 600 ft. ore shoot developed. The shaft, which is 4½ by 9 ft., extends to a depth of 247 ft., having one compartment to the first level and two compartments to the second level. It is equipped with a bucket, a steam hoist, and a steam pump. A raise connects the stopes of the two levels. The raise and levels are timbered, but the adit is cut through hard slate and greenstone, both of which stand firm without timbering.

The ore is taken out on a tramway through the adit and then about a hundred yards farther, where it is dumped into the ore-bin above the mill. The ore is treated in a 5 ft. Huntington mill which has a capacity of 12 tons in 24 hours. Simply the free gold is obtained from the ore; the tailing, which contains quite a percentage of sulphides, was until 1911 disregarded, but is now being saved for further treatment. Plans to cut the vein at about the 400-ft. level by means of a new adit are being considered by the owners of the Buclimo.

History of Discovery and Development.—The history of the discovery and early development of the Los Burros mining district was published by the California State Mining Bureau in the Eighth Annual Report of the State Mineralogist for the year ended October 1, 1888. Briefly, a part of this report follows.

"In 1887, W. D. Cruikshank was prospecting in Alder creek and discovered a 'blind lead' from two to four inches wide, containing free gold. He commenced sinking upon it, and the vein widened as he went down. He then crushed about 20 lb. in a hand mortar, and washed out $18 worth of gold. He continued sinking and put up a horse arastra. This he used for about four months, during which time he realized enough to erect a 3-stamp mill and a 2-hp. engine. He operated from November 1887 to the first of June 1888, when a failure in the water-supply, caused by draining the upper workings of the mine, compelled the removal of the mill, and a consequent temporary suspension of milling operations. Further development of Mr. Cruikshank's mine, which is called the Last Chance, has brought to light five distinct leads, each showing well defined quartz veins, three of which have been found of sufficient importance to work."

Since 1888, no report has been published about the district either by the State of California or by the U. S. Geo-

logical Survey. After working the property for two years, Mr. Cruikshank sold the Last Chance to T. A. Bell, who carried on mining for two years. Messrs. Cruikshank and J. M. Krenkel, district recorder, then leased the property for nine years. The mine then lay idle until 1908, when the Bank of California, which had the settling of Mr. Bell's accounts, sold the mine to a San Francisco company. The names of the new stockholders give the mine its new name, Buclimo. At the present time the mine is employing about twenty-five men in summer and about six in winter.

In 1902, important placer discoveries were made on Willow and Dog-vine creeks, and to work them, two mining companies were formed, the Gorda Gold Mining Co. and that of the Plaskett brothers. Many large nuggets were found in these deposits, the largest being one worth $800 on the Gorda claim, and one worth $104 on the Plaskett claim. Since the opening of the district placer work has been carried on by individuals, on a small scale, in all the nearby creeks and gulches. On February 7, 1911, the Bushness find was made, and toward the last of May 1911, the Plaskett find excited wide attention on account of the richness of the outcropping ore. It is upon the latter property that a 3½-ft. Huntington mill has been installed. About the first of February 1912 another discovery was made at Plaskett's. The outcropping vein is one to eight feet wide, and, according to information received from Mr. Krenkel, it is as rich as the find of 1911.

Production.—The production of the Los Burros mining district, so far as can be learned, is given below. No estimate can be obtained of the value of the placer production before the year 1904, but Mr. Krenkel estimates the output of the deep mining for the period 1888-1904 at $120,000. The remainder of the data is from the 'Mineral Resources of the United States, 1905-1909.'

Year.	Placer.	Deep gold mines.	Total.
1888-1904	.....	(est.) $120,000	?
1904	?	?	$6,295
1905	$1,248	125	1,373
1906	300	325	625
1907	250	826	1,076
1908	500	818	1,318
1909	0	333	333

Coal Production of New Mexico

The production of coal in New Mexico in 1911 was 3,148,158 short tons, with a spot value of $4,525,925, according to a statement by E. W. Parker recently made public by the U. S. Geological Survey. In common with most of the states in the Rocky Mountain region, New Mexico produced less coal in 1911 than in 1910. Several causes contributed to the decreased production—unusually mild weather in the winter of 1910-11, a drought in the Great Plains states which reduced the demands for coal for domestic use, decreased consumption by railroad locomotives, and the resumption of coal mining in the Central and Southwestern states after the six months' strike of 1910. The combined effect of these influences on the coal production of New Mexico was a decrease of 360,163 short tons, or 10.3%. The value declined $351,226, or 7.2%. All the counties of the state showed decreases in production except McKinley county, which increased 32,635 short tons. Colfax county, in addition to producing 75% of the total output of New Mexico, is also the only county in which coking operations are carried on, and in 1911 a total of 767,108 tons of coal mined in that county was made into coke. In 1910 the coal made into coke in Colfax county amounted to 701,204 tons.

JAPANESE living at Chinnampo, in Korea, propose to erect a blast-furnace there to smelt the iron ores which are now being shipped to Japan. The mines, which occur in north and south Phyonan and Huanghai provinces, have produced about 12,000 tons annually, but it is expected that 150,000 tons will be produced in 1912.

The Nature of Sherardizing

By J. W. RICHARDS

Sherardizing is an intensely interesting process, based on clear-cut but not very generally understood scientific principles. As proved in the paper, coating with zinc takes place regularly below the melting point of zinc, with probably no distinct break at the melting point, as long as the zinc-dust does not run together to fluid zinc. The process is without doubt operated by the vapor tension of the zinc, on the one hand, and the ability of the other metal, iron, copper, nickel, or brass, to absorb zinc vapor on the other hand. The process depends on 'a push and a pull,' the tendency of the zinc to vaporize and the tendency of the other metal to absorb the vapor. In the absence of numerical values for the heat of combustion of zinc vapor with iron, copper, nickel, or brass, to form alloys—the pull—I have reproduced a diagram showing the probable vapor tension of zinc at low temperatures, derived by analogy from the vapor tension of mercury at low temperatures, as printed in my 'Metallurgical Calculations, Part III.' While the figures given are not experimental results, yet they are worthy of consideration as first approximations. Johnson and Woolrich's results, as given in their Plate II, show that at a given temperature different metals absorb zinc vapor with different velocities; also that a given metal, at different temperatures, absorbs zinc vapor with different velocities. The first information tells us that sherardizing depends partly on the specific attraction of the metal being plated for zinc vapor, the second makes it a probable assumption that it also depends upon the specific ability of the zinc-dust to produce zinc vapor at the different temperatures.

As to the latter point, the vapor-tension curve of zinc gives us interesting conclusions. Johnson and Woolrich made 30-minute tests with copper, nickel, and iron, at 325°, 375°, and 425°C. They give the weights of zinc absorbed at these temperatures, and we can compare these with the vapor tensions of zinc at the same temperatures:

Temperature, °C.	Tension of zinc vapor, mm. Hg.	Relative tensions.	Square roots of relative tensions.	Relative Deposits. Copper	Nickel	Iron .....
325	0.002	1	1	1	1	1
375	0.028	14	3.7	2.4	3	4
425	0.183	92	9.5	4.8	6.3	10.9

The fourth column is added because it would appear *a priori* that if the tension of zinc vapor was zero at the absorbing surface, the driving force causing diffusion of zinc vapor would be the maximum possible tension at the vaporizing surface, and the quantity of zinc diffusing, being proportional to the diffusion velocity, would then be proportional to the square roots of those maximum tensions. It appears that the agreement is not bad; in fact, in the case of iron, it is quite instructive.

After the immediate surface of the metal becomes coated, the absorbing power must rapidly decrease, and the rate of absorption would then be limited by the rate at which the zinc soaks in, or is transmitted inward, from the surface. It appears from Johnson and Woolrich's results, that while copper and nickel have a greater combining power than iron, as far as their immediate surfaces are concerned, they do not, however, maintain that rate when greater quantities of zinc are absorbed at a higher temperature; the iron is evidently relatively more permeable to further absorption of zinc, at the higher temperatures.

*Discussion of a paper by A. R. Johnson and W. R. Woolrich, presented at the Boston meeting of the Amer. Electrochem. Soc., and printed in the *Mining and Scientific Press*. April 20.

Iron and Steel Division of the A. I. M. E.

The Council of the American Institute of Mining Engineers, at its meeting on April 26, established an Iron and Steel division to represent the interests of the Institute in the mining and metallurgy of Iron and Steel; its business to be in charge of the following committee, upon which shall rest the responsibility for securing papers and discussions on Iron and Steel for the meetings of the Institute: Charles Kirchhoff, chairman; Charles F. Rand, vice-chairman; Bradley Stoughton, secretary (165 Broadway, New York City); John Birkinbine, James Gayley, Henry D. Hibbard, Henry M. Howe, Robert W. Hunt, Julian Kennedy, Charles K. Leith, Richard Moldenke, Joseph W. Richards, F. W. C. Schniewind, Leonard Waldo, William R. Webster, Felix A. Vogel.

This committee has met and formulated plans for carrying out its intention of securing papers and discussions dealing with all phases of the mining and metallurgy of the ferrous metals, to such an extent as will make the American Institute of Mining Engineers the foremost iron and steel association in America, useful alike to the theoretical as well as the practical iron and steel man. The following subjects have been suggested: geology, mining, and preparation of ores; concentration; nodulizing, sintering, and briquetting; manufacture of coke and other fuels; refractory materials; blast-furnace, bessemer, open-hearth, and electric furnace practice; the duplex process; treatment, physics, and chemistry of iron and steel, including metallography. A campaign has already been started to secure papers and discussions on: alloy steels, heat treatment of steel, the duplex process, the thin-lined blast-furnace, fuel gas for open-hearth furnaces, ore concentration, manufacture of pig iron, mechanical charging of blast-furnaces, gas producers, charcoal iron, electric furnaces, recent improvements in open-hearth furnaces and practice. The committee will use its utmost endeavors to bring the papers presented on iron and steel to the attention of all members who are qualified to discuss them, and to stimulate a continuance of the discussion until all available data and information of interest have been secured for the *Transactions*.

A GEOLOGICAL examination should not confine itself to the points then needed. All features of an ore deposit are the result of geologic processes, and it is impossible to foretell just which ones are likely to be of economic importance in any one case. A man in charge of exploratory work should make an effort to work out the geologic history of the region, feeling sure that even an apparently theoretical matter may eventually prove to be of practical importance. This, of course, does not mean that a detailed geological survey should be made before an adit is driven or a shaft is sunk; it means that the man in charge of the work should be trained in field geology and should be capable of interpreting the geologic features that come to his attention day by day. In many cases questions will arise that can be settled only by an expert. It is therefore of importance that the man in charge of the work be familiar enough with the significance of geology to know when to employ specialists.

DREDGE TAILING is causing difficulty in the Wagga, New South Wales, district, and at a recent meeting of the citizens of Wagga it was proposed that no dredging shall be allowed on the watershed of the Murrumbidgee river.

Mineral Production of Colorado by Counties

(Compiled by the Colorado Bureau of Mines.)

COLORADO	GOLD		SILVER		LEAD		COPPER		ZINC		TOTAL VALUE
Name of County	Fine Ounces	Value	Fine Ounces	Value	Pounds	Value	Pounds	Value	Pounds	Value	
Boulder	7,888.312	$ 163,051.40	47,926.78	$ 25,546 40	151,501	$ 6,764.53	38,275	$ 4,676.81			$ 200.039 14
Chaffee	3,186.483	65,864 60	94,072 39	50,143.41	1,016,511	45,387.21	106,112	12,965.83	630,794	$ 35,374.93	209,735.98
Clear Creek	26,933.131	556,707.83	474,760.75	253,061.73	3,910,660	174,610.97	728,250	88,934.87	1,587,134	89,006 47	1,162,371 87
Costilla	1,081.736	22,359.49	96.62	51.50							22,410 99
Custer	74.549	1,540 93	11,716.42	6,245.20	17,601	785.88	1,899	232.04			8,804 05
Dolores	361 584	7,473 94	49,882.24	26,578.06	502,688	22,445.02	1,774	216.77	618,047	34,660 08	91,373 87
Douglas	1.700	35 13									35 13
Eagle	2,001.301	41,366 89	113,965.43	60,746.99	820,342	36,628.27	94,726	11,574.57	7,432,000	416,786.56	567,103 28
Fremont	8.601	177 78	1,345 12	716.99	19,918	889.34	17,047	2,082.97	25,359	1,422 13	5,289 21
Gilpin	38,106 510	787,661.58	518,947 56	170,008 62	1,401,595	62,581 22	1,361,022	166,303.28			1,186,554 70
Gunnison	6,650.238	137,460 42	25,024.64	13,338 88	413,054	18,442 86	10,946	1,337.49	454,501	25,488 42	196,068 07
Hinsdale	185.252	3,829.16	7,754.70	4,133 49	118,719	5,300.80	26,365	3,221.54	42,870	2,404 15	18,889 14
Lake	56,149.600	1,160,612.25	3,067,463.12	1,635,049 87	16,237,749	725,015.49	4,787,587	584,995 25	74,150,404	4,158,354.66	8,264,027 52
La Plata	13,896 973	287,250 43	68,266.06	36,387.88	1,516	67.69	89,933	10,988.92			334,694 92
Mineral	8,706.304	179,959.30	545,856.04	290,957 64	7,002,372	312,655.91	36,395	4,447.11	1,226,725	68,794 74	856,814 70
Montezuma			4.50	2.40			223	27.25			29 65
Ouray	93,602 831	1,934,770.50	484,608.02	258,310.59	4,002,798	178,724.02	668,414	81,673.50			2,453,479 51
Park	2,843.588	58,776.96	69,255.97	36,915.51	923,060	41,215 52	25,831	3,156 29	974,000	54,621 92	194,686 20
Pitkin	18 439	381.12	438,701.37	233,840.99	10,179,982	454,536.20	40,700	4,973 13			693,731.44
Rio Grande	.649	13.41	1,558 93	830 96	1,689	75 41	79	9.65			929 43
Saguache	20.274	419.06	2,437.01	1,299 00	48,003	2,143 34	4,963	606 42			4,467 82
San Juan	15,633.716	323,148.91	296,207.43	157,887.45	6,280 287	280,414.82	473,987	57,916.47	2,047,722	114,836 25	934,203.90
San Miguel	118,759.546	2,454,759 84	996,741 55	530,760 12	6,668,744	297,759.42	831,007	101,540.74	2,752,883	154,381.68	3,539,201.80
Summit	13,555.729	280,196.92	181,364 70	96,672 83	5,788,878	258,473 40	34,103	4,167.05	9,630,096	540,055 78	1,179,565 98
Teller	511,606.863	10,574,913.85	59,899 52	31,928 24	10,712	478.29	307	37.51			10,607,357 89
Total	921,273.909	$19,042,731.70	7,356,536.87	$ 3,921,414 75	65,518,399	$ 2,925,396.51	9,379,945	$ 1,146,135.46	101,572,535	$5,696,187.77	$32,731,866 19
					Boulder County's production		of Tungsten for 1911—1,20		0 tons		600,000 00
					Gilpin County's production o		f Uranium for 1911—20 ton		s		5,000 00
					San Miguel County's produc		tion of Vanadium for 1911				547,500 00
					Montrose County's productio		n of Uranium and Vanadiu		m for 1911—1,515½ tons		303,100 00
											$ 34,187,466.19

NOTE.—In above table, the calculations are made on the average price of the mineral for the year.
Gold, $20.67; silver, .53303; Lead, .04465; Copper, .12219.

El Boleo Smelting Practice

By An Occasional Correspondent

The chief interest attaching to the copper-smelting methods at the plant of the Compagnie du Boleo at Santa Rosalia, Baja California, results from the remarkably high percentages of silica and alumina in the charge. It is doubtful whether any other smelter in the world has continuously for long periods produced a slag averaging approximately:

	Per cent.
Silica (SiO_2)	52
Alumina (Al_2O_3)	18
Ferrous oxide (FeO)	6-8
Manganese dioxide (MnO_2)	4-6
Calcium oxide (CaO)	10-12

This unusual practice is due to the commercial necessity of dispensing with costly fluxes. Although deposits of hematite, pyrrhotite, and to some extent of pyrite, are not uncommon in Baja California and along the west coast of Mexico, they are generally unavailable for use at port smelters, owing to their inaccessibility, and also because of the low tenor in marketable metals characteristic of the west Mexican ores. High-grade ores in that region have never yet been developed in commercially important quantities. Hence the fluxes which are known to exist would more than eat up the value of the marketable metals in the smelting ores. At El Boleo, for example, the average copper content in the charge lies roundabout 4½%. It will readily be seen that the best California fluxes, even if sold at prices barely covering the cost of mining and loading, could not stand the charges of transportation by land and sea, plus the cost of putting through the furnace, with an ore of such grade, and the west Mexican fluxes would cost even more to move to Santa Rosalía than the ferrous ores of California.

While full details of El Boleo practice, rendering possible so brilliant an achievement as that attained by M. Michot, the manager, in reducing the FeO requirements to 6%, are not at hand, the conditions are sufficiently well known to give to a metallurgist an appreciation of the leading features.

The furnaces are of the most simple construction, measuring 12 ft. 6 in. by 3 ft. 6 in. inside, at tuyere-level. The water-jackets are 2 metres high, succeeded by 2 metres of brick shaft extending up to the charging-floor. The feed-doors are about 4 ft. high, the iron hood contracting above these to the chimney, from which latter the downtake leads off to the dust-chambers and main chimney. The furnaces are built with crucibles, and the settled matte is tapped off at intervals. It was found economically impossible to employ a forehearth on account of the rapid chilling of so acid a slag. A curious feature of the slag-discharge is that it is allowed to flow continuously from each end of the furnace through 4-in. slag-ports. It would occur to a metallurgist at once that this would lead to enrichment of the slag in copper. Actually the Boleo slags carry not less than 0.5% Cu, which is above what the majority of smelter managers elsewhere are willing to concede. The separation of the matte under such circumstances must be extremely rapid, else the slag would certainly carry much more than 0.5% Cu when drained from the slag-line inside the furnace. This may be explained by the high degree of fluidity imparted by the considerable quantity of manganese, at the high temperature prevailing just below the fusion-zone inside the furnace, but beyond doubt the high specific gravity of the matte contributes to this result, its copper tenor being above 60%, and often more than 65%. In passing, it is of interest to note that a premium of £2 per long ton is paid by the European refiners for matte of this grade, owing to its desirability for mixing with low-grade mattes for blowing in the converter.

It will be noticed that the furnace is relatively narrow (42 inches), that the column is relatively high (13 ft., 1½ in.) and relatively long (12 ft. 6 in.). The tuyeres are 12 in number on each side, and have a diameter of 4 in. Thus conditions are favorable for a good air-penetration at moderate pressure, the water-gauge actually reading between 50 and 60 centimetres.

The furnaces are run very slowly, each of the ten in blast smelting about 250 tons of charge per day. They are operated with a cool top, which is partly due to the slow speed of smelting and partly to the fact that the charge carries from 20 to 30% of moisture, the evaporation of which lowers the temperature in the upper part of the stack. Only a small proportion of the moisture contained is present as combined water. The copper in the ore is almost wholly in the form of chalcocite and covellite. The coke used amounts to about 12% of the charge, and it is claimed that it is more perfectly burned to carbon dioxide than is usual in copper-smelting practice in America.

Removing Fusions From Crucibles

By J. C. Bock.

In making fusions for the determination of silicates it is often hard to remove the fused mass from the platinum crucible, especially when the crucible is somewhat old. I remove the fused mass in the following way: A piece of nickel plate about 1 mm. thick and 5 to 8 cm. square is bent upward around the edges. This plate is placed on a layer of wet cotton or filter paper. Care must be taken to keep the upper surface of the plate perfectly dry.

When the fusion in the crucible is complete, raise the temperature as high as possible, taking care that the crucible is white hot on the side from which the fused mass is poured. Pour the melt quickly upon the plate. After a little experience it will be possible to remove the largest amount from the crucible in this way. The fused mass on the plate forms a flat cake which can be easily removed to a beaker by means of forceps. The crucible is also put into the beaker and treated in the usual way. The small amount which stays in the crucible is readily dissolved and the crucible is ready for another charge in a short time. This method is especially useful where there is a great amount of routine work to be done and the amount of platinum ware is small. It is not always necessary to use a nickel plate. I have used a plate of galvanized sheet iron of the same size. Such a plate can be used for many fusions, provided tests for tin and zinc are not made. Copper sheet will serve the same purpose in many cases. Care must be taken in all these cases that the plate is sufficiently cooled by means of the wet cotton or filter paper to chill the fused mass quickly.—*The Chemist-Analyst.*

L. Vogelstein & Co. give the following figures of German consumption of foreign copper for the months January to March, 1912:

	Tons.
Imports of copper	54,645
Exports of copper	2,820
Consumption of copper	51,825

as against consumption during the same period in 1911 of 40,106 tons. Of the above quantity, 47,687 tons was imported from the Untied States.

Need for a general knowledge of mineralogy by working miners was evidenced recently by the discovery of a 6-in. seam at the Lady Rose mine, Victoria, Australia. The miners regarded the material as worthless, since there was no indication of gold in it, and large quantities of it which had been broken were discarded as worthless. A visiting engineer recognized the material as scheelite, of remarkably good quality, worth $400 per ton, much more than the gold-bearing quartz the miners were seeking.

Platinum producing properties in Colombia have recently been purchased by the Consolidated Gold Fields of South Africa.

Eastern Comment on Copper

THE SITUATION AS SEEN IN NEW YORK.

The copper situation has lost a large part of its interest for the public for the reason that it is now conceded on all sides that the control of the present coterie of men is so complete that natural conditions are no longer a dominant factor. While there is no copper merger as a tangible organization, yet to all intents and purposes the same end is secured. There is no longer any question of control, and the only topic of discussion is whether or not the present controling interests have been obliged to take on a heavy load of copper in order to accomplish what has been done. The Copper Producers' report, which appeared this week, was ignored so far as market action is concerned. The April statement shows an increase in accumulated stocks of approximately 2,750,000 lb., with a copper surplus on May 1 of 65,066,029 lb. The market for copper is at the moment a little easier, around 16¼c. per pound, with the copper producers declaring that they are firmly opposed to any further advance in the price. Some well known copper authorities are predicting an 18c. copper market, but it is hard to believe that the people now in control of the market, headed by John D. Ryan, would permit any such advance.

W. E. Corey, former president of the United States Steel Corporation, now one of the prominent figures in the copper world, is on record in a recent interview as considering Mr. Ryan the master spirit in control of the copper situation throughout the world. Certain it is that Mr. Ryan's work in copper has been a steady series of triumphs during the past three or four years, culminating in his work of a year ago abroad when he was apparently able to bring the copper people in England and on the Continent into line for harmonious action with the producers on this side. As to the outlook for the coming year, while the world's production is increasing, the fact that the situation is so completely in hand apparently removes all portent of danger from this source. An examination of results shown by the large producers during the first quarter of the current year, as compared with last year and the year preceding, shows a very general and substantial increase in output. The rehabilitation of many mining properties of importance has made this result a foregone conclusion for some months, and were competitive conditions the same as prevailed a few years ago there would undoubtedly be some record-breaking shipments from Butte, and from the mines of the Southwest. There was a good deal of discussion occasioned by the fact that there were heavy sales of copper during the month of April, while exports as shown by the figures for the month were much lighter than in March. One of the principal reasons for this apparent discrepancy was the strike among the stevedores at Baltimore, where loadings were much curtailed.

Referring again to Mr. Ryan and his work in the world of copper: This gentleman has returned to New York from a long trip throughout the West accompanied by a party of the more important of his associates. In Butte Mr. Ryan gave out a statement to the effect that men in the party expected to expend $12,000,000 in Montana in the next year. Part of Mr. Ryan's statement was to the effect that Butte would show greater prosperity in the next twelve months than during any similar period in its history. Some skeptics might feel justified in questioning this statement, as Butte has come to be so very largely a 'one-company' district that any spread of general prosperity is by this very condition largely precluded. While Mr. Ryan was in Butte he held several conferences with R. L. Agassiz, vice-president, and James MacNaughton, general manager, of the Calumet & Hecla. The meeting and the interviews gave rise to a rumor that some changes in the Calumet & Hecla control were impending. The rumor has been emphatically denied and is undoubtedly without foundation, though it must still be considered a long step when the Boston-Lake Superior copper interests are seen to be working hand in hand with the porphyries and newly developed mines in the far corners of the globe, such as the new mines in Alaska and Braden and Ferrobamba in South America. The Lake country is turning out a record amount of copper. It is said that there are no copper supplies at Houghton, and that many ingots are put into the cars before time has been allowed for them to cool.

The Shannon Copper Co. announces that it is about to pattern after the Rio Tinto and treat some of its semi-oxidized ores by a leaching process. The general manager of the Shannon, J. W. Bennie, was for some years chief chemist for the Rio Tinto in Spain, and he has patented a process which it is believed will allow the Shannon to successfully and economically treat some 3,000,000 tons of partly oxidized ore which it can extract at a very low cost, and the copper produced can be laid down in New York at not more than 9c. per pound. The Shannon also has something like a million tons of tailing from the concentrators which will be treated by the new process.

The directors of the Granby Consolidated have approved the plans for a 2000-ton smelter to handle the ores from the Hidden Creek property and have made appropriation from the next year's earnings of $500,000 to cover the cost of equipment and development. The question of financing the erection of the smelter is temporarily postponed, and expenses, so far as possible, will be met out of the combined earnings of the Granby and the Hidden Creek properties. Part of the $500,000 will be expended in the construction of docks and a railroad of a mile and a half in length to connect the docks, the mine, and the smelter.

The market expects to receive plans in the near future for some new financing by the British Columbia Copper Co. Some additional mining ground, known as the Voight property, was taken under option something under a year ago, and, development work having proved satisfactory, it has been decided to complete the payments under the option and also to erect a new smelter. An issue of convertible bonds will in all probability be made. The prosperity which the British Columbia Copper Co. has enjoyed since it resumed operations late last year is largely due to the high gold content which it has been recovering. The copper ores of the British Columbia, like those of the Granby, are of very low copper content running about the minimum limit of commercial value, but owing to the precious metal, the company has been able to lay down refined copper in New York at 8 cents.

Kurnal R. Babbittt was elected a director of the Utah Copper Co. at the recent meeting, to succeed the late Ernest Thalmann. Mr. Thalmann was the head of the house of Ladenberg, Thalmann & Co., and one of the prominent figures in Wall Street. Mr. Babbitt has been an associate of Messrs. Jackling, MacNeill, and Penrose for many years and is the working law officer of the Guggenheim organizations. The important development at the recent meeting of the Utah Copper Co. was the statement by the engineering staff showing ore reserves totaling 300,000,000 tons. According to unofficial statements, it is believed that 200,000,000 tons can be added to these figures. With a total ore reserve of 500,000,000 tons of ore, the Utah Copper would have a life of nearly 100 years. The magnitude of the operations carried on at the Utah Copper Co.'s plant precludes any possibility of its equaling the Rio Tinto in length of years, but it stands at the head of the world's copper mines with a wonderful record in the way of its being brought to its present point of production in so short a time. The recently published list of shareholders shows the Guggenheim Exploration Co., the Bankers Trust Co., and W. J. Yates as the three largest shareholders. The Bankers Trust Co. is the trustee for the French investors. The Guggenheim smelter which is being erected at Hayden, Arizona, to treat the ores of the Ray Consolidated, has so far progressed as to have the stack completed. It is expected to handle regular shipments from the Ray next month. L. Vogelstein & Co. in a circular letter speak of the copper market as in equilibrium and likely to remain so for some weeks.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Statement of Construction Costs

The Editor:

Sir—The publication of a detailed summary of construction costs should serve one or more purposes. A system of bookkeeping should be indicated which could, with advantage, be adopted elsewhere either entirely or in a modified form to suit local conditions. The summary should be arranged so that an engineer would be able to isolate the totals for future reference as to construction costs in that, or in a similarly situated locality. The statement should appeal to him, as well as to the bookkeeper, as being logically arranged. In your January 6 issue a detailed summary of the construction costs at the new Portland mill, Cripple Creek, is published. In this summary there are 27 main divisions of cost, each of which is capable of dissection into 31 subdivisions, thus providing for a statement of 837 possible totals. The ledgering of such a system must have involved immense labor, and I am venturing on a criticism, from all points of view, in the hope that I may initiate a discussion on the matter which may result in the general adoption of some simple system which would, even in a summarized form, afford information of considerable value to mining engineers. With such a system in general use I venture to predict that much more data would be available as to the costs of mill construction.

In the statement referred to there is an obvious need of some sort of explanation, and even the primary division of expense calls for comment. Such headings as 'chemical,' 'solution,' and 'engineering' are too vague to convey any definite idea as to what is implied. Our curiosity as to the type of plant erected is excited, but by no means satisfied. The $804.97 of 'tank steel' charged to 'coarse crushing plan,' and $855.97 of 'belting' to 'classification' are equally inexplicable. The 'wire' account is difficult to place and cannot include leads to motors, because there are 13 departments with motors, and only 6 entries for 'wire.' In the search for ideas as to what 'solution' is meant to include we find in the statement $37.87 for 'paper,' $169.12 for 'lath' and 'plasters,' $2.38 for 'powder,' and $48.47 for 'skylights and windows.' Surely no statement of cost could be more enigmatic to a metallurgist. On the other hand, our sympathies go out to the superintendent whose house, according to the accounts, possesses neither skylight nor window. Let us hope that the doors are there, and have been charged under 'miscellaneous.'

The itemizing of small amounts in a summary is a practice open to question, but 'consistency is a jewel,' and I can see no logic in the entry, for example, of a total cost of $0.61 for 'hardware' in the 'transformer house' account, when the total charges to 'miscellaneous' and undistributed expense together amount to over $25,000.

Under 'precipitating' is seen a 'machinery' expenditure of $15,686.80, an amount higher than in any other department. Under 'motors' the highest expense was incurred in the 'agitating' department, and amounted to $1901.14. From the inclusion of 'pumps' and 'pipe' in the latter account it would seem that centrifugal-pump agitation is being adopted, and the result is awaited with interest. In the 'conveying department' it seems that $1132.26 of 'shafting' are necessary to run a $378.46 conveyor. Surely 'shafting' might go under a special power account, and a total for 'conveying department' include only the original cost of the conveyor and sundries, and the expense involved in erecting it. 'Radiators' and 'pipe' are charged to 'heating plant.' Why not 'shafting' to 'power plant'? Where power is taken off the same line of shafting in different departments the correct proportion of construction costs is an impossibility. The dissection of 'lighting,' 'heating,' 'superintendence,' etc., are equally impracticable, and separate accounts are indicated as the only possible means of arriving at a logical statement of expense.

As regards the inclusion of 'belting' in a statement of construction costs it must be remembered that, if this is done, the belts so charged are expected to last the life of the mill; and a proportion of the original outlay, a capital expenditure, would be written off annually under 'depreciation.' To charge original belting to construction, and renewals to working cost, would necessitate expert figure juggling to hide a rise in operating expense when none had actually occurred.

In order to promote further criticism and discussion I am adding three blanks and a summary, as suggestions, which can readily be adapted to suit local requirements.

1. CONSTRUCTION OF BUILDINGS ACCOUNT

	Labor	Lumber	Mortar and concrete	Structural iron and steel	Roofing and siding material	Paint	Sundries	Totals
Mill building								
Power-house								
Machine shop								
Assay office								
Totals								

2. CONSTRUCTION OF TREATMENT PLANT ACCOUNT

	Labor	Plant and machinery	Lumber	Mortar and concrete	Steel tracking	Piping and fittings	Sheet iron and steel	Sundries	Totals
Ore transport									
Breaking									
Milling									
Fine grinding									
Classifying									
Dewatering									
Agitating									
Conveyance of pulp									
Filtering									
Conveyance of solution									
Storage of solution									
Precipitation and smelting									
Disposal of residue									
Totals									

3. CONSTRUCTION OF AUXILIARY PLANT ACCOUNT

	Labor	Plant and machinery	Lumber	Mortar and concrete	Steel track	Piping and fittings	Sundries	Totals
Power								
Lighting								
Heating								
Assaying								
Workshops								
Totals								

4. GENERAL SUMMARY AND TOTALS

Buildings account .....
Treatment plant account.....
Auxiliary plant account.....
Superintendence, etc. .....
Extra: road building.....
Undistributed expense .....
Total .....

It will be noticed that cost of construction of the buildings is kept separate from the cost of construction of the treatment plant and also the auxiliary plant. Items incapable of dissection and distribution in a general statement, such as superintendence and road building, can be added to the summary. The analysis of such a statement is an easy matter, and the system may be used to form the

basis of a complete and detailed account of the various expenses involved.

London, March 9. A. W. ALLEN.

Magmatic Origin of Ore-Forming Solutions

The Editor:

Sir: On the question of 'Magmatic Origin of Ore-Forming Solutions' I have said in a paper before the Canadian Mining Institute, Toronto, March 1912 (not yet out of press):

"On the question of the genesis of ore deposits which has occupied so much of the discussion of the technical mining world for the last fifteen years, and referring to the controversy between the fire men and the water men as to which was the predominating agency in the deposition of orebodies, I have always regarded Professor Kemp's 'The Rôle of the Igneous Rocks in the Formation of Veins' (*Trans.* Am. Inst. Min. Eng., Vol. XXXI, p. 169), as well-nigh the keynote of the situation. But in Nova Scotia, it must be acknowledged, is one of the exceptions, one of the few places where the deposition is not apparently traceable to an igneous source. Yet I would prefer to consider it probable that a laccolith or a high place in the granite existed at no profound depth beneath this tungsten deposit."

Denver, May 8. VICTOR G. HILLS.

Spanish-American Dictionaries

The Editor:

Sir—Between the Rio Grande and the southernmost point of South America, as well as in the islands where Spanish is the native tongue, there exists an immense field for literary effort, which has practically been left unexplored up to the present time. There are schools, colleges, universities, military and naval academies, as well as sectarian institutions in Spanish America, wherein textbooks in the higher grades are in French, English, or even German; the reason being that the better textbooks have not been translated into Spanish. Works in English of the most important character, treating on mining, metallurgy, surveying, agriculture, hydraulics, irrigation, husbandry, medicine, manufacturing, industrial arts, and hundreds of other subjects, are not known, except to the learned few, in Spanish-speaking countries, and there can be no doubt that good translations would find a ready and immediate market. It may be a surprise to many that there is not even a complete up-to-date Spanish-English, English-Spanish dictionary on the market. Velazquez has had no revision at all since 1899, and then only a slight one, embracing the dropping of a few obsolete words and the addition of an occasional explanation. No attempt has been made to add the thousands of new words that have been added to the sciences, mechanics, arts, and manufactures in the past thirty years—some twenty-five years ago. Ponce de Leon published in New York a technological dictionary which is still being issued from the original plates. Pocket editions on special subjects have appeared from time to time, but up to the present no effort seems to have been made to publish a work that should be complete and up-to-date; such a work alone would, in a literary as well as a financial sense, be an unqualified success from the start. In 1910 the Latin American Union, at its annual meeting in Buenos Aires, adopted a resolution to the effect that such a work was a necessity, and had the Union had funds at its disposal for such a purpose it would no doubt have acted on the hint; as it is, the field is still uncovered; it is equally so with books on the important subjects of mining, mineralogy, assaying, and agriculture, as well as textbooks for the higher institutions of learning and works of reference for libraries. It would astonish some publishers, who cater simply to the home market, to find at what prices well translated standard works could be sold. So far a few Eastern publishers have confined themselves to sporadic efforts at introducing into Spanish America juvenile textbooks, with but indifferent success, due to the fact that this class of textbooks is abundant enough in Latin America. Thousands of teachers write these and have them printed and adopted locally in proportion to the influence they have; they are not always of a high character, but serve.

In our efforts to open new fields for our industrial surplus the important subject of understanding each other's languages seems to have been neglected; notice how rarely a Spanish catalogue appears from even our large manufacturers, and a good Spanish catalogue is almost unknown. North Americans are keen after Spanish-American trade, but how many of the men are sent after it who know even the names of the articles they are sent out to sell?

The influence of literature between nations is great, it creates a harmony, an understanding between peoples who have been strangers—whose different languages were a gulf. If we would seek to acquire an influence over our Latin-American neighbors, let us study Spanish; if we want them to buy our goods, let us tell them at least their names in English and Spanish. This work is, of course, largely accomplished by manufacturers' catalogues, but the merchant, manufacturer, miner, agriculturist, and student needs, most of all, words of reference, books that are up to date.

San Francisco, May 1. TRAVELER.

The Situation at High Grade

A few weeks ago, W. H. Storms, state mineralogist of California, published a warning to the public concerning the new mining camp, High Grade, situated up in the northeast corner of the state in Modoc county, advising those who might be induced to go there or to buy stocks in the numerous mining companies owning undeveloped claims in that district, to carefully investigate before turning their money over to the eager promoters. This warning was issued, not because no gold has been found at High Grade, for gold actually has been found there, but because the entire county was covered by snow early last winter and is still under the snow, which is still several feet deep. Naturally, promoters do not like interference of any sort in their plans, and particularly official interference. One of those who takes umbrage is N. E. Guyot, frequently referred to in the attractive literature concerning the district as 'the father of the camp.' Mr. Guyot has sent the following letter to Mr. Storms. It is of such nature that it needs no reply.

Sir—Your letter, 30th, at hand. The History of your life does not interest me. All there is to your letter appears to be solicitude you express for the welfare of the 500 men attracted to High Grade by my efforts. Leave that to them for I shall be with them. Are you so ignorant that you do not know that I warned miners in search of mere *work* not to go in? That I notified all of the deep snow? That those now there went of their own volition with full notice of the fact that it is a wilderness of splendid possibilities? They go as all mine operators and prospectors do, prepared to fight hardships. Spare yourself any uneasiness on that score for they are my friends. Re Denver *Mining Record* and their advertisers, settle your grouch with them. If all advertisers from cradles to coffins were indicted for the rainbows they attach to their particular products, you would have them all in the stocks. I know of no other business, however, which is cursed by a self-constituted inquisition which arrogates to itself the functions of prosecuting attorney, jury, judge and court of appeals, such as the mining business is inflicted with in yourself. As if your ilk has not turned down and blackmailed every new camp. You are so infallible, you scribblers, you repeat your advice to me to "adhere to the truth." You ineffable, nincompoop and immeasurable, irresponsible blackguard in office. It is a dirty bird that fouls its own nest and you have assuredly, unwarrantably defiled your own state of California, by denouncing, in ignorance, the greatest gold camp discovered in the state for 50 years. Burn these remarks into your petrified brain. Yes, you shall hear from me again. Yours truly,

San Francisco, Cal., May 10. N. E. GUYOT.

Special Correspondence

NEW YORK

News Notes from Mexico, Arizona, Butte, and Cobalt. —Tacoma Smelter.—Heinze Again.

While many of the mines in Mexico are closed down or fortified to withstand a siege, the Greene-Cananea is unmolested and production is increasing regularly from month to month. Mr. Thornton, general manager, states that the company will in a short time be turning out 10,000,000 lb. copper per month. The Mines Company of America is one that has found it impossible to continue distribution of earnings. The regular quarterly dividend has been deferred. The stockholders are left to draw their own conclusions as to just what this means. Inasmuch as they will not receive the usual check, the distinction between synonyms is bootless.

N. L. Amster, president of the Shannon Copper Co., has purchased the R. R. R. copper mine near Patagonia, Arizona. The Three R's, as it is commonly known, has changed hands a good many times. At one period the late W. C. Greene held the property under option. The recent owners were persistent in trying to develop the property against the advice of engineers who examined the ground, and recent reports show their faith to have been apparently justified. Telegraphic despatches report the opening of a large body of copper glance such as was found in the early days of the Copper Queen.

The rumored merger of the American Zinc, Lead & Smelting Co. with the Butte & Superior is officially denied. Both concerns have been doing some new financing through the house of Hayden, Stone & Co., but apparently there is to be no consolidation. The issue of convertible bonds made by the Butte & Superior has all been turned into stock. The new concentrator of the Butte & Superior is just about ready for actual work, and by the end of June the property is expected to be producing 1000 tons of ore daily. The present orebody of the Butte & Superior is reported to be one of the richest zinc and silver orebodies ever discovered in Butte.

Cobalt is apparently well past the peak of its load. At present there are only six properties shipping, and the output is much lighter than has been the case at any time since the production was fully under way. The Kerr Lake Mining Co. has held a special meeting of its directors, and Julius A. Lewisohn was elected president of the company in place of Edward Steindler, deceased; and Wm. G. Nickerson of Boston was elected to the board of directors. At the annual meeting of the Nipissing Mines Co., August Heckscher, one of the controlling factors of the New Jersey Zinc Co., and who is also heavily interested in the oilfields of Mexico, was elected a director to succeed Wm. B. Thompson, of Thompson, Towle & Co., resigned. Mr. Thompson is the head of the Inspiration Consolidated Copper Co. and has been prominent in the development of mining properties throughout the Southwest during many years, having had a large share in the development of the Cumberland Ely, which was afterward absorbed by the Nevada Consolidated, in which latter company he is still a director.

The importance of the Tacoma plant of the Guggenheims is increasing. During the past eleven months the Alaska properties have shipped a total of 35,000,000 lb. copper, nearly all of which has gone to the Tacoma smelter; the bulk of the shipments coming from the Morgan-Guggenheim Bonanza mine. The market in First National Copper has been recovering a little, owing to the installation of another device to control the sulphur fume from the smelter. It is believed that the smelter can be again blown in within a few weeks. Nevada Consolidated has been a market feature during the past fortnight, and rumors have been active to the effect that the Utah Copper Co. intended to renew its offer for exchange for Nevada Consolidated shares, and there has also been some talk of an intended increase in the Nevada Consolidated dividends. It is officially stated, however, that neither rumor has any foundation, and that the only reason for the sharp advance in Nevada Consolidated in the market lies in the improved conditions in the metal market. Nevada Consolidated produced 17,578,000 lb. of copper during the quarter ended March 30, and earned $1,233,768, as against $1,012,729 for the corresponding quarter of 1911.

Copper curtailment received a little setback from the U. S. Geological Survey report, just issued, covering 1911, which report gives the output for the year as being the largest in history, and figures the total smelter production from ore mined in the Unites States at 1,097,232,749 lb. Having 'sidetracked' the negotiations conducted for a time with Phelps, Dodge & Co., the Shattuck-Arizona company is to immediately proceed to build a 400-ton smelter at or near Douglas, Arizona. The Heinzes are having an exceedingly hard time to retain their hold on any of the interests which they at one time controlled. Some two years or more ago F. Augustus Heinze fell into the hands of one A. D. F. Adams of Boston, a loan broker whose business it was to make loans on unlisted securities having an active market, thereupon immediately selling out the stock so pledged with him. In carrying forward these transactions Adams used stock brokers who themselves acted in good faith, and for the past two years Heinze has been endeavoring to secure the return of a large amount of Davis-Daly, Ohio Copper, and other shares which he pledged with Adams, but by a recent finding of the Master in Chancery it is found that he has no right to make claim on the stock in the hands of innocent purchasers.

SILVERTON, COLORADO

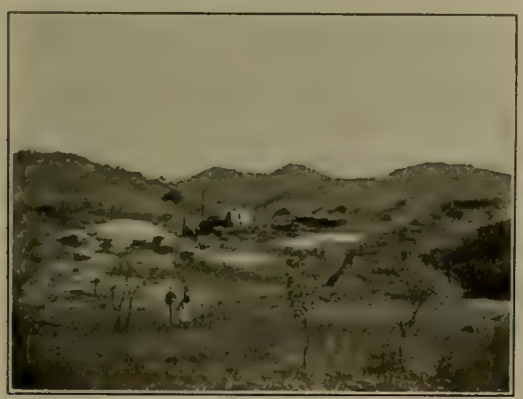
Frisco Mill. — Sunnyside Zinc Mill. — Esmeralda Leased.—Rich Ore in Congress.—Champion Resumes Development.

Mining affairs in San Juan county already show considerable improvement and the summer promised to be an active one. A number of properties long idle have already resumed operation, and many others are planning to do so in the near future. The Frisco Mines Co., owner of the Bagley adit at Animas Forks, is rushing work on a 150-ton concentrating mill. The timbers are being framed in Silverton and the structural steel and machinery are in transit. All materials will be transported to the mine and set in place as soon as the railroad is cleared of snow. The work is under the direction of Charles Gagner as manager and Paul Hansen as mill superintendent. The Sunnyside at Eureka keeps up a maximum production and the new zinc-separating plant is reported successful. Lessees are working the Esmeralda on a small scale, with no ore shipments yet. The Mildred group, in Maggie gulch, is being developed under the direction of Finney Jones, and employs 20 men at present. The intersection will be started at an early date, and the mill capacity will be doubled by the addition of five stamps. The lessees expect to treat 30 tons daily during the summer. The Iowa Tiger Mining Co., lessee of the Iowa and Tiger mines, is milling an average of 3000 tons per month and has an excellent body of new ore in the north drift on No. 2 level of the Melville lode. The Silver Lake is running two shifts and is pushing development on the Titusville lode, with promising results. The Silver Ledge is being unwatered and is being examined by engineers in the interest of New York people. It is announced that systematic development will be carried on in an effort to open the hoped for orebodies of this mine, which have been partly mined on the upper levels. Lessees on the Congress mine at Red mountain found a fine body of ore May 3, which shows 5 ft. wide and averages 0.78 oz. gold, 9 oz. silver, and 20% copper. The lease is owned by H. B. Maris and F. B. Goudy, of Silverton, and the owners are pushing development and expect to ship at least 25 tons of ore per day during the summer. The Champion mine, near Silverton, owned by the Ross M. & M. Co., is again active and is being developed through the Pittsburg adit, under the direction of Mr. Bryce, of Pittsburg. A force of 20 men is employed at present.

RHODESIA

Cam & Motor Development. Mining Laws for Northern Rhodesia. Activity Among Copper Mines.

Premature crushing has done an incalculable amount of harm to Rhodesian mining. Mine after mine in Rhodesia has failed, and failed lamentably, largely because of undue haste in the erection of plant and the commencement of crushing operations before any really adequate sort of development had been achieved. The directors and management of the Cam & Motor, operating in the Gatooma district, appear to be fully aware of this, and a thoroughly commendable policy of exploitation has been carried out in these properties. It is stated that there is now 'in sight' in the property well over a million tons of ore of a value of 52s. per ton. This must not, in the absence of more detailed and accurate data, be accepted as absolute. It is, however, certain that an amount substantially in excess of that blocked out at the end of September, namely, 700,000 tons of a value of 47s. 2d. per ton, is now developed. Not only have the directors been well advised and careful in the matter of development, but they have also acted in a commendable and cautious way in regard to equipment. The Cam & Motor ores are known to be somewhat refractory, and, accordingly, before proceeding with the erection of a



A SMALL RHODESIAN MINE.

permanent plant a small experimental installation has been utilized. According to London advices, the cost of the permanent reduction and treatment equipments will be £80,000. The working capital resources of the company at the end of June last amounted to £120,000 in round figures.

Hitherto, mining companies and prospectors operating in Northern Rhodesia have been at a distinct disadvantage because of the absence of any properly promulgated mining laws. This state of affairs is now being remedied. In order that those interested may have sufficient time in which to comply with regulations as to pegging, registration, etc., of establishing locations, warnings were some little time ago issued to principal holders as to forthcoming enforcements. The promulgation of this law will, of course, be welcomed, as it will give a security of title which has not hitherto obtained. A mines department is now being established at Livingstone, and the organization of the mining office is in hand. An acting secretary for mines has already been appointed. Such a course has been necessitated by the exploitation of the country and the increasing importance of some of the mines.

Northern Rhodesia is not to be compared with the southern provinces from a mineral-producing point of view. Nevertheless, some of the properties lying beyond the Zambesi river are of considerable potential value, and now that the territory is traversed by a railway line, evidences of real endeavor to bring certain of the Northern Rhodesian base metal mines to the productive stage are not lacking. The most famous is the North Rhodesia Broken Hill, which, on account of the complex nature of its mixed zinc-lead ores, is still inactive, and recent ore shipments have only been small lots sent to England for experimental treatment. In regard to copper, however, much activity is being displayed. A smelting plant has been erected at the Sable Antelope mine in the vicinity of Kafue river. Last year copper from the neighboring Silver King mine of an estimated value of £251,000 was smelted at this plant. To the north of these mines the Kansanshi copper mines have four new traction engines running to the railway at Nikola siding, carrying a load of 22½ tons per trip. A new pumping plant and a new smelting plant have been installed. The Bwana M'Kubwa is also preparing to export fairly large quantities of copper. All these mines are situated to the south of the Katanga belt, where much trouble is now being experienced in regard to smelting.

DAWSON, YUKON TERRITORY

Recent Amendments to Placer Mining Act.

George Black, commissioner, has issued the following explanation of the recent amendments to the Yukon placer mining act:

The effect of the bill amending the Yukon Placer Mining Act passed at the session of Parliament just closed, and which amends sections 51, 74, and 75, is, as to:

Section 51. To prevent the grouping of claims other than adjoining claims, except in cases where such claims are part of the same operation or system of mining being carried on; and prevents the holding of isolated claims for speculation, the working of one or more of which will have no effect on the others.

Section 74. This section was intended to provide for the arbitration of disputes between the owners of claims, but in the original section no provision for a case where one of the disputants declined to arbitrate was made, in which event the section was found to be unworkable. The amendment empowers the gold commissioner to appoint an arbitrator to represent the claim-owner who refuses to appoint one for himself. There is nothing new in principle in the amendment. It merely makes the old section workable.

Section 75. The amendment to section 75 provides for the settlement by arbitration of the amount of damages payable to the owner of mining property which may have tailing, water, or other material dumped onto it by other operators.

BLACK HILLS, SOUTH DAKOTA

New Reliance Shuts Down.—Rich Ore at Golden Summit.—Forest City Mill.—Mica Production.

The dredge at Mystic is being overhauled and put in shape for operation after a shut-down since December. Some minor changes are being made, including devices for breaking up clay-balls that are found to carry off gold. The dredge was started last June, and the first season's operation was quite satisfactory, and even greater success is anticipated for the coming summer. Financial difficulties have caused the suspension of operations at the New Reliance property, on Annie creek. Officials of the company state that a speedy adjustment of all troubles will be made so that work can be resumed and advantage taken of the good weather which is now due. The property operated at a disadvantage during the winter months and costs were far above normal. Ten additional stamps were installed, as well as labor-saving features which have tended to reduce costs. Briquetting machinery is to be installed by the Gilt Edge-Maid company in its concentrator at Galena, so that a good product can be furnished the Black Hills Smelting Co. The Gilt Edge-Maid property contains a large body of porphyry ore carrying a high percentage of iron pyrite, with a small gold content. Its proximity to the smelter makes it attractive for fluxing.

The Titanic Gold Mining Co. has elected directors for the ensuing year, as follows: W. H. Bonham, I. A. Webb, and W. S. Elder, of Deadwood, South Dakota; E. Bright, Columbus, Ohio; and J. M. Rothwell, Martinsburg, West Vir-

ginia. The company owns a large acreage in the Carbonate district, and expects to resume work in the shaft early this summer. Del Canfield and associates have opened a body of ore in the Golden Summit property, near Hill City, that shows 2 in. of 'specimen ore,' worth on the average $4 to $5 per pound. This is being sacked and shipped to Denver, and the low-grade ore piled up to be treated in the mill on the property. At the Forest City property, near Hill City, work is progressing on the mill, and it is hoped to have the plant in operation within a few weeks. The mine shows 3 ft. of high-grade free-milling ore, and the mill contains 5 stamps and a concentrating table.

Harry Francis is operating a mica property near Keystone, having found a market for the product with a Wyoming company which manufactures asbestos goods, including shingles. A considerable amount of mica is used in these shingles. Mr. Francis is sorting the mica, and saving the larger blocks for shipment to Eastern consumers. The Mascot group, in the Two Bit district, is under bond to Denver people, and it is expected that a sale will be made. The Imperial company has paid to Lawrence county a little over $10,000 in back taxes, and is preparing to resume operations. Nickoli Brothers have found a streak of ore assaying as high as $178 per ton gold in a lease they hold on the Monarch property, in Two Bit gulch. The ore is being sorted and a good shipment will soon be made to one of the smelters.

BUTTE, MONTANA

Oil Flotation Plant of the Butte & Superior.—Development in Mine.

The first unit of the 1000-ton mill being erected by the Butte & Superior Copper Co. is expected to be in operation by May 20, and the second 500-ton unit about a month later. Some ore has already been put through the coarse crusher, and the machinery has been operated for the purpose of smoothing it up, but otherwise the plant has not been operated. The management is confident that the new mill will make a good recovery by the oil flotation process, put in by James M. Hyde.

The mill is designed to treat 1000 tons of ore per day, and consists of a crushing plant, jigs, a hydraulic classification, a slime plant for oil flotation, and Wilfley tables, used only to separate the lead from the zinc. The ore is first reduced by rolls to 6 mesh, and after jigging, the tailing is reground to 40 mesh, and the tailing from the fine jigs ground to 100 mesh and treated by oil flotation. The pulp is thickened in setttling tanks to three parts water and one part ore, and is mixed with a small quantity of oil and sulphuric acid and agitated. The gases generated by the acid from the carbonates in the ore, together with the entangled air particles from agitation in the mixing vats, forms a spongy pulp of sulphides which floats on the surface of the water, while the silica, which has no affinity for oil, drops to the bottom and is discarded as tailing.

The Hyde system has been used successfully by the Butte & Superior at the Basin reduction plant, owned by the United Copper Co., but the plant is antiquated and has not sufficient settling capacity to enable the Butte & Superior to treat its jig tailing. The rental for the Basin plant is also heavy, and for these reasons the Butte & Superior has been gradually closing down the Basin mill, and for some time has been shipping only 200 tons of ore per day, while putting 350 tons per day into a stock pile at the mine with the object in view of having a stock pile large enough to keep the new mill running continuously while a change in hoists is made, which is contemplated. The present hoist is now working to its full capacity, the mine being 1600 ft. deep, but the new engine, which is to be delivered in June, is designed for a 5-ton skip and with power to work to a depth of 3500 ft. Development in the mine during recent weeks has added greatly to the value of the property and ore reserve. The work is at present confined to the Black Rock claim, which is developed by a shaft 1600 ft. deep.

LONDON

Yorkshire Method of Shaft Sinking.—Financial Position of Amalgamated Zinc.—Result Secured.

A new method of sinking shafts through watery strata has been adopted in South Yorkshire, the system consisting of the use of steel piles. Steel joists were arranged vertically and their flanges were interlocked by intermediate members. These joists were then driven into the sand by a pile-driver that traveled round the circle. This method of interlocking steel piles is the specialty of the British Steel Piling Co., and is extensively applied in bridge, dock, and railway work. The present instance is its first use in connection with shaft-sinking. The steel joists were 33 ft. long at No. 1 shaft and 28 ft. at No. 2 shaft. They measured 15 by 5 in. in cross-section, and the interlocking members measured 6¼ by 4 in. The webs were slightly bent, so that when assembled the joists could be set up in a circle 26¼ ft. in diameter. When driving was commenced a 3000-lb. weight was used, and each joist was forced down 5 ft., the driving-plant traveling gradually round the circle. Toward the end a 4000-lb. weight was used, as it was desired to penetrate the sandstone for 3 ft. Each pile was then driven 1 ft. downward at a time, and as many as 1300 blows were required for each foot sunk. When the piles had all been driven, sinking was commenced. It was found that the lining was only 1½ in. out of plumb, and that the leakage was approximately 5 gallons per minute. Experience in other directions has shown that this method of sinking can be successfully employed to a depth of 100 ft. and that within this limit the cost and the time occupied in shaft-sinking through wet strata should be much less than by any other method.

A fortnight ago I announced the welcome news that the De Bavay and Minerals Separation flotation processes were to cease hostilities and that in future the controllers would pool the Australian royalties. It is therefore of interest to record the financial and industrial position of the Amalgamated Zinc Co. which controls the De Bavay process. The present company was formed in Melbourne at the end of 1909, and the business consists of treating the zinc tailing from the North and South mines at Broken Hill belonging to the same group. The company also secured the contract for the treatment of zinc tailing from the Block 10 mine, but this mine is not at present producing, owing to the reconstruction of the lead-concentration plant under way. The report for the half-year ended December 31 last shows that 256,454 tons of zinc tailing was treated, and the production was 75,587 tons of zinc concentrate, assaying 48.7% zinc, 6.6% lead, and 9.7 oz. silver, and 1408 tons of lead concentrate, assaying 53.8% lead, 16.8% zinc, and 32.2 oz. silver. The income was £264,728, part of which came from the sale of current zinc concentrate, the price of zinc being figured at £22 per ton, and the remainder from the adjustment of the account of the previous period, taking £26 11s. 7d. as the settlement price for zinc instead of £22. The balance of profit for the half-year was £122,291; out of this, £20,000 has been placed to the equalization reserve fund, £10,000 placed to reserve for depreciation, and £50,000 distributed as dividend. Since the end of the period under review a further £50,000 has been paid to shareholders. As with the previous period, there will be a further income for the past six months on the final adjustment of prices. For every £1 above £22, the company will receive £13,600 additional on the 75,587 tons sold.

Camp Bird, Ltd., has acquired a considerable interest in the Messina (Transvaal) Development Co., Ltd., and has agreed to guarantee the interest for five years on £350,000 worth of 6% debenture stock which is to be issued by the latter company.

Gold production in the Urals during 1911 amounted to 258,240 oz., a decrease from 1910 of 10,520. The most productive districts are Miask, southern Ekaterinburg, and the Kvarken mines, Orenberg. The Kotchkar goldfields of the Miask district have been worked ever since 1844, and have yielded over two million ounces.

General Mining News

ALASKA

Katalla

The Amalgamated Development Co. is planning to sink a well on each claim before applying for patent. The company is now extending its refinery so as to make illuminating oil as well as gasoline, which latter is already on sale regularly at Valdez, Cordova, and other coast towns. The British Columbia-Katalla company is said to have raised $300,000 in England to be expended in developing oil lands here.

Ketchikan

(Special Correspondence.)—Considerable activity in this district is anticipated this year as a result of the increased price of copper, but at present little is being done. The Mt. Andrew is temporarily idle, though Rush & Brown recently opened an orebody on the second level and shipped several hundred tons. At Copper Mountain an examination is being made on behalf of the owners, to determine whether the mine shall be re-opened. This company was formerly known as the Alaska Copper Co. In case it is decided to resume

COPPER MOUNTAIN SMELTER, PRINCE OF WALES ISLAND, ALASKA.

operations a reorganization will be necessary with, probably, the issue of new stock and a change of name. On the Prince of Wales island five men are at work and the Red Wing mines of the Prince of Wales, Ltd., at the Copper City on Hetta inlet, Ketchikan bay.

Juneau, May 1.

Valdez

The mosquito fleet was busy until recently, as prospectors and miners were rushing supplies into their camps before the trails softened. Now transportation is largely at a standstill till summer trails become available. A hoist, compressor, cars, and track for the Millard M. & D. Co. have arrived and will be sent to the Rutherford-Ramsey as soon as possible. In the meantime sinking has stopped. About 400 sacks of ore are reported ready to bring out over the glacier. A mill test on ore from the Bruce & McDonald property on Shoup bay, yielded 14 oz. 12 dwt. gold from 5400 lb. of ore. Three additional Nissen stamps were put to work in the Cliff mill early in May and sinking from the 400-ft. level is in progress. The new building for the Valdez Iron Works on the municipal dock, is about ready for occupancy. The Valdez Mining Co., has asked for bids on a 225-ft. continuation of the lower cross-cut begun last summer. W. A. Dickey is erecting new buildings at the Three Man mine, preparatory to increasing the scale of operations this summer.

ARIZONA

Cochise County

The Midnight, in White Tail canyon, 22 miles from San Simon, has been sold to G. H. Davis. The ore carries gold, silver, and lead, and averages $50 per ton. The West Side group of claims has been bonded to Philadelphia people for $17,000, of which one-fifth is to be paid on June 9. A vein 80 ft. wide has been opened to a depth of 9 ft. and shows 3 to 4½% copper. H. E. Henderson has secured a lease on the Humboldt. Work has been started on the bins at the Maine. Hallum & Sutherland have sunk to a depth of 25 ft. on the orebody of the Leadville.

Gila County

(Special Correspondence.)—The Guggenheims have taken an option on the Needles group of 27 claims and 13 adjoining claims, three miles west of Miami. The Needles group is owned by Dan R. Williamson, and the deal was conducted by F. W. Hoar of Globe. It is proposed to explore the group by churn-drilling. George H. Garrey, mining geologist and engineer for the various Guggenheim corporations, will supervise the work of exploration, and Ralph C. Nowland, chief engineer for the Ray Consolidated Copper Co., will have direct charge of the drilling. After a month spent in examination and sampling, a group of Michigan men has obtained an option on the 600,000 shares of treasury stock of the McMillen-Stonewall Mining Co., which owns the Stonewall Jackson mine, 16 miles northeast of Globe, a famous silver producer thirty years ago.

Globe, May 9.

The Live Oak began shipping concentrate to Cananea on May 6. Machinery and supplies for the South Live Oak Development Co. have begun to arrive at Miami. Harry Millard will have charge of drilling operations. Three holes are being drilled on the Southwestern Miami, but they have not yet passed through the Gila formation. At the Inspiration a small force has been put to work underground. The survey for the site of the Inspiration Con. mill has been made at Salt river and that of the possible site at Black Warrior, two miles north of Miami, is being made. The attachment suit by the Cordova Copper Co. against C. W. Van Dyke, for $15,365 loaned him, was decided in favor of the plaintiff. The Warrior Copper Co. is suing the Warrior Development Co. for $69,000 damages.

Mohave County

The clean-up for the past four weeks from the Tom Reed mine yielded a bar worth $71,000. The recovery for the year has averaged $43 per ton in the 20-stamp mill, which has a capacity of 120 tons per day. At the Gold Road two more tube-mills will be installed and 20 stamps will be added to the 40 now dropping. The company is treating 200 tons per day with a recovery of $15 per ton, and the changes will bring the capacity to 350 tons per day. It is reported that a Los Angeles corporation will begin work on a dam across the Colorado river at the mouth of Diamond canyon for hydro-electric power development. The Yucca M. Co. is unwatering its mine and will sink another 100 ft. in the hope of cutting the rich ore found in the upper levels.

CALIFORNIA

Calaveras County

The Esperanza, or Boston, mine is to be unwatered and the vein sampled. The shaft is 1000 ft. deep. Joe Handel is working the old Marlette gravel mine at the base of Stockton hill. The Petticoat mine has resumed work after two years of idleness. A. T. Copley is manager and J. E. King is superintendent. The Comet mine is working a full crew on a 3-ft. vein of high-grade ore. F. W. Boire and H. W. Seeman have cleaned up a thousand dollars from a short run at the Boire Brothers' gravel mine. They have bought a Cox pan and will put in a modern plant to handle the gravel. Retimbering of the Hexter adit has been completed.

Kern County

Frank McCabe has purchased the Tuber Canyon mining property, and it is likely that a new mill will be erected, as plenty of $12 ore is available.

Lassen County

Baker & Bidwell, of Denver, have been drilling placer ground near Moonlight, and it is reported that a dredge will be put at work.

NEVADA COUNTY

Suit has been brought against the Tarr Mining Co. and various water companies to prevent them taking water from Bear river and its tributaries in Yuba and Nevada counties. The ranch owners who have brought the suit allege that their riparian rights have been infringed. Much interest has been excited by the finding of two good veins in his back yard, by F. S. Hooker, of Willow Valley. F. E. Sipe, of Mansfield, Ohio, is engaged in opening the Rough and Ready. D. S. Donahue has found that 250 ft. of rock supposed to be barren at the Justice-Sound Money Consolidated mine, four miles northeast of Washington, has a good gold content. The California mine at Gaston is working 90 men, and a long and deep adit is proposed at the Erie. Sale of the Waldeck is contemplated and improvements are projected at the Artie. The new Oakman mill is now in operation. The Maryland Gold Quartz M. Co. has elected directors for 1912. L. V. Dorsey is secretary and treasurer.

PLUMAS COUNTY

The cyanide plant at Crescent Mills to work the tailing of the old Green Mountain and Crescent mines is in course of construction. E. H. Tracey is in charge. Sinking of the 450 shaft at the Altona is in progress, a 12-hp. gasoline hoist having been installed. There are three veins, ranging from 3 to 7 ft. wide, on the property, with an average gold content of $11 per ton. The litigation over the Del Monte will be settled soon. Rich ore has been found in the Four Hills mine by Andrew Bachels.

SIERRA COUNTY

(Special Correspondence.)—The vein in the lower adit workings of the Tightner has widened to 30 ft. and been opened a distance of nearly 400 ft. It is said the capacity of the 10-stamp mill is to be increased. Abe Hall is manager. Sinking at the Rainbow is progressing. L. P. Woodbury is manager. C. C. Derby has obtained control of the bond and lease on the Gold Canyon, and is arranging to operate the mill and mine plant with hydraulic power. It is stated the Sierra Power & Mining Co. has taken a five years' lease on the Butte Saddle mill. The Brandy City Hydraulic Co. has managed to keep four to six giants in action the greater part of the season, despite the light winter rains. George F. Taylor is manager. San Francisco people, headed by George W. Hegarty, have arranged to resume operations at the Irelan and Snow Point mines, Alleghany district. It is planned to erect a 5-stamp mill at the Irelan this summer.

Alleghany, May 6.

TUOLUMNE COUNTY

Sale of the App mine to the Tonopah Belmont Development Co. is announced at Jamestown. It is known that W. A. Nevills, some time since, gave a deed of trust for the property to a Los Angeles banker, and that San Francisco and Los Angeles associates of Mr. Nevills have been for some time pressing him to sell. The property was examined by engineers of the United States S. R. & M. Co. some months since, but for some reason the deal fell through. Later Frederick Bradshaw and other officers of the Tonopah Belmont company visited the property, and on completion of the examination the sale was announced. The App is a large, low-grade, Mother Lode mine which has a good record of production. The surface works are run down and part of the underground workings suffered within a year from a cave, but the property itself is considered good. The shaft is 1700 ft. deep and stopes said to be as much as 110 ft. wide are worked. There are sixty 950-lb. stamps in the mill. Amalgamation is followed by concentration as usual along the Mother Lode, and concentrate is shipped to smelters.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—The Pennsylvania M. Co., operating the John L. Emerson and other properties on Bellevue mountain, is making ready to construct a large mill. Experiments are now being made to determine the best method of treatment. L. Sternberger is manager. Machinery is to be purchased by F. L. Patrick, manager of the Dorit mine on Chicago mountain. A milling plant of 50 tons capacity is also being considered.

The Teller mine, a former producer of high-grade ore, is again to receive attention. J. Owen is manager. The Oneida mine is one of the heaviest producers in the district. Shipments of smelting ore average $25 per ton in gold. A mill of 50 tons capacity will be erected during the summer. J. Owen is manager. Charles McCall, district judge, has granted an injunction restraining the Pewabic M. Co. from further work in a drift run from the shaft. The Old Town Con. M. Co. has filed suit asking for judgment in the sum of $200,000, alleging that amount of ore was extracted from its ground.

Idaho Springs, May 10.

(Special Correspondence.)—The Cashier mine is again undergoing development. Chance & Co. is operating under lease and occasional shipments are going out that bring a settlement for 160 oz. silver per ton. Work will be resumed next week on the White property, situated on Columbia mountain. G. J. Hite is manager. The St. Paul M. Co. will begin development June 1. The adit will be continued 600 ft. to intersect the series of veins owned. C. D. Runkle is manager. Work has been resumed on the Welsh property, on Leavenworth mountain. Stoping is in progress on a 6-in. streak of $90 ore. A pool of Silver Plume operators has taken a lease on the Vulcan mine. A small streak of 350-oz. silver ore is showing.

Georgetown, May 10.

LAKE COUNTY (LEADVILLE)

The Leadville Mines Pumping Co. is sending out its contracts for signature. These provide that if 95% of the claim-owners of the Fryer Hill district sign, the company will at once install electric pumps and proceed with the unwatering. The royalties asked are reasonable, and if within thirty days after a mine has been unwatered the owners do not work a property or sublet it, the pumping company has the right to work it or sublet it until July 1927. In case the pumping company fails to do so within ninety days, the control reverts to the owners. The proposal is attracting much interest, and it is hoped that the united action can be secured which is essential to success. A new electric hoist is being installed at the Gold Basin, on Breece hill. The Small Hopes Consolidated M. Co. has been purchased by F. Zaitz and associates.

TELLER COUNTY (CRIPPLE CREEK)

The Elkton company has declared a dividend of 1c. per share, payable May 24. The net value of the ore shipped by the El Paso in April amounted to $53,987. From January 1 to March 31 the earnings of this company were $143,780. The lowering of the water in the district now totals 141 ft., the decrease during April having been 15 ft. During April the Ajax shipped 33 cars of average $30 grade and the Gold Dollar shipped 36 cars of $20 ore on company account. Fourteen sets of lessees are at work, and the total ore shipped was over 2000 tons. The Anchoria-Leland produced 15 cars of $20 ore. The Acacia was shut down during the month, but royalties from lessees amounted to about $1800. Edwin Gaylord, who has leased the Dante, on Bull hill, has started the erection of a mill to treat the low-grade ore. The Portland No. 1 shaft will be sunk to the 1600-ft. level, the water having receded 75 ft. below the bottom of the sump. The tonnage treated by the Portland mill at Victor during April was 13,000, though interrupted by a shut-down. The tonnage during May should reach 15,000,

IDAHO

IDAHO COUNTY

The American Mines Co., which is capitalized at $500,000, and has an option on properties in the Salmon river country, has filed articles of incorporation. The construction of the roaster at the custom reduction plant is progressing rapidly and a trial run will soon be made.

B. C. Austin is examining the Mineral Zone mine, in

the interest of F. W. Bradley and associates, of San Francisco.

LEMHI COUNTY

The Idaho Tungsten Co. is erecting a 100-ton concentrator on its property at Patterson, sixty miles south of Salmon City. The company, which has a lease for seven years on 21 patented claims, last year built a 20-ton reduction plant and shipped a large quantity of ore. The upper adit is in 900 ft. on a 3½ ft. vein and the lower adit 250 ft. It is estimated by George Kessler, superintendent, that 36,000 tons of ore is blocked out.

SHOSHONE COUNTY

E. J. Carter has filed a petition for the appointment of a receiver for the Stewart Mining Co., alleging that F. A. Heinze has transferred a large block of the stock of the company to H. C. Hart without consideration, has dissipated the assets of the company, and converted its earnings to his own purposes. M. W. Bacon, Stanley Gifford, and L. Dunham are codefendants.

MONTANA

LEWIS AND CLARK COUNTY

Receipts of the United States Assay Office at Helena during April were $158,649, an increase of more than $33,000 over the receipts a year ago. Receipts from the different counties were: Madison, $57,801; Fergus, $41,425; Lewis and Clark, $32,333; Chouteau, $24,466; Missoula, $1286; Granite, $108; Park, $52; Deerlodge, $10; Washington state, $331.

LINCOLN COUNTY

(Special Correspondence.)—The Shaughnessy hill group of claims of the Hazel T. M. Co., eight miles southwest of Libby, on Granite creek, has found 10 ft. of clean shipping ore in an adit which has cut the vein at a depth of 300 ft. in a length of 640 ft. The ore is rich in silver and lead and the hanging wall has not yet been found. The Snowshoe mine and mill will be started up within a few days, according to the plans of William Jennison, the receiver, the property having been closed down since his appointment several weeks ago. Robert C. Davis, of Butte, is to have charge of the property as superintendent.

Libby, May 7.

SILVERBOW COUNTY

(Special Correspondence.)—The Davis-Daly Copper Co. is making good progress in the development of its property and in profit earning under the new management. The Colorado shaft has been sunk to a depth of 2000 ft. A small zinc vein was discovered on the 1700-ft. level, and has been opened again on the 1900, where the vein is still small but rich in zinc. The Davis-Daly company is shipping daily about 50 tons of ore to the Washoe smelter, the shipments being of first-class ore.

Fair progress is being made in driving the cross-cut on the 2000-ft. level of the West Gagnon to develop the Silver King and Plymouth veins at that depth. The work is being done by the Anaconda company under a contract with the Davis-Daly. The lessees on the east end of the Silver King are shipping some ore of fair grade from the 200 and 300-ft. levels. The Pioneer Leasing Co. has taken a lease on the Great Republic, one of the Davis-Daly properties, about 1000 ft. north of the old Blue Bird mine, west of the city. The leasing company has pumped the water from the old workings down to a depth of about 200 ft., and expects to have the mine fully unwatered soon.

Butte, May 13.

NEVADA

CHURCHILL COUNTY

(Special Correspondence.)—Development is being done, and ore is being opened up on all levels of the Nevada Wonder mine down to the 500, and preparations are being made to begin drilling on the 600. A cutting-out stope is being started on the second ore-shoot north of the shaft on the 400-ft. level. The mill is now handling its full capacity of 100 tons per day, and 18 bars of bullion were shipped as a result of the clean-up for the last two weeks of April. Most of the machinery for the improvements which are being made to the mill is on the ground and some has already been put in place. No stopping of work will be necessary to complete the work.

Wonder, May 13.

HUMBOLDT COUNTY

(Special Correspondence.)—The litigation between the Mammoth National and Workman interests has been settled. Following the discovery of high grade quartz in the Shively holdings, on the north side of Winnemucca mountain, a rush has developed and practically the entire mountain is staked out. Dyke, in the Pine Forest mountains, is attracting some attention. Rich streaks of gold-bearing quartz are reported near the surface. New machinery will shortly be purchased by the Sheba Mining Co., operating the old Sheba mine in the Humboldt range.

Winnemucca, May 11.

LYON COUNTY

The smelter at Wabuska handled 2632 tons from the Nevada Douglas, 1623 tons from the Mason Valley, and 655 tons from other mines during the week ended May 2, an average of over 700 tons per day. The shipment of copper matte to Garfield was 9 carloads. Most of the Nevada Douglas ore comes from the sixth level of the Ludwig where the ore has been averaging 4½ % copper, though the Douglas Hill and Casting Copper mines contribute to the output.

NYE COUNTY

(Special Correspondence.)—The Associated mill is running at full capacity of 50 tons per day on a 500-ton shipment from the White Caps. Operations will be resumed on a 1000-ton shipment from the Steffner lease as soon as the White Caps product is finished, to be followed by shipments from the Kendall-Douglas and other leases. Seven companies, the Big Four, Mineral Hill, Dexter Union, Toro Blanco, Amalgamated, Morning Glory, and Thanksgiving, are operating on their own account. It is reported that the Mustang, St. Patrick, Chipmunk, Red Top, Giant, and other companies are preparing to work. Placer mining is attracting renewed attention. About 30 operators are active, with operations extending over a distance of nearly four miles. A number of deals have been recently made whereby new interests have secured some of the most promising locations.

Manhattan, May 11.

WASHOE COUNTY

Mrs. J. W. Mackay and Clarence H. Mackay have given $150,000 to the University of Nevada for the endowment of the Mackay School of Mines.

WHITE PINE COUNTY

The Ely Verdi company has just been formed with a capital of $5,000,000. George Wingfield, L. L. Savage, S. R. Roberts, John Berry, A. P. Sawyer, M. R. Brown, and H. S. Anderson are the directors. The property owned by the company lies to the south of the Copper Flat pit of the Nevada Consolidated, and it is announced that development will be at once commenced. Shipments of Giroux ore to the mill of the Nevada Con. have averaged 3½% copper, which is unexpectedly high. There are persistent rumors that the Nevada Consolidated and Giroux companies may be merged. One section of the Steptoe mill is now devoted to the treatment of Giroux ore.

NEW MEXICO

OTERO COUNTY

Ore is being shipped to the El Paso smelter from the Sulphur Canyon mine, in the San Andreas, about 30 miles from Tularosa.

SOCORRO COUNTY

(Special Correspondence.)—The Oaks Company treated 145 tons in April from 128 ft. of development on the Pacific mine, which will be sufficiently developed to begin stoping within thirty days. At the Johnson mine, the full width of the new shaft is in ore, which is being transported to the Deadwood mill. Development was advanced 10 ft. dur-

ing the week at the Deadwood mines, and 325 tons of ore was mined. In the mill 22 sacks of concentrate and the regular precipitate clean-up was made. Especially good ore is coming from the 300-ft. level north. Approximately 5000 tons was milled during April by the Socorro mines. The level at the bottom of the winze in the Deep Down is being driven west in good ore. During the week the Ernestine M. Co. crushed 735 tons of ore, producing 58 sacks of concentrate and the usual zinc-box precipitate. The last ten-day clean-up in April yielded 10,135 oz. of bullion and 9800 lb. of concentrate. During the month of April 3000 tons was milled, producing 28,700 oz. of gold bullion and 31,000 lb. of high-grade concentrate. This property is now producing every 50 days the price paid for the Last Chance mine by the present owners.

Mogollon, May 7.

UTAH

Juab County

Numerous cave-ins in the workings of the Iron Blossom have occurred recently, and the latest, in the No. 1 shaft, has considerably delayed operations, and is likely to do so for a week more. From the No. 3 shaft 100 to 150 tons per day can be hoisted. The cave-in occurred in the adit through which the ore is transported to the Eureka Hill railway. The directors' meeting of the Lower Mammoth was held on May 9. Development is in progress at the mine and conditions are but little changed. Encouraging reports are received from the May Day, where good ore has been found on the 1000-ft. level. The shaft of the Tintic M. Co. is down over 100 ft. and will be continued to the 500-ft. level. Good ore is being found in the Opohongo. The Mammoth M. Co. has secured an injunction against Werrot & Orton, who purchased the McIntyre dump, as it was thought at the time of the sale that the dump contained but 4000 tons and now proves to be over 9000.

Salt Lake County

The Utah will place the tenth and eleventh sections of the Arthur mill in commission about May 20. The Ohio Copper Co. reports satisfactory results from its mill.

Summit County

The work of remodeling the old Ontario mill is being hastened by the Mines Operating Co., which is controlled by G. H. Dern, the manager of the Consolidated Mercur Gold Mines Co. The mill is intended to handle the low-grade ore which was used as stope filling by the early operators. It is estimated that 700,000 tons of a gross content of $6,000,000 is available. The company has a ten-year lease, and the reconstruction of the mill, which will have a capacity of 150 tons, is expected to cost $125,000, though the capacity may be doubled later. Small quantities of ore assaying $15.17 per ton are reported from the East Ontario. The Daly-Judge has issued its quarterly report, showing that from January 1 to March 31 18,319 tons of concentrating ore and 813 tons of shipping ore were produced; 5588 tons of lead concentrate averaging $28.53 per ton and 184 tons of zinc concentrate averaging $25.09 per ton were sold. The average milling cost was 71c. and the average monthly earnings $27,700.

CANADA

British Columbia

Shipment of 500 tons of galena concentrate from the Portland Canal M. Co.'s mill has been made to the Tacoma smelter. This represents the last month's run of the mill before closing down last winter. Development work will be undertaken on the Sullivan and Daly group on Salmon river. The Boundary district mines shipped 35,752 tons of ore to the smelters during the week ended May 10. Two-thirds of this went to Granby and the rest to the British Columbia Copper Co. The total ore treated by these two smelters during this year is 650,000 tons. The Granby has shipped 7,500,000 lb. of copper this year. At the Rocher de Boule, near Hazelton, 15% copper ore is reported. J. F. Cowan is operating the property. A 150-ton zinc concentrator will be built either at Three Forks or Zincton by the Lucky Jim M. Company.

Ontario

A compressor will be installed at the Hughes mine and the shaft will be sunk to the 200-ft. level. Fuel is short at the West Dome, and some of the men have been laid off. The boat lines have resumed operations on the Mattagami river, and a road will be cut through Turnbull township and stopping places constructed. At the Hollinger 400 men are at work, and it is hoped to get the 40-stamp mill in operation by June 1. The No. 2 shaft has reached a depth of 50 ft. Rich ore has been found on the 200-ft. level of the Jupiter. The Crown Chartered shaft has reached 200 ft. in depth; work has been started on the Gold Crest. Shipments from Cobalt for the week ended May 4 constitute a record, amounting to 707 tons. The bullion shipments for the week were 105,000 oz. The total for the year to May 4 amounts to 2,853,459 oz., worth $1,647,653; of this, the Nipissing yielded 1,292,485 oz. At the Buffalo mill 86,854 oz. of silver was recovered during March from 4007 tons of ore of an average content of 25.95 oz. Extensive diamond-drilling will be undertaken at the Dominion Silver, in North Cobalt. The Ophir Consolidated has resumed work. During April, 17 mines shipped ore, the total amounting to 1743.7 tons.

MEXICO

Chihuahua

The Naica Mining Co., Lepanto, Gibraltar, Ramon Corona, and San Patricio companies are still operating, but the supply of dynamite is low, and unless a fresh consignment is received operations will have to be suspended in a few weeks. Thousands of tons of ore are piled up at the railroad station at Conchas, awaiting shipment to Torreon and Monterey, as the railroads are out of commission. Torreon is well defended by the Federal troops.

Oaxaca

(Special Correspondence.)—The litigation concerning the San Juan mine has been settled between the heirs of Juan Baights and the San Juan Mining Co., by which the heirs relinquish all their right, title, and interest in the San Juan mine to the San Juan company, while the latter abandons all claims to the profits derived from the mine during the three years it was in Juan Baights' possession. This property, which is the deepest in Taviche, was acquired by C. A. Hamilton eleven years ago, but was subsequently occupied by the original owner, Baights, who in three years took out ore worth ₱1,050,000. The property, to which the title is now clear, is valued at ₱5,000,000. The property is shipping 2 cars of high-grade ore, and recently E. M. Hamilton examined it and recommended the construction of a cyanide plant, as some 200,000 tons of ore of too low grade to ship is available. Robert Wilson is general superintendent.

Oaxaca, April 29.

Sonora

The new smelter of the Richfield Copper Co., 45 miles east of Querobabi, has been completed, but its blowing in may have to be postponed until conditions become more settled. The Estrella M. & S. Co. has a shipment of high-grade ready to send to Cananea. The output of the Cananea Consolidated during April was over 6,000,000 lb. of copper, one day's output being 157 tons. Mining in northern Sonora is not much disturbed, thirteen companies having shipped 12,226 tons of ore and concentrate during April, but the smaller properties in the south have ceased operations, only the Mina Mexico and La Dura are at work in the Yaqui river district. The Dos Cabezos, in eastern Sonora, has recently closed down. The Alamos district is quiet, but La Mina Prieta has suspended operations on account of a broken cam-shaft, and will not resume until communications are reopened. The Southern Pacific railroad has suspended service on account of the depredations of Yaqui Indians, and practically all the Americans have left. Hundreds of mineral denouncements in Sonora have been declared forfeited for non-payment of taxes, and when peace is restored much land will be open to denouncement.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

AL PAGE is at the Palace.

F. L. SIZER has gone to Arizona.

E. A. MONTGOMERY is in Nevada.

GEORGE H. GARREY is in Arizona.

F. L. RANSOME has been at Miami.

GEO. A. SHEA is at the St. Francis.

R. E. HORE has gone to Porcupine.

EDGAR COLLINS is at Pearce, Arizona.

FREDERICK G. CLAPP is in Ontario, Canada.

A. J. OREM visited Salt Lake City last week.

J. A. BURGESS has been at Bodie, California.

W. G. SHARP has returned to Salt Lake City.

G. M. FRASER was at Salt Lake City recently.

GELASIO CAETANI has returned from Colorado.

J. E. CALLAHAN visited San Francisco recently.

E. D. BANNISTER visited San Francisco recently.

M. A. NEWMAN has returned from Los Angeles.

CALVERT WILSON was in San Francisco this week.

ROBERT M. SMALL was in San Francisco recently.

F. F. SHARPLESS is on his way to the Pacific coast.

E. H. CLAUSEN has gone to Quincy, Plumas county.

W. H. BLACKBURN is at San Francisco from Tonopah.

FREDERICK BRADSHAW was in San Francisco Wednesday.

EDMUND PUTNAM has returned to El Paso from Boston.

CHARLES JANIN is expected in San Francisco during the week.

WILLIAM MAGENAU has returned to Gomez Palacio, Durango.

C. H. WATERS has been drilling placer ground in Jackson county, Oregon.

ALBERT E. SEAL has left Tarkwa, West Africa, and is now in London.

RUDOLPH EMMEL, of Fairmont, West Virginia, is at Ludwig, Nevada.

C. EARL RODGERS is now at Sheep Creek, B. C., from McKenzie, North Dakota.

CHAS. P. RICHMOND is now with the Lluvia de Oro Mining Co. at Choix, Sinaloa.

G. N. PFEIFFER, who has been at O'Fallon, Illinois, is now at Hanna, Wyoming.

ALEXANDER FYFE, formerly of Waihi, New Zealand, is at Cobalt, Ontario, Canada.

ALTON L. DICKERMAN is now consulting engineer for the Old Colony Copper Company.

W. L. SAUNDERS will give the annual address at the commencement of the Colorado School of Mines, May 24.

T. IRWIN CROWLEY, of Mount Bullion, California, who has spent some time in San Francisco, is now at South Porcupine, Canada.

M. W. VON BERNEWITZ is leaving Kalgoorlie for San Francisco. He will visit the Eastern states of Australia and New Zealand on his way.

CONCESSIONS have been granted by the Madras Government, India, for developing alluvial gold deposits, and two mining engineers have been sent by Gowolo, of Calcutta, to conduct work on the Dilambur river.

RICH gold and copper deposits have been discovered at Chilposan, Phyongsan district, Korea, by the natives, and work is now in progress, according to a Japanese report.

On Saturday, May 4, 1912, the Bunker Hill & Sullivan M. & C. Co. paid dividend No. 176 of $65,400. This makes the total amount of dividends paid $13,453,950.

Market Reports

LOCAL METAL PRICES

San Francisco May 16.

Antimony	11—11½c	Quicksilver (flask)	41.50
Electrolytic Copper	16½—16¾c	Tin	50—51¼c
Pig Lead	4.45—5.40c	Spelter	7¼—7½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, May 16.—Metal dealers are cheerful. The Copper Producers' statistics, announced May 8, made a favorable impression and caused heavy buying both here and abroad. Lead was also in somewhat better demand and sellers were not so anxious. Spelter is in excellent demand on account of the large consumption; there have been many sales and at advancing prices. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
May 9	15.68	4.20	[illegible]	60⅜
" 10	15.73	4.20	6.60	60⅜
" 11	15.75	4.20	6.60	60¼
" 12	Sunday.	No market.		
" 13	15.85	4.20	6.68	60⅜
" 14	15.90	4.20	[illegible]	60⅜
" 15	[illegible]	4.20	6.70	60⅜

LONDON QUOTATIONS

(By cable, through the courtesty of C. S. Burton & Co., New York.)

	May 16.
Camp Bird Ltd	£ 7¼
El Oro	4⅛
Esperanza	7⅜
Oroville Dredging	1 1/16
Santa Gertrudis	6¼
Tomboy	5⅛

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, May 16.		Closing Prices May 16.
Adventure	$ 8½	Mohawk	$ 61½
Allouez	43	North Butte	27⅜
Calumet & Arizona	71⅛	Old Dominion	56
Calumet & Hecla	480	Osceola	116
Centennial	24⅜	Quincy	87½
Copper Range	57⅜	Shannon	18¾
Daly West	5	Superior & Boston	2⅛
Franklin	11⅜	Tamarack	41½
Granby	63½	Trinity	6⅛
Greene Cananea, ctf.	9⅛	Utah Con	13½
Isle-Royale	25½	Victoria	4
La Salle	6½	Winona	6½
Mass Copper	7	Wolverine	106

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, May 16.

Atlanta	$ .25	Mayflower	$ .02
Belcher	.87	Mexican	2.75
Belmont	9.95	Midway	66
B. & B.	.06	Montana-Tonopah	3 05
Booth	.10	Nevada Hills	1.87
Chollar	.06	Ophir	1.42
Combination Fraction	.19	Pittsburg Silver Peak	1.27
Con. Virgina	.71	Round Mountain	.46
Florence	.70	Savage	.10
Goldfield Con.	3.90	Tonopah Extension	2.15
Gould & Curry	.06	Tonopah of Nevada	7.12
Jim Butler	.59	Union	1.07
Jumbo Extension	.42	Vernal	.15
MacNamara	.27	West End	2.05

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. May 16.		Closing Prices. May 16
Amalgamated Copper	$ 83	Miami Copper	$ 25⅜
A. S. & R. Co	85	Mines Co. of America	3⅜
Braden Copper	5⅝	Nevada Con	21½
B. C. Copper Co	5	Nipissing	7⅜
Chino	29¾	Ohio Copper	1½
First National	2⅜	Ray Con	19
Giroux	5⅝	Tenn. Copper	43½
Goldfield Con.	4	Tonopah Belmont	10
Greene-Cananea	9⅜	Tonopah Ex	2½
Hollinger	10⅝	Tonopah Mining	7
Inspiration	19½	Trinity	6⅛
Kerr Lake	2⅝	Tuolumne Copper	3⅜
La Rose	3½	Utah Copper	63
Mason Valley	11¾	West End	2
McKinley-Darragh	1⅝	Yukon Gold	3⅜

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

PLACER CLAIMS—ASSOCIATION LOCATIONS—MARKING BOUNDARIES

The unit of an individual placer-mining claim is 20 acres. But an association of persons may make a location of a tract which shall embrace as many individual claims of 20 acres each as there are individuals in the association, not to exceed eight locators making a location aggregating 160 acres. One discovery is sufficient to support the entire location of 160 acres. Where the boundaries were originally marked in such a way as to be readily traceable by a person making a reasonable effort to follow them, but were subsequently partly obliterated by fire, the original locators may restore their boundaries and will be protected against conflicting locations made by others prior to such restoration.

Hall *v.* McKinnon, (Alaska) 193 Federal, 572. December 4, 1911.

CHURN-DRILL HOLES AS IMPROVEMENTS

In an application for patent of several overlapping lode claims, it was sought to have churn-drill holes, made upon the overlapping portions of two claims, accredited as common improvements for each of the locations. The Commissioner of the General Land Office holds (subject to claimant's right to appeal to the Secretary of the Interior), that churn-drill holes are acceptable as individual improvements upon the locations upon which they have been sunk, but cannot be allowed as common improvements for each of the locations entered.

The Globe, Globe Fraction, and other lodes, Decision of Assistant Commissioner Proudfit, April 26, 1912 (not yet published).

Note.—The Commissioner's decision is based on a ruling of the Secretary of the Interior in *ex parte* C. K. McCormick and E. W. Bird, dated March 14, 1912 (unreported), in which the Secretary holds drill-holes acceptable as individual improvements.

CONCLUSIVENESS OF PATENT-MEASURE OF EXTRALATERAL RIGHT

The owner of the Lucky Corner patented lode claim brought suit to eject an adjoining claim-owner from the extralateral part of the Lucky Corner vein. Defendant attempted to show that the Lucky Corner claim was located and patented without the discovery of any vein, lode, or ledge; that therefore it carried no extralateral rights; further, that the several veins in the Lucky Corner intersected its side lines instead of the end lines, that the side lines were not parallel; that hence no extralateral rights attached to the claim. It was held, however, that the Lucky Corner patent was conclusive in determining every question which was properly within the jurisdiction of the land department and was not open to collateral attack. The patent established conclusively the discovery of the apex of a vein in the discovery cut of the Lucky Corner claim prior to patent, and the patent was *prima facie* evidence that the discovery vein did extend transversely across the claim as patented. Whatever may have been the right of the defendant to raise the question, by protest, or other appropriate proceeding, of no discovery, prior to patent, that question was forever foreclosed when the patent issued except by a direct proceeding to set it aside or to have the patentee declared a trustee. The extent of the extralateral right depends upon the length of the apex, and it is measured not necessarily by the end lines—and only so when the vein passes across both end lines—but by bounding planes drawn parallel to the end lines and passing through the claim at the points where the vein enters into and departs from, the same.

The Work Mining & Milling Co. *v.* The Doctor Jack Pot Mining Co., (Colorado) U. S. Circuit Court of Appeals, March 2, 1912 (not yet published).

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

COLD BEND tests of steel are made to determine differences in ductility of different grades.

OPAL is found in Washington in lemon yellow to orange colors. When cut it is worth $1 to $1.50 per carat in stones of one to five carats size.

PRESSURE-FILTERS have the disadvantage of small capacity per charge, but this is overcome by the rapidity with which charges are treated. With a pressure-filter, also, there is no limit to the pressure that may be used, and hence to the closeness of contact of solution and mineral that may be enforced.

SEARLES LAKE, or Borax lake, as it is variously known, was discovered and located thirty years ago by Dennis Searles, who erected a crude plant and extracted borax from the waters at a time when the region was inhabited by hostile Indians. His cabin, surrounded by a stone wall for defense, may still be seen near the lake.

MONTANA sapphires occur in a variety of colors, and when cut form beautiful gemstones. The prices varies with the color and size of the stone. There are no regular quotations on uncut material, but recent offers of cut stones one to two carats in size are: blue, $2 to $30 per carat; straw colored, $3 to $10; white, $2 to $4.

ESTIMATING ore reserves requires the determination of the number of cubic feet per ton. In the case of iron ore this varies from 7 to 18, and in making estimates of Michigan ores, C. K. Leith used the following figures: Marquette hard ores, 8; Menominee and Gogebic ores, 10; soft ores of the Marquette, Crystal Falls, and Iron River districts, 12; low-grade high-silica ores, 14. The Oliver company uses the figure 10 cu. ft. per ton throughout, on the assumption that the error in this figure is considerably less that in assumptions as to dimensions of orebodies.

OIL for use in a blow-pipe lamp should be rich in carbon. Refined rape-seed oil is used for the purpose, as is olive oil, lard oil, and mixtures of turpentine and alcohol. The disadvantage of these is that they are not always easy to obtain and are objectionable in case the oil is spilled. For this reason, an ordinary small alcohol lamp is commonly employed, but it is impossible to secure a reducing flame from it. A candle is best for the reducing flame, but the ordinary 'short six' is too small to give a large enough flame. In some places large candles of about 2 in. diam. can be procured or, with an empty condensed-milk can to serve as a mold, and employing the smallest size of flat lamp-wick, they can be made with very little trouble by remelting ordinary candles.

CHROME ORE varies in price from $10 to $20 per ton, depending on grade of ore conditions and supply. According to E. F. Burchard, imported ore from New Caledonia carrying 50% chromic oxide was quoted in New York in 1910 at an average price of $15 per long ton in carload lots, exclusive of cost of transportation. In 1909 the price averaged $16.24 per ton. If the chromic oxide exceeds 50%, the value of the ore rises in proportion; if the chromic oxide is less than 50%, the value of the ore decreases at a more rapid rate. The price of the California ore is governed almost entirely by local conditions, as there is little or no competition with foreign ores. The price of chrome bricks f. o. b. Pittsburg is $175 per thousand. American potassium bichromate was sold at 7⅜ to 8c. per pound, and the Scotch product at 10¾c. per pound in the latter part of 1910.

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EDITORIAL

CANADIAN coal-mining and markets are elaborately treated in a special number of the *Colliery Guardian* issued April 17. A number of papers read at the recent meeting of the Canadian Mining Institute are reproduced.

COLORADO'S state ore-testing plant, at the School of Mines, at Golden, is to be run under the advice of a consulting board consisting of Messrs. Philip Argall, D. W. Brunton, J. T. Milliken, W. G. Swart, and Thomas B. Crowe. Whatever there is of good in the plan of the station, and we see many possibilities, should surely be realized with such a competent board of advisers.

HONOR of the judiciary has received a smirch in the charges brought against Mr. R. W. Archbald, judge of the Court of Commerce. Regardless of how many of the allegations can be substantiated and how many disproved, it is abundantly clear that general respect for the judiciary has been lowered by the conduct of one who should never have been a member of it. The Court of Commerce should be abolished; it serves no good purpose in reviewing the decisions of the Interstate Commerce Commission, which is expected to make rulings with the full knowledge and regard for justice of a court, and it has been used to defeat the ends of public good.

CULTURE is a complex thing, presenting different facets to different minds. Sidney Smith once proposed *'Tenui musam meditarum avend'* as a motto for the *Edinburgh Review*, and following a similar line of thought, there is no good reason why the oftentimes arduous labor of the engineer may not be made to yield abundantly of that culture which Mr. W. L. Saunders, in an address from which we present excerpts on another page, points out as so necessary and valuable to the development of the whole man. The young man who expects to bound his life by dull routine can afford to regard only the crudities of life, but those who hope to overcome circumstance and win in the wide fields of endeavor dare not neglect any of the aids to success; good manners, good speech, good writing, and good reading.

FINAL figures of metal production in the Central states in 1911 are now being distributed by the United States Geological Survey. Complete reports on coal production in Utah, Wyoming, Maryland, and New Mexico are also now available. Last year the corresponding separates and press bulletins were distributed in August, September, and October. The improvement in promptness in publication is as gratifying as it is striking. The census year is always a peculiarly annoying and difficult one for the regular statisticians of the Government, since the Census Bureau asks for many details not called for on the regular blanks. This makes work not only for the producers but for the officials, and it slows the work almost in geometrical ratio to the number of questions asked. Despite this difference in conditions in the two years, much credit is due Mr. E. W. Parker and his associates for the distinctly noticeable im-

provement in the statistical work of the Geological Survey. The preliminary statements issued at the first of the year are proving reliable and helpful. In many instances they are practically final as to total output, the work of the succeeding months being the more tedious task of tracing production to its sources. Accurate and prompt statistics are extremely valuable, and we extend congratulations on the excellent and timely tabulations now being published.

CONVERTER matte at the Great Falls plant of the Anaconda Mining Company has an average grade of 38.9 per cent, not 28.9, as we were made to say last week by a typographical error. The copper content of the matte is not an essential factor in the remarkably good work done at this plant, the criterion of success being rigid and accurate temperature control by skilled workmen. That the acid or basic character of a slag is dependent upon the ratio between the acid and constituents and not directly upon the percentage of silica present, as briefly discussed last week, is so generally overlooked, yet so important, that some elaboration of the topic will be worth while. This may be made clearer by assuming a slag in which the two bases present have greatly differing atomic weights, such as barium and iron. A bisilicate slag of these two elements (SiO_2.FeO.BaO) might vary from 45 per cent SiO_2, when only FeO is present, to 28 per cent SiO_2 when only BaO is present without changing its bisilicate character. To speak of slags over 40 per cent SiO_2 as 'high silica' slags and those below that percentage as 'low silica' is confusing, since a 'high silica' slag is not necessarily a silicious, or acid, slag. The terms 'half slag' and 'quarter slag' used in lead smelting are less objectionable, but it might be well for some of the workers on slag constitution to devise a new terminology by which the relation between molecular constitution and physical characteristics can be more accurately expressed than by the use of terms devised at a time when the nature of slag was a veiled mystery.

Metal Prices

Higher prices for metals have now obtained so long that producers have begun to recover from the shock of surprise and to ask why, and for how long they may be expected. That the steel mills are at last busy and copper has gone up has obscured the fact that spelter has been advancing for months. In keeping with the general disposition of that metal to be different, spelter prices began to rise when copper was still low. This year record prices have been paid for both zinc ore and spelter. In the week ended May 12, Joplin ore sold on a basis price of $59 per ton for 60 per cent metallic zinc. This is $2 per ton above the record of 1905, and $17 per ton higher than the price for the corresponding week in 1911. Joplin production is now about 4500 tons per week, materially below former outputs during periods of high prices. New production at Joplin comes in slowly, and that from the West, in part because of lower grade of the ore, and consequently lower price, fails to make up for the deficiency. In the United States there is an admitted shortage in smelting capacity, a situation foreseen two years ago, but which, because of the then ruling low price of spelter and uncertain business conditions, it was impossible to forestall. When metal is high, the smelting margin favorable, and smelting capacity taxed, high-grade ores naturally have the preference, and Western zinc ores accordingly have not profited as much by improved conditions in the spelter market as was anticipated. When metal prices fall there will be renewed talk among spelter makers about the tyranny of the Joplin producers. By that time more retorts will doubtless be available and it will be economical to handle the lower-grade Western ores. It is anomalous that high prices should favor high-grade ores, but it is a coincidence rather than a case of cause and effect.

A few years ago one of the ablest and best informed American mining engineers in privately discussing the future of the metals predicted rising prices for copper and lead, but stationary or falling prices for silver and spelter. The basis for his belief in low prices for the last named metals was the great accumulation of zinc-silver ore then just coming into the market from Broken Hill, Australia. On another page Mr. C. T. Durell, who has recently returned from that district, gives a glimpse of present conditions. Broken Hill has made good its claim to a place among the world's great zinc-producing districts. The annual output now amounts to 470,000 tons of concentrate containing 47 per cent of zinc. A recent estimate places the reserve at roughly 20,000,000 tons containing 18 to 20 per cent zinc. Whatever may be the accuracy in detail of this estimate, the Broken Hill district undoubtedly contains the greatest known reserve of immediately available zinc ore, and, as shown by Mr. Durell's figures, this ore is reaching the market in a steady stream. With the spelter is a parallel stream of silver and yet prices of spelter and silver are high, while, contrary to the expectation of the engineer who made the estimate, lead has benefited little by the recent increase. The reasons are not altogether clear, though some may be mentioned.

Expanding industry and cleaning up the scraps have put up the price of copper. Steel is also in good demand and, since half the spelter made is used in galvanizing, and because of their use in the same industries copper carries with it zinc, the high price of spelter is a natural consequence. Silver is high, and may be higher, because of the demand in the Orient. One steamer carried from San Francisco last week treasure to the value of $2,500,000 and shipments to the Far East are steadily increasing. Direct exportation of silver from the Pacific Coast to China is not important as compared with the regular course through New York to London and on to Bombay. China, however, is now absorbing large sums, and both Western and Eastern ports are sending out the metal which is to be used in financing the new Republic. At present, promises to pay form the main counter current, but as industry develops bulky merchandise will follow.

Lead occupies an anomalous position among the metals in the American market this year. In part this is natural and in part artificial. As is well known, about 65 per cent of the lead business in the United States is in the hands of the American Smelting & Refining Company and affiliated concerns. Lead has been brought under control and 'stabilized' and the policy of valorization involves prevention of extra high prices quite as much as protection from low prices. The so-called 'trust' has perhaps more to lose as a consumer through a temporary orgy of high prices, than it has to gain as a producer of metal, and it is consistently playing the game. The natural factor is that consumption of lead has not expanded as rapidly as has that of the other metals. In the recent period of extremely low prices the one demand for lead that persisted came from the paint trade in the granger states. The farmers took advantage of the lull to paint their barns and fences and so, quite unintentionally, saved one 'trust' a bad half-year. Even Tom Sawyer, if we remember correctly, could not place an unlimited number of coats of whitewash on the famous fence, and the farmers' barns are all painted. The present revival of business has not yet taken the form of extensive building outside of the large cities, and it is where wood is the favorite material that paint is popular. In city houses, too, nickel plumbing is popular and tin has

long since superseded the sheet lead that our aristocratic grandfathers, assuming we are among the elect that had aristocratic grandfathers, once used for roofing. In truth, lead has lost some fields and has not crept into new ones as rapidly as the other metals. This is the natural condition that underlies the superficial control of the market. Despite appearances, fundamental conditions do control the metal markets in a broad way, and despite the sympathy between metals, each has a place and a market all its own.

High Grade and the Boom

The West has long been waiting anxiously for a boom in gold mining. Not that gold mining as an industry is not doing well, for in fact it is doing exceedingly well. The statistics show comfortable increases in production throughout all the Western states, and the progress of metallurgy is as rapid and significant as ever. Gold mining, however, is fast losing its luring quality and becoming a regularly established business. The big metal production of the West now comes from the big enterprises. Take out of California's gold production that won by the dredges at Oroville and Natoma, and that coming from four of the quartz mines, and the total has shrunk enormously. The same is true in most of the Western states. Idaho has large extent, but the Coeur d'Alene district contains the mines. Alaska furnishes lots of talk of quartz mining, but Douglas island ships the gold. This does not satisfy the West. No one becomes a pioneer to work in a factory, and the restless ones are not much interested in the established and the routine.

In Colorado they have a tradition that a great gold camp will be discovered every ten years, and, with a little twisting of history, Gilpin county, Leadville, the San Juan, and Cripple Creek can be marshalled into the approved order. Colorado hopes have alternately flickered and died down since Cripple Creek attained its majority, but when her own mountains remained obdurate, her citizens flocked *en masse* to the desert and contributed mightily to the making of Tonopah, Goldfield, and the new Nevada. Since the bottom dropped out of the Nevada boom and the mines of that state settled down to the prosaic task of paying dividends, the experienced boomers to whom typewriters and telegrams are better mining instruments than are drills and dynamite, have fallen on evil days. The public has been persistently and sadly apathetic and no boom has attained robust proportions; materialization getting no further than the haunting outline familiar to the spiritualist's plate. The boomers, however, have not been the only ones waiting. Paying dividends is tedious work, but it puts money into circulation and piles up surpluses. There has been less noise about Western mining in recent years, but more profit, and there are many men in the West who are now ready to back a legitimate venture. In our discussion column this week Mr. Victor Barndt tells of the spirit in which some of the successful men in Nevada and California are attempting to find potash deposits, and the instance he cites is typical.

Into this favorable habitat, and at the psychological moment, a party of experienced boomers have lit, and therefore High Grade has begun to grace the head lines. The typewriter and telegraph blanks have been called into requisition and the ad-writer is busy. Our Denver contemporary, *The Daily Mining Record,* is using its largest and blackest type to advertise EXTRA SPECIAL bargains in High Grade stocks, and you are informed that you will "have to hurry" if you are "to make your $28.50 today worth $75.00 next month." Remembering a long series of disappointments, the public has been a bit chary about accepting these statements, and those, ourselves among the number, who have a favorable opinion of the district itself, are prejudiced by the advertising it is getting. Mr. W. H. Storms, State Mineralogist of California, has sounded a note of warning, mentioning the fact that the boom was started when the ground was comfortably covered with snow, when, as is well known, one claim looks as good as another - and is as good for purposes of capitalization. Opinion as to Mr. Storms' warning is divided. Mr. E. N. Guyot, 'the father of the camp' and a Cripple Creek prospector, replies in a scurrilous letter that fixes the status of the writer, and one Nevada paper, the editor evidently mixed in his geography, suggests that Mr. Storms stay in his own state and suggests "tearing him limb from limb"—a fine and useful phrase that in criticism. On the other hand, one Denver broker quotes in good 12-point Richelieu caps, Mr. Storms' statement that "there is no doubt that there is gold at High Grade, the principal property there at present being that of the Fort Bidwell Consolidated Mining Company, which has a ten-stamp mill. The camp will probably develop other good mines." Good advertising alone cannot make a good mine, though it helps any enterprise, but bad advertising may prejudice readers against a really good district, and part of the existing hesitation regarding High Grade flows from the transparent methods of the promoters.

As to the district itself there is much good to be said. An accurate and valuable account of it, including pictures of the principal veins now attracting attention, was published in the *Mining and Scientific Press* May 12, 1910. It was written by Mr. Norman C. Stines, and was based upon a careful personal examination. Following his report, the Fort Bidwell Consolidated Mining Company built a ten-stamp mill which was operated by Mr. Algernon Del Mar, and in our news columns there have been frequent references to the progress of the work. The reason this has been overlooked is that the newcomers have organized a new mining district and re-christened the camp. As the Hoag district in Modoc county, California, it failed to attract attention; but as High Grade, near Reno, Nevada, it is having fame thrust upon it.

According to Mr. Stines' report, the district is one of eruptive rock, including rhyolite, quartz andesite or dacite, andesite, and basalt. There are two distinct occurrences of ore; quartz veins in the basalt and andesite, and replacement deposits in the dacite. The former are 'gash' veins, small, rich, and erratic. The replacement deposits are large, of moderate grade, and contain persistent ore-shoots. All the ore is free milling and the ratio of gold to silver is 1 to 1.5. One ore-shoot on the Sugar Pine, seen by Mr. Stines, was "at least 150 feet long, with an average width as developed of 5 feet." Sixty feet west of it another ore-shoot had just been found when he visited the camp. The ore from the shear zones varies from $7.50 to $30 per ton in value. On the Big Four, Mr. Stines measured an ore-shoot over 300 feet long and averaging $18.50 over 18 inches in width. The Sunshine vein, only about 10 inches wide, averaged more than $100 per ton. Last fall at the completion of the work of the season, the Sunshine, Consolidated, and Big Four properties, could be fairly considered to have been proved to have value. Around them the field was one for prospecting. Now everything is staked, the known ground is largely leased, and the prospectors are on the ground. When the snow melts the final value of the district will be determined. We hope that the three known properties will prove to be but vanguards of a company of big mines, but the district is one for careful prospecting rather than the sale of stocks "certain" to be of large value. We wish it and its citizens the best of fortune at the same time that we refuse to take too seriously the statements of the more enthusiastic.

Culture in the Education of Engineers

By W. L. Saunders

*At one of the meetings of the American Institute of Mining Engineers, held in the hall of Sheffield Scientific School at New Haven, a discussion arose as to whether or not sufficient importance was given to cultural studies in our scientific schools. A diagram was exhibited showing graphically the relative proportion that culture bore to other studies in the various colleges. In some there was a wide distribution of cultural work, in others the proportion was small, and in a few cases it was shown that these studies were entirely omitted from the curriculum. During recess, a group of students were discussing the subject; one of them, a senior, said, "I don't see why they should *learn* a person culture in a scientific school." This remark, made in my presence, so impressed me as a concrete example of neglect in true educational lines that it has been chosen as my text.

Education in its broadest sense is mental and moral training. High schools and colleges differ from common schools in that they aim at higher planes of mental and moral life. The small boy is taught by stuffing, as one puts sawdust in a doll; this is because his mind has not grown to the stage when it can think for itself. Impressions are received and transfixed by memory: the process is one of mental photography: the moral code is learned by rote as though it were the multiplication table. Not so with the older, the college student: his highest aim in education is to learn to think for himself. "If you are a student, force yourself to think independently; if a teacher, compel your youth to express their own minds," writes H. F. Osborn of Columbia; and again, "The lesson of Huxley's life and the result of my own experience is that productive thinking is the chief *means* as well as the chief *end* of education."

Now what is productive thinking? Let me answer this question by giving you Huxley's definition of culture: "The pursuit of any art or science with the view of its improvement." The storage process is of paramount importance only when applied to elementary education. It is but the handmaiden of the scholar who has passed from the junior to the senior stage of student life, and who aims to do things in the world. The pursuit of facts is a mathematical study. We learn of things that exist as a result of divine and human creation. The earth is round and it is composed of land and water: water is hydrogen and oxygen combined: the square of the hypothenuse of a triangle is equal to the sum of the squares of the other two sides. How elementary are these facts! It is important that we should know them; but even a large volume of facts when stored in the human mind is powerless to add one cubit to progress. It is like putting a pair of legs on the Encyclopedia Britannica and expecting it to do something. Knowledge is power, but reason is power in action.

James Gayley, of the United States Steel Corporation, told me recently that the professor at Lafayette College who taught him how to think made so deep an impression upon him that it has lasted throughout his life. Mr. Gayley is distinguished for what he has done as a metallurgical engineer. His life has been one of productive thinking: he has pursued science with the view of its improvement. That teacher, Mr. Gayley said, once gave him a solution containing iron, and instead of instructing him how best to precipitate the metal, he told him to try three or four ways of doing it and report which was best. This led directly to thought and reason, and built up a master mind among engineers. We may still heed the voice of old Carlyle crying from the heathery hills of Duncore: "Produce! Produce! Were it but the pitifullest infinitesimal fraction of a product, produce it in God's name! 'Tis the utmost thou hast in thee: out with it, then."

Where among all the professions do we get the results that come through productive thinking as from engineering? The engineer is the architect of the world's progress. Transportation in railways and ships, in motor cars and aeroplanes, is the productive thinking of mechanical engineers woven into our industrial life. The men who did these things were students of science, not that they might be mere storehouses of knowledge, but that they might produce. Civil, electrical, chemical, and mining engineering are fields which afford infinite opportunities for research and progress. If you men of the future do not rise to your chances in these lines it is not because the fields are not still open for cultivation and growth, but rather through your own inefficiency or top-heaviness.

"In vain our toil,
We ought to blame the culture, not the soil."

Even Huxley feared that men might be overfed scientifically when he said: "An exclusively scientific training will bring about a mental twist as surely as an exclusively literary training. The value of the cargo does not compensate for a ship's being out of trim; and I should be very sorry to think that a scientific college would turn out none but lopsided men."

All this bears upon culture in its broadest sense. Productive thinking is the most important form of culture. It makes for power, refinement, progress, knowledge, taste, civilization. The subject, you see, is a very broad one; the obligation upon you as students of science is equally broad. Take care that you be not 'lopsided men.' A graduate of the Colorado School of Mines, like all graduates of the higher institutions of learning, misses his opportunities and discredits his college if he does not carry throughout all his walks of life the imprint of the educated man. *Noblesse oblige* is a degree, and an obligation, which is uniformly conferred upon all college men. To carry this obligation properly, one should study culture in all its phases and in its broadest sense. Study it as an undergraduate and study it still harder and more fully through all your post-graduate life. To this end let us accept and profit by that definition of culture given by Mathew Arnold: "acquainting ourselves with the best that has been known and said in the world." A professor at Wellesley College defined culture as that which is left after all else learned at college is forgotten.

Virtue and moral training belong to cultural work in the education of engineers. It is a mistake to suppose that schools and colleges are places for mental training only. Physical exercise through athletics is just as much a part of one's college life nowadays as the study of mathematics; the one helps the other. Emerson said, "archery, cricket, gun, and fishing-rod, horse and boat, are all educators, liberalizers." To the engineer physical training is of value in order to fit him for out door work. Moral training is of even greater importance. Locke has placed virtue first in defining the objects of education. Wisdom he puts next, and then good breeding; last of all, learning. It is more the province of the teacher than of the student to safeguard and train the character by precept and example, for, after all, "the foundation of culture, as of character, is at last the moral sentiment. This is the fountain of power."

It is a common saying that manners make the man. Good manners afford us easy weapons with which to win friends and to conquer enemies. Manners adorn the gentleman and smooth the way of the educated man through the world. Manners are never born in men; but they

*Address delivered at the Thirty-eighth Annual Commencement of the Colorado School of Mines, Golden, Colorado, May 24, 1912.

are bred by association and study. Like oil on the journals of an engine, they avoid friction and aid efficiency. There are many reasons why we should be polite, but the best reason is because it pays; it costs nothing. It is said of William Earl of Nassau that he won a subject from the King of Spain every time he put off his hat. So engaging were the manners of Charles James Fox that Napoleon said of him on the occasion of his visit to Paris in 1805, "Mr. Fox will always hold the first place in an assembly of the Tuileries." "My gentleman," said Emerson, "will out-pray saints in chapel, out-general veterans in the field, and out-shine all courtesy in the hall. He is good company for pirates and good with academicians; so that it is useless to fortify yourself against him; he has the private entrance to all minds, and I could as easily exclude myself as him."

Good speech is a rule of manners. It always avoids exaggeration. Moderation in language and tone is the trade-mark of good breeding, and good breeding is, after all, mainly a matter of self-culture. Madame de Staël valued conversation above everything, and so engaging was she in that art, that a prominent lady of France said of her, "If I were Queen, I should command her to talk to me every day." The man of education mixes with the right kind of people and reads good books. Books lead us into pleasant paths of culture and happiness. Read that you may avoid worry; read that too much hard thinking may not dull the edge of intelligence and sap the roots of memory; read that you may know what has been done in the world; read that you may acquire that power which comes from knowledge; read that you may learn to value the example of great men's lives; that through them you may know that the grave is not the goal of life. Montaigne had a passion for books and never traveled without them; he said that reading roused his reason and employed his judgment rather than his memory.

But of greater importance than good speech and reading, of higher value to the engineer than manners, is ability to write good English. Engineers are not given to public speaking; they pride themselves in being workers; they compare themselves with General Grant, who did things. It is very true that the engineering profession is one of practical work; but no one can hope to achieve prominence in this profession who cannot write good understandable English. An engineer may not talk, but he must make reports; he must write letters; he should draw specifications and plans. To do these things properly, he must command and know how to use the tools of language. Lord Bacon tells us that "reading makes a full man, conversation a ready man, and writing an exact man." Engineering is an exact science; accuracy is the one column on which the whole structure is reared. To write clearly and accurately can hardly be called an accomplishment; it is really a necessity. No college course is complete, whether it be a classical, scientific, medical, or law course, without a thorough training in English. No graduate is worthy to be called an educated man who does not speak and write good English. It lifts a man above the common.

Margaret Fuller said that the object of life is to grow, and James Freeman Clarke has written a lecture upon this subject: 'Man's Duty to Grow.' A post-graduate course in self-culture will tend to upward growth. Such a course is open to every one. The greatest opportunities for that education which unfolds the whole nature of man are those which are opened when we close the college door behind us. Graduation only marks the beginning of education to one whose face looks forward and upward. Let us build high; "they build too low who build beneath the stars." Build so that life and strength and growth may vitalize the whole structure; build on lines that are straight; build so that every root and branch of the tree of knowledge lends support and does not add a twist to the whole; build that men may see in you not alone skill and wisdom, but honor, culture, manhood, example; study to improve self—

"For virtue only makes our bliss below,
And all our knowledge is ourselves to know!"

Flotation of Zinc Ores

By C. T. Durell

No metal is receiving such world-wide attention today as zinc. No mining camp in the world produces so much zinc as Broken Hill, in Australia. The same reasons that have caused the phenomenal increase in the production of zinc in the past ten years will continue to increase the production for years to come and make the zinc industry a permanent and stable one. The present mountainous untreated dumps, as well as the immense ore reserves at the different mines, will continue to increase the zinc production of Broken Hill. Last year the world's production of spelter was upward of a million tons. Of this, Broken Hill supplied over one-fifth.

The 'barrier reef' at Broken Hill has been remarkable in many ways, having been worked in the early days of its history for silver. The camp is not quite as old as Leadville. Twenty-four years ago it was furnishing one-third of the world's silver production. The people of Broken Hill have the same cause for remembering the year 1893 as the people of Colorado. However, it was quick to recover, for in a couple of years it was demonstrated that the average grade of sulphide ores, of which there were millions of tons, would pay for treatment. This spelled prosperity with larger letters than before. Americans built treatment plants, as they had before mined these immense bodies of silver-lead-zinc ores. American machinery was introduced, and a close saving was made of the silver and lead, but the zinc went into the tailing. This country had no streams into which to turn the tailing, and, with mills treating from 500 to 1000 tons each per day, small mountains of waste soon accumulated which could be seen for miles across the desert.

Electric separators were introduced eleven years ago, and the tailing heaps, representing an expense account for stacking, at once became an asset. Experiments were being carried on with flotation processes, and two years later the first fifty tons of zinc concentrate won by flotation was shipped from Broken Hill. Last year there was produced 470,000 tons of zinc concentrate of a grade of 47% zinc. This was all extracted by flotation methods. During these nine years there was great competition between the flotation processes and the several methods of electrical separation. There is no question as to the rather startling result. The big plants of electrical separators are very conspicuous by their presence on the scrap heaps. Each and every one has been discarded, and the vast tonnage of zinc concentrate produced last year at Broken Hill was entirely by the four different flotation methods now in use there. A most excellent reason exists for the scrapping of these new and expensive electrical separation plants. It was the fact that from 10 to 20% more zinc was saved by flotation. Nor is the end yet in sight, for the Proprietary, the premier mine of the district, will soon have in operation a new flotation process for extracting the zinc from the slime which is at present being stored.

Not since the advent of the cyanide process has milling received such an adjunct as flotation, which has been termed 'concentration upside down,' owing to the fact that the sulphides rise and float off to the storage bins, while the barren gangue sinks and is drawn off to the tailing dump. The possibilities of this purely scientific process are just beginning to be understood, and Americans, usually in advance with new methods, have been eclipsed by the Australians. Concentration depends principally upon difference of specific gravity—degree of fineness of the crushing and dissemination of the mineral in the rock. In addition to these properties, flotation also depends upon form and lustre of the surface, capacity for the resistance of surface weathering, forms and dimensions of the crystals, and perhaps many less important and unknown properties. It is these properties that give rise to the surface tension effects upon which flotation depends. These vary even with similar ores, so that a flotation process in the hands of one

unacquainted with these properties is sure to be a failure.

Anyone can concentrate sulphides in a gold pan and explain accurately just how they are saved. Everyone who has used a gold-pan has also seen the sulphides float instead of sink, but this surface-tension effect has only recently been brought into common use. Owing to the ignorance of the properties it is dependent upon, a few failures have been made in the United States. Failures occurred in Australia at first, but this does not detract from the wonderful and invariable successes of the present. At Broken Hill the Proprietary mine treats its own ores and tailing by a flotation process invented and perfected by the present manager. All the other companies have contracted, leased, or sold their tailing to separate companies organized especially to treat it by a flotation process.

Painting Cement Surfaces

To make oil paint adhere to cement, the surface of the material should be washed with diluted sulphuric acid (1 part concentrated acid to 100 parts of water), which afterward must be washed off and the surface allowed to dry, according to Herr Glinzer, director of the State Building School of Hamburg, Germany. Or the surface may be covered with diluted silicate of soda (water-glass), the solution to be 1 to 3 or 1 to 4, and applied three times. Still another method is to apply two coats of building 'fluat' at least 24 hours apart. Practical builders state, however, that they do not use sulphuric acid, and that such success as they have results merely from careful work and the use of good materials. Oil paint may also be applied to cement in the following manner: The surface is given one coating of linseed-oil varnish, to which is added a first coat of white lead when the varnish is dry. A second coat is then added, also containing white lead together with more or less coloring matter, as the building laws in Germany forbid the use of absolutely white paint on the exterior of structures. For wet climates the use of oil paints is recommended, as they are waterproof and present smooth surfaces which attracts a minimum of dirt.

Applied to iron, linseed-oil varnish when used by itself flakes off readily. It should be thoroughly mixed with red oxide of lead, 'caput mortuum,' or ochre graphite. This mixture serves as a first coat after the perfectly clean and dry surface has been gone over with the ordinary hot linseed-oil varnish. When the dead color has dried, another coat of the color desired is applied. The oil, being partly converted into resin, combines with the coloring material, making a thick coating that is the more impervious to water according as the color is finely ground or not. Lead should be used when the paint is exposed to water. The water colors so frequently used in Germany have, as a rule, silicate of soda as their base. These colors can be used on cement, plaster of paris, brick, or glass. Liquid casein paints are easily worked and are said to be durable. The discoloration of cement buildings frequently results from the class of cement employed rather than from the color applied afterward.

Working Conditions at Porcupine

Wagon-roads around Porcupine are good in the winter, but nearly impassable in summer. Freight rates to the outlying mines range from $2.50 to $3 per ton in winter and $10 to $15 in the spring. Telephones connect outlying properties with the town and with each other. Wood, where used for fuel, must be cut in winter and hauled to the power-houses. Supplies should be brought in during the winter. Since the completion of the railroad, prices rule about the same as in the other mining districts of Ontario. General labor is plentiful, though experienced miners are scarce. The wage is $4 per 9-hour shift for carpenters, $3.85 for machine-men, $3.10 for trammers, $3 for topmen, and $2.85 for firemen and general surface labor.

Miami Copper Company

By B. Britton Gottsberger

*The past year witnessed the end of the preparatory period of the operations and entrance of the company into the producing class. On March 15, 1911, one section of the mill was started, and from that date production continued on an increasing scale to the end of the year, when five sections were running, treating about 2500 tons of ore per day. The equipment of the sixth section is complete with the exception of the fine-grinding machinery. These machines will be in place by the middle of this month, and the entire plant operating with a daily capacity of 3000 tons.

Mine.—The mine has responded without difficulty to the increasing demand for ore. The output of 2000 tons per day, originally planned, has already been exceeded and development is under way to place the mine on a 3000-ton basis. This has progressed far enough to insure the mill supply by making up any deficiency from the stock pile.

POWER-HOUSE AT MIAMI.

The underground work consisted mainly of completing the 420-ft. tramming level and opening the ground in the northwest portion of the orebody, the limits of which had been defined by churn-drilling. On the 570-ft. level, designed to be the second tramming level, the drift from No. 4 shaft was advanced to the orebody, and during the coming year this level will be opened, preparatory to starting work on the sub-levels between the 420 and 570-ft. levels. During the year 32,935 ft. of drifts and raises were driven.

The ore extracted by stoping was taken largely from the eastern part of the mine, above the 370-ft. level. This work was started by cutting out under the capping by means of square sets and has progressed by a combination of square-setting and sub-level caving which has been very satisfactory. The capping above this ore has caved, the result showing on the surface, where a gradual subsidence of the ground is taking place. This result was anticipated and is causing no serious inconvenience. In the west and northwest parts of the mine it is planned to extract the ore by means of shrinkage stope rooms. Five of these rooms have been started and their working has been most satisfactory. The ore hoisted during the year amounted to 450,036 tons, derived from the following sources:

	Tons.
Stock pile	43,347
Mine development	152,074
Square set and sub-level caving	204,362
Shrinkage stope rooms	50,163
Total	450,036

Previous to the starting of the mill, 18,771 tons of ore was added to the stock pile, and at the end of the year the amount remaining was 226,343 tons in the stock pile and 5000 tons in the bins.

Mill.—As stated above, milling of ore was started in the month of March, and the plant has operated continuously

*From report as general manager, for the year ended December 31, 1911.

since that time, handling a gradually increased tonnage. The estimated capacity of 2000 tons per day for the entire plant has been greatly exceeded, the amount treated per section having been increased to about 500 tons per day. The operation of the plant from a mechanical and a metallurgical standpoint has been very gratifying. The results of milling operations for the year are as follows:

Ore milled, tons (2.48% copper)	115,936
Concentrate produced, tons (40.36% copper)	29,965
Copper in concentrate, pounds	16,195,561
Copper recovered per ton, pounds	36.39
Mill extraction, per cent	73.37

Production.—From the concentrate produced the net return of refined copper amounted to 15,385,783 lb. Based on the net production, the cost of copper in concentrate on board cars at Miami was as follows:

	Per Ton Ore.	Per Lb. Copper.
Mining	$1.2134	$0.03500
Milling	0.6274	0.01810
General	0.1706	0.00492
Total	$2.0114	$0.05802

Ore Reserves.—Prospecting the unexplored territory adjacent to the orebody by means of churn-drills in progress during the early part of the year was discontinued. The drilling done consisted of eight new holes, most of which were in ground too low in grade to be considered of value. Hole No. 37, drilled in the bottom of No. 3 shaft situated on the Red Spring mining claim, disclosed ore of commercial grade, and drilling has just been resumed to complete the examination of this part of the company's ground. Underground, the development drifts and raises have confirmed the churn-drill work in the northwest part of the orebody and above the 420-ft. level have added slightly to the ore developed. After allowing for the ore extracted during the year, the reserves are estimated to amount to 18,232,000 tons, averaging 2.58% copper.

Construction.—The equipment of the milling plant is, as before stated, practically complete, and the entire plant will be in operation in the near future. To provide the power necessary to handle the increased tonnage of ore, additional machinery is now being installed at the power-plant and will soon be in operation. These facilities consist of a third 1000-kw. electric generator, a second air-compressor of 4000 cu. ft. capacity, and a spare condenser. Foundations for these machines were provided in the original design of the plant, so that no increase in the size of the building was required. At the main water-supply pumping plant the second pump has been equipped with an electric motor, so that this plant is now complete in duplicate, thus insuring against any possible failure in the water-supply. At this plant a small air-compressor has been installed and used for testing the driven wells on the ranch. One of these has been flowing at the rate of 250 gallons per minute for some time. It is the intention to pipe these wells to the pump and make use of this supply of water. From this source it is expected that from 500,000 to 1,000,000 gallons of water per day will be obtained in addition to the 2,000,000 gal. per day now being received from the Old Dominion mine.

MAIN HOISTING SHAFT AND ORE-BINS, MIAMI COPPER COMPANY.

Additional details are given in the tables below:

ORE PRODUCTION

	Tons.	Per Ton.	Total.
Inventory stock pile	269,780	$1.0000	$269,780.00
Mine development	450,036	0.3100	139,511.16
Mining	406,599	0.8743	355,506.67
Preliminary power plant	406,599	0.0085	3,456.44
Handling on stock pile	43,437	0.0960	4,171.97
			$772,426.24

CONCENTRATOR OPERATIONS

	Tons.	Per Ton.	Total.
Ore from ore production	445,036	$1.2134	$540,016.13
General expenses at mill	445,036	0.6058	269,601.35
Preliminary mill operations	445,036	0.0216	9,620.23
		$1.8408	$819,237.71

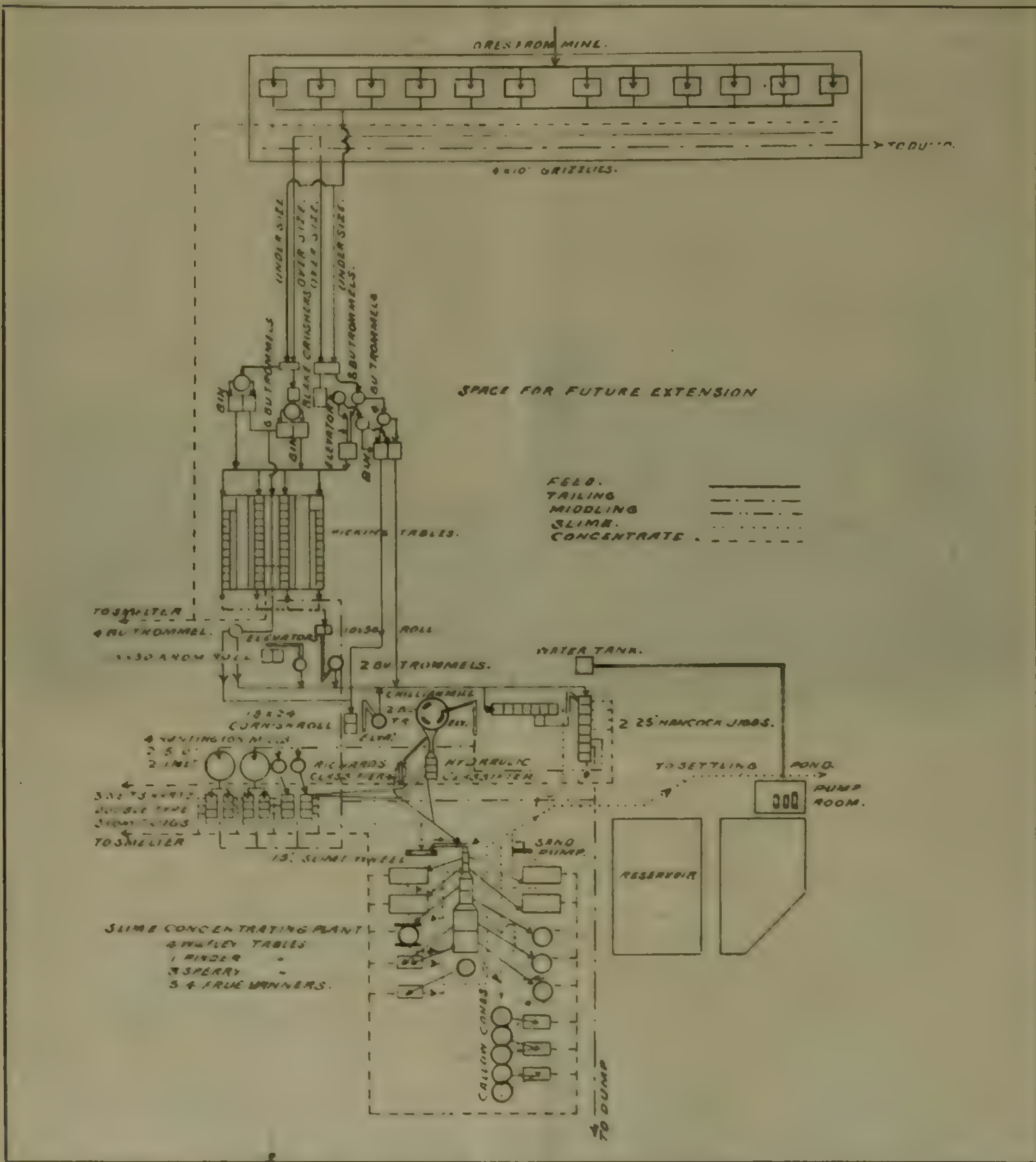
COPPER ACCOUNT

		Cents per Lb.	Total.
Concentrate, pounds	14,970,557	5.310	$ 795,000.24
General mine expenses:			
Taxes	$35,890.62		
Accident insurance and general expenses	25,893.52		
Mine office	19,037.37		
General surface	15,509.24		
Engineers, superintendent, and managers salaries	14,721.50		
Gain in supplies	4,253.75	0.714	106,799.00
Freight on concentrate		0.629	94,316.24
Smelting, refining, and freight on pig copper		2.326	348,223.20
Selling expenses		0.171	25,589.67
New York office		0.175	26,164.41
		9.325	$1,396,092.76
Less:			
Silver proceeds	$27,077.69		
House rentals	6,195.40	0.222	33,273.09
		9.103	$1,362,819.67
Transfer to profit and loss account			587,849.78
			$1,950,669.45

The Osaruzawa Mine

By Takeshi Kawamura

The Mitsu Bishi Company is one of the largest private concerns in Japan, and has among its holdings ten metal mines, including the Osaruzawa, Arakawa, and Hisaichi in Akita prefecture; Takara in Yamanashi; Sado in Niigata; Omodani in Fukui; Ikuno in Hyogo, Yoshioka in Okayama, Makimine in Miyazaki, Togi in Ishikawa. The company also owns eight coal mines, including the Namazuta, Kamiyamada, Shinnyu, Hojo, and Kanada, in Fukuoka prefecture, Ochi, Miyabe, and Yoshinotani in Saga; and the Takashima in Nagasaki. The company is one of the principal mining firms in Japan, and its total output (average taken for the past five years ended 1910) amounts roughly to the following figures: gold, 700 kilograms, silver, 16,000 kilograms; copper, 6000 long tons; coal, 2,000,000 long tons. This production is annually increasing.



FLOW-SHEET OF THE OSARUZAWA MILL.

The Osaruzawa mine, one of the more important properties of the company, is also one of the principal copper mines of Japan. It ranks only behind Ashio, Kosaka, Besshi, and Hitachi mines. It is situated near the town of Hanawa, Kazuno district, Akita prefecture, and can be reached by a five hours' journey from Odate on the O-U railway line. The journey is first over the Kosaka railway leading to that well known property of the Fujita & Co., followed by a 15-mile riksha ride over a fair road. Freight to and from the mine goes by another road direct from the mine with Odate. The concession on which the

mine is situated measures 1427 acres. Tradition dates the discovery of the mine as far back as the early part of the eighth century, since which time gold-mining was intermittently carried on until the feudal lord of the district made it his property some 150 years ago. The auriferous veins discovered having been nearly worked out at the time, efforts were turned chiefly to the winning of copper. The property went through many vicissitudes, but the average output of copper per year during the ownership of the fief seems to have been not less than 365 tons. After passing into the possession of a private merchant at the beginning of the reign of the present Mikado, the mine changed hands several times until in 1887 it became the property of the Iwasaki family, from which it was taken over, in 1893, by the Mitsu Bishi company, which is controlled by the Iwasaki families.

The ore deposit occurs in the form of veins filling numberless fissures in the country rocks which consist of Tertiary shale and tuff and volcanic rocks. The latter include liparite and propylite. The veins constitute a most complicated series intersecting at many points, and range in width from less than 1 to over 20 ft. The strike of the different veins varies, but according to dip they may be classified into five groups of 15, 45, 75, 105, and 135°, respectively. For convenience of operation they are, however, divided into three main workings, the Motoyama, the Takori, and the Akazawa mines. The ores consist of chalcopyrite, bornite, chalcocite, and native copper, of which the first named constitutes the greater part. Carrying a high percentage of iron pyrite and frequently associated with blende, galena, and hematite, they are rather poor in quality, 3 to 4% being the usual quantity of copper contained.

In mining, overhand stoping has been adopted. In driving levels when haste is necessary, rock-drills are sometimes employed. For this purpose three water Leyner 2½-in drills are used. Air is furnished by a 12 by 4-in. tandem two-stage compressor made by the Leyner company, and driven by a 50-hp. induction motor. The mine is opened by ten adit-levels, and there is only one blind shaft. This is the Motoyama mine and is of 6 ft. 6 in. by 14 ft. 3 in. cross-section, and 347 ft. deep. The ore is hoisted by a Lidgerwood double-drum friction hoist, driven by a 35-hp. induction motor. Two more shafts will soon be opened, one in the Motoyama and the other in the Akazawa mine.

An unfavorable feature of the mining here is that, owing to the scarcity of timber and small rainfall in the district, water, especially for ore-dressing purposes, is scarce. To remedy this condition a powerful pumping station is being built on the Yoneshiro river. In it will be placed two 150-hp. 10 by 15-in., 3-throw horizontal plunger pumps. Water will be sent by them about 10,000 ft. to the mine. On the completion of this station, the ore-dressing and other plants will be greatly extended.

After underground sorting, ore richer than 12% copper is classed as first and sent directly to the smelter. Ore containing less copper is classified into middle and third class, containing about 8 and 3% copper, respectively, and are taken to the concentrating mill, which stands on the Shinko adit of the Motoyama mine. The middle-class ore is subjected to spalling and cobbing, and its middling is treated like the third-class ores. The outline of the present Osaruzawa concentrator is shown in the accompanying flow-sheet. At this mine were installed the first Hancock jig, Akron Chilean mill, Richards pulsator classifier, Sperry slimers, Callow cones, and Frenier sand-pumps used in Japan. The concentration ratio is 3:1, while the recovery of metals averages 70 per cent.

The concentrate contains about 80% of material smaller than 12 mm. Formerly this fine material was roasted in 8 roasting furnaces of Herreshoff type. The roasted material was mixed, with slime produced in the concentration, by mixing machines moved by a 10-hp. motor and then made into briquettes by 52 steel stamps weighing 82½ lb. each. The briquettes were dried in 16 drying furnaces with the waste heat of molten slag. Since the roasting pot proved to be satisfactory, 7 cast-steel pots, each of 8 ft. 1 m. diameter and 5 ft. deep, have been used. Each has a capacity of 8 long tons. To furnish blast there are two Root No. 4 blowers, driven by a 50 hp. induction motor. A single campaign of the roaster occupies 8 hours. The feed contains 22% sulphur, while that in the product contains but 4 to 5%. The roasted product equals 80 to 90% by weight of original charge, while the fine material that must be returned to the next campaign constitutes 20% of the roasted product.

The ore larger than 12 mm. is fed into the furnaces raw. There are 3 blast-furnaces: No. 1, 180 by 42 in.; No. 2, 96 by 36 in.; No. 3, round, 45 in. diameter at the tuyeres. The No. 2 furnace is commony used while the others are held in reserve. One charge consists of one long ton of ore containing 7% Cu, 200 kg. of refinery slag, and 300 kg. of limestone. The capacity of the furnace is 90 to 100 tons of ore with the pressure of 45 mm. The matte, of 45% Cu, is intermittently tapped from the forehearth into cast-steel pots and carried to the refinery in a molten state. The average composition of slag is: SiO_2, 40%; Fe_2O_3, 32%; CaO, 15%; Al_2O_3, 5.6%; MgO, 2.7%; and CuO, 0.25%. Blast is furnished by three Thwaites No. 7 Root blowers, two being driven by a 100-hp. motor, while the other is held in reserve.

For refining, there are ten *mabuki* hearths. These are constructed of charcoal powder and clay, in the ground, being 3 ft. in diameter and 1.8 ft. deep. The *mabuki* is a primitive process of bessemerizing and has been in practical use in Japan for a long time. Though it is simple and depends solely upon the laborer's skill, it permits good results to be obtained at very low initial cost. It is, therefore, in use at all the copper mines of Japan except the four larger ones previously mentioned. Four to five long tons of 45% matte is charged in the hearth molten and blown for 23 to 24 hours, at 40-mm. pressure, into blister copper of 98% purity. The blister copper contains 0.0008% gold and 0.06% silver. It is shipped to the Osaka electric refinery belonging to the Mitsu Bishi Company, where the noble metals are recovered.

For the supply of the power, the mine has a hydraulic power-house with a 150 and a 200-kw. generator at a point about seven miles distant. A second power-house has lately been erected, with one of the three 500-kw. generators that are to be used in it. Altogether, 1600 hands are employed at the time; the monthly output of ores averages 8000 tons, while the smelting works turns out copper to a monthly amount of 180 long tons. The poduction of the mine for 1910 is as follows: gold, 13.005 kg.; silver, 1192.728 kg.; copper, 2295.607 long tons.

Softening Water by Permutite

Permutite is an artificial zeolite which has the property of removing certain constituents from water and of softening it, as described by A. Kolb in the *Chemische Zeitung*. The constitution of the substance is

$$3SiO_2.Al_2O_3.(K_2O.Na_2O.CaO).5H_2O$$

Experiments were made, both by shaking and filtration, as to the interchange taking place between permutite and chlorides of calcium, magnesium, and potassium, and it was found that the soda of the permutite was replaced by the bases of the salts added in molecular proportions. The permutite could be regenerated by treating the used substance with common salt. As well as the alkaline earth metals, iron and manganese could be removed similarly from solution. It is stated that with a filter formed of permutite complete softening of water can be effected. The water must not be acid, and must not contain suspended matter. A muddy water, in addition to blocking the pores of the filter, coats the grains of the filtering material with inert matter and prevents the chemical reaction taking place. The regeneration of permutite by a solution of common salt is of industrial importance, as it enables the same filter to be used for an indefinite time. The richness of the treated water in sodium salts is not detrimental to a boiler-feed water.

Work of the Tonopah Mining Company

In the tenth annual report of the Tonopah Mining Co., recently issued, there is much of technical interest. W. H. Blackburn, superintendent of the mine, gives the average mining costs for the year as below:

Per ton of dry ore shipped to mill	$3.704
Including diamond-drilling and extra excavation	3.740
Per ton of wet ore and waste hoisted	2.960

The apparent reduction of 25c. per ton below the cost of the preceding year is stated to be due principally to curtailment of development work and cessation of pumping from the lower levels of the Mizpah shaft. No new orebodies have been found, though the boundaries of known orebodies have been extended. The estimated value of the ore reserve February 1, 1912, was $5,237,974. The total available tonnage at that date, including ore in dumps, was 304,824. The average cost per ton of mining, milling, and marketing the ore for the past year, excluding extraordinary work, was as below:

Mining	$3.71
Milling	2.71
Metal losses in milling	1.89
Freight on ore milled	0.72
Marketing mill products	0.57
Total	$9.63
Profit per ton	$10.34

As is well known, the company has been making active efforts to find a new mine, and as to that J. E. Spurr makes the following comment:

"The search for new mines, to enlarge the sphere of operations of the company, has been systematically carried on. Our work has consisted both in sending our own engineers into favorable districts to investigate, and in considering properties brought to us by outside engineers and others interested in mining. The total number of properties thus submitted is very large, averaging around 50 per month thus far. Of these, many are eliminated after careful study of the reports and maps which are presented, and are declined either as of no value or not suitable to the company's purposes. Certain kinds of mines are eliminated because they are outside of the class in which the Tonopah Mining Co. feels that by experience and equipment it can rank as a specialist. Many of the properties brought in are rejected at once on account of small size of orebodies, too high price, too stringent terms of sale, or difficult conditions of operation. Those which appear attractive are selected and made the basis for further negotiations and inquiry, and if this is satisfactory, options are secured giving opportunity for careful examination, measurement of ore, and appraisal of future probabilities. A preliminary report is made by one of the staff of engineers; if this is favorable, the property is examined briefly by myself and a decision is made as to an exhaustive examination. During the last three months some 25 properties, roughly speaking, have been examined in the field, of which about 10 were inspected by the writer. Two of the properties examined are being considered favorably at present, and these are being carefully examined by our staff engineers. There are several other attractive properties that are about to be investigated."

A. R. Parsons, mill superintendent, states that there was so little departure from the regular routine, in the operations of the milling plant of the Desert Power & Mill Co., during the last fiscal year, that a review of such operations is necessarily brief.

In the last year's report, attention was called to the condition of the Huntington mills, and under an appropriation of $11,660.86 two Chilean mills were installed, replacing the five Huntingtons used for regrinding the oversize from the stamp batteries. Three of the old Huntington mills were left in place, being put in service while making repairs to either of the Chileans. The cost of regrinding in Huntington mills during the year 1910-1911 amounted to $0.169 per ton of ore milled; the cost of regrinding in Chilean mills since July 1, 1911, to February 29, 1912, was $0.117 per ton of ore milled, a reduction in the regrinding cost amounting to $0.052 per ton of ore milled. Since September 1911 the mill has been operated without the Johnson vanners, formerly used for concentrating the finer ore, as experiments indicated that the mineral could be recovered by cyanidation, making a saving to the company through a reduction in the cost of marketing concentrate, of which the Johnson vanners produced about one-third.

During the year there were milled and treated 174,685 dry tons of ore, averaging 0.286 oz. gold and 26.05 oz. silver, or $19.97 per ton, which is 0.034 oz. gold and 2.60 oz. silver, or $2.01 per ton, lower than the average of the ore milled during the previous year, when silver averaged $0.424 per oz. lower. The total contents of the ore milled were 49,796 oz. gold and 4,550,199 oz. of silver, with a gross value of $3,503,255.21, from which there was recovered by concentration and shipped to the smelter 1290 dry tons of concentrate averaging 4.962 oz. of gold and 696.66 oz. of silver per ton, with a total content of 6400.101 oz. gold and 898,509.82 oz. silver, and a smelter gross value of $589,349.56. The cyanide treatment yielded in bullion 3,379,712.66 troy ounces, containing 38,493.312 fine ounces of gold and 3,217,601.61 fine ounces of silver, with a smelter gross value of $2,545,557. The slag and refinery by-products shipped to smelter amounted to 86 dry tons, averaging 0.832 oz. gold and 54.72 oz. silver per ton, with a total content of 71.741 oz. gold and 4720.18 oz. silver, of a gross value of $3849. The cost of marketing products, including freight, treatment, sampling, and express on bullion, concentrate, and slag, amounted to $81,203, or 46.5c. per ton of ore milled, a decrease of 5.1c. per ton compared with the cost of the previous year. This is due to a lower value of the concentrate, the smaller quantity of products produced, and a recent cut of $1.50 per $1000 valuation in the express rate on bullion. During 1911-1912 silver averaged 54.079c. per oz., an increase of 0.424c. per oz. over the price of the previous year. This increase in price applied to the 4,120,832 oz. silver produced, added $17,472 to the revenue derived from silver produced above what would have been realized on the quotations of the year previous.

The percentage of recovery by concentration, cyanidation, and combined extraction shows the recovery by concentration to have been 12.75% of the gold and 19.75% of the silver content of the ore. The recovery by cyanidation was 77.5% of the gold and 70.81% of the silver content of the ore; giving a combined extraction by concentration and cyanidation of 90.25% of the gold and 90.56 of the silver, total 90.56 of the content of the ore. The combined recovery for the previous year was 90.13% of the gold and 92.40 of the silver, total gold and silver recovery 92.40% of the ore contents. Upon comparison, this shows an increase of 0.12% in the gold extraction and a decrease of 1.84 in the silver extraction. In reality, there was an improvement in extraction, both of gold and silver; the contradiction of this statement by the figures above being explained by the manner in which the contents of the ore milled were calculated. Had the gold and silver in the products of last year been added to the gold and silver in the residue discharged from the plant and these results been taken as the gold and silver contents of the ore milled, as was done this year, the extraction for the year 1910-1911 would have been 90% of gold and 90.01 of silver.

The milling costs for the year 1911-1912 were $0.208 per ton lower than during 1910-1911. The direct milling cost per ton for 1910-1911 was $2.732, indirect $0.212, total $2.944. The direct milling cost per ton for 1911-1912 was $2.532, indirect $0.204, total $2.736. A decrease in the direct cost amounting to $0.20 per ton, indirect $0.008, total, $0.208 per ton, as above. A further analysis of the cost sheets shows that the reduction of $0.200 per ton in the direct costs is made up of a reduction of $0.0716 per ton for labor, $0.1376 per ton for supplies, total $0.2092, and an increase of $0.0092 per ton for power, leaving the net reduction $0.200 per ton.

C. A. Hughee, secretary of the company, lists the dividends paid as below:

No.	Date paid.	Rate, %	Amount
1	April 22, 1905	25	$250,000
2	July 22, 1905	25	250,000
3	Oct. 21, 1905	25	250,000
4	Jan. 22, 1906	25	250,000
5	April 21, 1906	25	250,000
6	July 21, 1906	35	350,000
7	Oct. 20, 1906	35	350,000
8	Jan. 21, 1907	35	350,000
9	April 22, 1907	35	350,000
10	July 22, 1907	25	250,000
11	Oct. 21, 1907	25	250,000
12	July 21, 1908	25	250,000
13	Oct. 21, 1908	25	250,000
14	Jan. 21, 1909	25	250,000
15	April 21, 1909	35	350,000
16	July 21, 1909	35	350,000
17	Oct. 21, 1909	35	350,000
18	Jan. 21, 1910	35	350,000
19	April 21, 1910	35	350,000
20	July 21, 1910	40	400,000
21	Oct. 21, 1910	40	400,000
22	Jan. 21, 1911	40	400,000
23	April 21, 1911	40	400,000
24	July 21, 1911	40	400,000
25	Oct. 21, 1911	40	400,000
26	Jan. 20, 1912	40	400,000
*27	April 20, 1912	40	400,000
			$8,850,000

*Declared March 14, 1912.

In addition to the dividends above, in February 1905 the company retired its issued and outstanding preferred stock, with interest, amounting to a total of $380,557.

The balance sheet of the company shows its assets to be as below:

Property		$1,410,040.22
*Exhaustion of ore deposits, to date		859,817.42
		550,222.80
Plant and betterments		59,573.81
Total property, plant and betterments		$609,796.61
Stocks and bonds owned		3,151,578.50
Total investments		$3,151,578.50
Loans and advances to subsidiary companies		56,037.71
Accounts receivable:		
Miscellaneous		17,129.93
Desert Power & Mill Co.		89,890.38
Materials and supplies		39,765.61
Net value of ore on dump		248,349.33
Stored ore at mill at cost of mining and handling		39,931.27
Loans on collateral		50,000.00
Certificates of deposit		325,000.00
Cash		479,043.78
Total current accounts		$1,345,148.01
Deferred charges (unexpired insurance)		1,527.18
Total assets		$5,108,050.30

*This exhaustion of ore deposits at $1.54 per ton, from the period January 1, 1909, to February 29, 1912, is placed upon the books of the company in accordance with the rules, regulations, and instructions of the U. S. Internal Revenue Service.

It is interesting to note that the surplus of the company is invested in large part, though not wholly, in local securities. The complete list is as below:

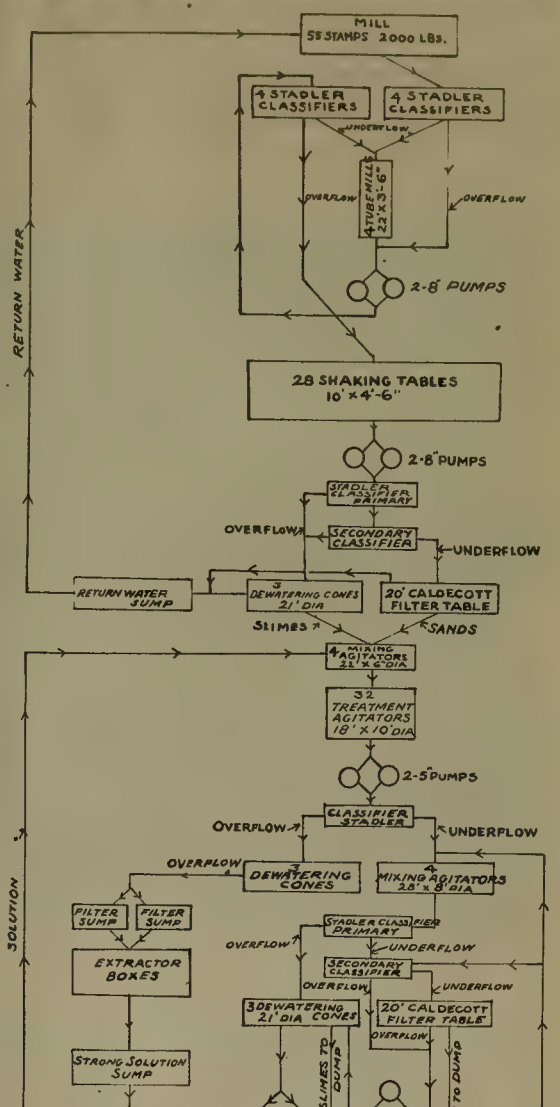
Tonopah & Goldfield Railroad Co. common stock		$988,700.00
Tonopah & Goldfield Railroad Co. preferred stock		283,400.00
Desert Power & Mill Co. mill		800,000.00
Esmeralda Power Co. stock		127,200.00
Tonopah & Crystal Water Co. stock		3,241.00
Tonopah Banking Corporation stock		1,400.00
	(Par. val. bonds.)	
Reading Co. gen. mtg. 4% bonds	$350,000	342,375.00
Southern Pacific Co., San Francisco Terminal first mtg. 4% bonds	225,000	208,700.00
Public Service Corporation of New Jersey gen. mtg. 5% bonds	100,000	93,750.00
Kansas City, Ft. Scott & Memphis R. R. Co. refunding 4% bonds	100,000	79,750.00
Manufacturers Water Co. 5% notes	75,000	75,000.00
Great Northern Ry. and Northern Pacific Ry. joint (C. B. & Q.) 4% bonds	50,000	48,000.00
Jamestown, Franklin & Clearfield R. R. Co. first mtg. 4% bonds	50,000	47,062.50
Pacific Power Co. first mtg. 6% bonds	40,000	39,000.00
Midway Milling Co. first mtg. 6% bonds	35,000	13,000.00
Loans on collateral		50,000.00
Loans to subsidiary companies		58,918.39
Certificates of deposit		325,000.00
Selby Smelting & Lead Co. mill products		219,695.29
Cash		886,266.65
Absorption in Desert mill		53,860.00
Storehouse supplies		126,142.43
Ore on dump at Tonopah		248,349.33
Ore at Desert mill		48,197.36
Accrued interest on loans and bonds		14,249.25
Prepaid insurance		6,930.50
Accounts collectable, miscellaneous		1,682.89
Total invested		$5,189,870.59

From this amount there are deductions for accrued taxes, accounts payable, insurance, net exhaustion of ore, amounting to $509,828.48. The whole report indicates that, whatever may be the success of the company in reinvesting its surplus and operating a new mine, it has done excellently with the Mizpah.

The Way-Arbuckle Process at Benoni

JOHANNESBURG CORRESPONDENCE

During the past twelve months some interest has been aroused by the announcement that, although the East Rand Proprietary Mines decided against the adoption of the Arbuckle process, the Benoni Consolidated Mines, on



FLOW-SHEET, BENONI MILL.

the recommendation of the consulting engineer, has decided to adopt it, subject to certain modifications, at the Benoni mines. In its altered form it is called the Way-Arbuckle process and possesses several new features. The most interesting of these is the proposed continuous treatment of the sand and slime by using the Arbuckle dewatering and thickening cones in conjunction with the Way-Arbuckle agitators and the extensive use to be made of

the Stadler classifier. There is nothing novel in the stamp-mill, which consists of 55 stamps, 2000 lb. each, and is designed according to the results of the experiments made from time to time by the Mines Trials Committee of the Chamber of Mines, so as to obtain the highest efficiency with stamps and tube-mills.

The real objects are to obtain a maximum crushing efficiency and to simplify the treatment of sand and slime, and to reduce the time necessary for their handling to a minimum. But the simplification of the treatment of the combined sand and slime at one continuous operation and in as many hours as the ordinary system takes days, has attracted the most attention, and it is just this part of the process that seems, so far, to have failed. Had it succeeded as anticipated by Mr. Way, it would not only have saved time and expense, but would probably have at the same time materially reduced the capital cost of Rand reduction plants. But, like the Giesecke mill, it seems to have proved a failure as yet, though a short detailed description of the process, together with a flow-sheet of the plant, may not be without interest.

Referring to the flow-sheet, it will be noticed that the mill-pulp is classified by four Stadler classifiers, the overflow joining the discharge from the tube-mills, and is raised by pumps to other classifiers, where the separation of the +60-mesh can take place without overloading the tube-mills with -60-mesh material. The underflow from these classifiers is returned to the tube-mills, and the overflow to the 28 shaking-tables.

After passing over these shaking-tables the pulp is again pumped to Stadler classifiers, the overflow going to three Arbuckle dewatering cones, and the overflow to a 20-ft. Caldecott filter-table. From the dewatering cones and Caldecott table the water passes to the return sump; the slime from the cones as well as the sand from the table going to the first set of agitators to be mixed with strong solution before reaching the Way-Arbuckle agitators. Here the pulp is aerated for four or five hours, during which time the gold should be practically dissolved. It is again elevated to a Stadler classifier, the overflow passing to the Arbuckle thickening-cones, and the underflow to the second set of agitators, where with the underflow from the classifier it is mixed with weak cyanide solution. The overflow from the cones is run to the zinc-boxes, the overflow being pumped to the first set of four mixing agitators. The pulp under agitation with the cyanide solution passes from the second set of agitators to two sets of Stadler classifiers, the underflow being run to a 20-ft. Caldecott filter-table. The overflow goes to the second set of thickening-cones. The residue when taken from the Caldecott table is quite dry and passes direct to a belt, while the slime pulp, after being dewatered, is conveyed to the dump by the residue-sand belt.

The reduction plant was started near the end of last year, and it was soon known that trouble was being experienced with the handling of the slime. However, at the end of November it was officially announced that the mill was crushing at the rate of 500 tons per day, and that the mill and sand plant were running smoothly. As regards the slime plant, the consulting engineer assures the board that it will be a proved success as soon as a few initial mechanical difficulties are overcome. The slime meanwhile is being temporarily stored, and the consulting engineer of the company is thoroughly satisfied with the ultimate efficiency and economy of the whole of the reduction plant.

The first declaration of output as the result of running the reduction plant was made last January, when 17,000 tons had been milled with a yield averaging 18s. 4d. per ton at a cost of 21s. 2d. per ton for mining and milling, showing a loss of practically 3s. per ton, while during February 19,000 tons was treated which, with a yield of 19s. 7d. per ton, just managed to pay expenses. The slime meanwhile is being stored.

The manager reports as follows to the end of December: "The preliminary running of the reduction plant has proved satisfactory so far as the crushing and sorting station, the mill and tube-mills, and the waste-rock conveyors are concerned. In the cyanide plant it was found that the elevation of the settled slime by means of the screws attached to the Arbuckle settling-cones was not feasible, and centrifugal pumps were installed beneath each set of cones. The thickened slime is now drawn off from the underside of the cones and pumped direct to the treatment agitators. The same operation is performed after treatment and the residue delivered to a slime-dam. It appears, however, that with this latter method of dealing with the settling capacity of slime, the nine Arbuckle cones are insufficient for the slime product from a mill feed of 20,000 tons per month. The absorption of gold which invariably takes place in a new plant accounts for the low actual extraction from November 12 to December 31, and will affect the extraction also to a less extent during the month of January." With this description of the results of the first run of this plant, the consulting engineer, Mr. Way, expressed his entire agreement, pointing out that certain additions to the cyanide plant will be necessary to bring it up to the capacity for which it was intended, and he was of the opinion that when these additions were made the company will have a plant capable of giving a high extraction which will be mechanically efficient at a satisfactory working cost.

The Jumpers Gold Mining Co., Ltd., which holds a large interest in the Benoni Consolidated Mines, considered it advisable to call in an independent engineer to report on the whole position, and W. Laurie Hamilton was engaged. In his report he has no fault to find with the sorting and crushing plant, but definitely states that the Way-Arbuckle plant as erected at this mine has not proved a success. He does not condemn the process, as it seems that with certain modification and additions it may be made a success. The Caldecott tables do good work, but the Arbuckle slime dewatering and thickening cones failed to do the work for which they were intended, and with these cones Mr. Hamilton does not recommend further experiment. The main principle of the process was to remix the sand and slime after dewatering, and re-treat the mixtures in the 32 agitators, but owing to the failure of the screw cones, the treatment of the slime had to be abandoned. This militated against the complete success of the agitators, as the presence of the slime would help materially in the agitation. Yet in spite of this drawback, so long as the treatment was continuous and without unexpected stoppages, it was fairly successful. There was no proper arrangement for drawing off the contents of any individual tank when for any reason it became necessary to cut it out of the circuit, and in the event of any unforeseen stoppage of the circuit, all the agitators at once silt up. Recently a failure at the transformer house cut off the power for 3½ hours, with the result that the agitators became silted up to such an extent that it took 12 hours to get them running again. Another stoppage of 2½ minutes of the air-compressor caused 2 hours stoppage, and these stoppages affect everything back to and including the mill. An arrangement to obviate this is absolutely necessary, including the substitution of some other arrangement for the dewatering cones, and then perhaps the plant may be fairly successful in treating both sand and slime. F. L. Bosqui is also reporting on the plant.

TRANSVAAL gold output for the month of March has been declared at 830,723 fine oz., valued at £3,528,688. Included in this total, which is the highest yet recorded, was reserve gold amounting to 70,143 fine oz., valued at £297,946.

The COPPER RANGE CONSOLIDATED COMPANY OF HOUGHTON, is about to add to the traction equipment of its mines five 4-ton electric trolley mining-locomotives, purchased from the General Electric Company.

THE Elmore vacuum plant at the mines of the Sulitjelma company, Norway, produced 884 tons of copper concentrate during the month of April.

Work of the Chino Copper Company

By D. C. Jackling

**Mining Property.* Since the last report a number of additional mining claims have been patented and some changes have been made on other accounts in the unpatented list of claims. A number of locations lying outside of the mineral zone, and therefore having no value except for surface purposes, were found to be superfluous and were abandoned. A few additional locations and purchases have been made, with the result that the total number of claims now owned and controlled, either by patent or location, is 144. Of this number, final patent has been received for 95. Final receipts from the Land Office have been issued, covering 36 others, leaving only 13 claims upon which it is necessary under government regulations to do further work before patent can be procured. The total acreage of all claims, patented and unpatented, is 2643, of which 2412 are covered by patent and receiver's certificate, leaving 231 acres, covering which application for patent has not been made. The company also owns at Santa Rita, New Mexico, 160 acres of patented lands acquired under agricultural entry, making the total area of all classes of claims and lands owned at Santa Rita 2803 acres. This, together with some small areas and rights of way in connection with which surface rights only have been purchased, rounds out the property into a solid block of ground containing everything in the vicinity that is at all likely to be of value or needed either for mining or surface uses.

Millsite and Water Right Property.—The total area owned and controlled at Hurley and in that vicinity for millsite purposes and in connection with water rights is 7156 acres. Of this total, 677 acres is leased from the state and individuals, the area owned by the company being therefore 6479 acres. This comprises all the lands that are now or are likely at any time in the future to be required, and the titles or other evidences of ownership and control are in a satisfactory state throughout.

Development and Improvements at the Mine.—On the date of the last annual report, 208 drill-holes, together with underground work, had developed a total of a little less than 19,000,000 tons of ore. After that date only a comparatively small amount of underground work was done for development purposes, as it soon became apparent that a much greater percentage of these ore deposits could be mined by steam-shovel than was at that time thought possible, and it will be unnecessary to do any considerable amount of underground mining for a great many years.

ROMERO OPEN-CUT AND THE OLD MINE WORKINGS, CHINO.

Development by drilling was continued until about October 1, 1911, at which time 467 holes, aggregating a total of 182,000 ft. of drilling, had been completed. Of this number, 409 holes showed ore of commercial value. The average depth of the holes proving the existence of orebodies was 385 ft., and the average thickness of the ore so disclosed is 107 ft. Drilling of the area in which these holes were situated was completed in such a way that all of the ore is now properly classed as fully developed. The principle of drilling regularly on the corners of 200-ft. squares was followed, except where there was any irregularity of the ore occurrence or uncertainty as to value, and in such cases the ground was drilled at more frequent intervals wherever necessary to fully demonstrate the facts.

The total ore so developed is 54,970,646 tons, containing an average of 2.24% copper. Of this quantity, it is estimated that something over 32,000,000 tons, or nearly 60%, can be mined by steam-shovel. The average grade of ores that will be mined in this way is slightly less than the average grade of all ores developed, being 2.21% copper. Calculations as to the percentage of ore that may be more economically mined by steam-shovel than by underground methods are based on mining by this means to a depth of not exceeding 200 ft. below the average

*From annual report as general manager for the period ended December 31, 1911.

surface. In certain portions of the ore deposits it will be desirable and practicable to extend steam-shovel or open-pit mining to considerably greater depths, and therefore the percentage of ores that will actually be mined in this way will be considerably greater than that stated.

Further developments will unquestionably result in the disclosure of large additional tonnages, particularly in a southwesterly extension on the south side of Santa Rita creek, where sufficient drilling was done before development operations ceased to indicate extensive orebodies of good commercial grade. These bodies will not, however, connect directly with the main orebody now developed, and will probably be mined entirely by underground methods, and consequently the plans for mining them and methods of developing for that purpose will not be affected in any way by the extraction of the orebodies on which we are now working, and as we have already proved a quantity of ore sufficient to supply to its full capacity the mill we are now completing, for approximately thirty years, it was not deemed necessary at this time to continue the development of further reserves.

The mine has been provided with commodious shops, warehouses, etc., as well as living quarters for officers and employees, and no further construction or facilities of these kinds will be necessary. Electric power for all mining and domestic purposes is being supplied from the central steam-plant at Hurley. Resultant upon the decision to increase the mill capacity from 3000 to 5000 tons per day, it was necessary to increase the steam-shovel and locomotive equipment. The company now has 6 steam-shovels and 9 locomotives in use, and 2 additional locomotives have been ordered. Permanent trackage arrangements and yards connecting with the Santa Fé railroad have been completed. The total trackage owned by the company in these yards and about the mine on January 1 was about 10.5 miles, and it is estimated that the completion of the entire system will require some eight miles of additional tracks.

Operations at the Mine.—The total quantity of material moved by steam-shovels up to the end of 1911 was nearly 2,000,000 yards. Of this quantity 1,700,000 yd. was waste, the remainder being ore of a more or less oxidized character. The latter was put in stock-piles for future use, except as to a comparatively small tonnage sent to the mill. The average cost of steam-shoveling for the period was 31.68c. per yard, being equivalent to a little over 15c. per ton. At the present time the quantity of stripping and ore being handled amounts to about 250,000 cu. yd. per month, the cost being about 26c. per cu. yd., and it is believed that the average cost applying in the future will not exceed this figure.

All of the ores mined and sent to the mill have come from near the surface of the Romero, Whim Hill, and Chino sections—most of it from the Romero, the largest pit now opened. The upper ore zones that have been and are now available for mining in these three sections, and especially the Romero, contain considerable quantities of oxidized material which it is necessary to send to the mill or to the ore stock-piles in order to avoid wasting about equal amounts of good concentrating ore associated with it. The result of this situation is that the ore which has been going to the concentrator contains approximately one-half its copper content in the form of carbonates, which are not recoverable in large percentage by concentration. This condition will prevail for several months with respect to the orebodies in question, or until the first steam-shovel cut, representing about 40 ft. in thickness of these mixed ores, can be removed. In the meantime, the character of the ore is gradually improving in the sections from which we are now producing, and it is expected that, by the middle of the current year, the ore going to the mill will be fully up to average grade and of such quality that good recoveries can be made.

Construction and Operation at the Mill.—Grading for the plant was started early in July 1910, and the laying of concrete foundations was begun early in October. The mill was then designed to be built in three sections, but subsequently, on account of the rapid increase of tonnage at the mine, it was decided to add two additional sections and build the plant with a capacity of 5000 tons per day. The first section was completed and started on October 16, 1911, about fifteen months after the commencement of construction work. The second section was put in commission about the end of December, and the third section was placed in operation on April 1, 1912. The fourth section will be ready to start about June 1, 1912, and the fifth section before the first of September. The two sections now in operation have demonstrated a capacity of more than 1000 tons per day each during the months of February and March, and it is proved, therefore, that the completed plant will readily have a capacity of 5000 tons per day.

The power-plant, designed primarily for the requirements of a 3000-ton concentrator in addition to the requirements of the mine, has proved ample in capacity to accommodate the enlarged concentrator, and it will not be necessary, therefore, to extend this department. The mill, power-plant, shops, and other buildings are of steel and concrete, and, therefore, fireproof. The four sources of water-supply serving the concentrator have been thoroughly developed and equipped, and have proved capacities fully up to those anticipated. In connection with the mill the company has constructed and owns some sixty buildings, including offices, boarding-houses, and residences, for the accommodation of officers and employees. All of the buildings and improvements of the town of Hurley, excepting a few tent-houses, are owned by the company.

Since the first starting of the mill in November, no difficulties of importance have been encountered, either mechanical or otherwise, and it has been found that no alterations of any material consequence will be necessary, either as to design or methods of operation. The yield in pounds per ton of ore treated has been such that the commercial results have been very satisfactory under the circumstances. During the months of November and December, a comparatively small tonnage only was being treated in one section of the plant. This section started up in October on about 500 tons per day, and the usual adjustments, incident to starting such an institution, prevented the average treatment of more than about 700 tons per day in December. The yield for the entire period of copper contained in concentrate was a little over 24½ lb. The grade of concentrate was comparatively low, partly because it contained a considerable amount of carbonates, this resulting in correspondingly increased smelting costs; and operating costs, in general, were naturally high on account of irregularities of operation attending the starting up of a new plant, and, especially so, in connection with so small a percentage of its tonnage capacity. However, the total cost of producing copper for the full period the mill was in operation before the end of the year, was a little less than 10c. per pound. In January of the current year, on a yield of only a little over 22 lb. per ton and a tonnage rate of 800 tons per section for the two sections then in operation, the total cost per pound, including all expenses of every nature, was 8c. At the time of this writing, the final results are not available; but, during that month, the plant averaged in the neighborhood of 1100 tons per section for the actual running time of the two sections then in operation, and it is now estimated that the cost of producing copper for that month, on a yield per ton very similar to that for January, will not exceed 7½c. per pound. Approximately the same rate of tonnage, and conditions generally, are applying to March operations, and the costs stated will be improved as we can decrease milling and all other expenses through the treatment of larger tonnages and secure from the mine a better grade and quality of ore. Taken as a whole, the recoveries of the class of copper minerals reasonably amenable to concentration have been excellent, as high, in fact, as those of any other plant in the country with the operation of which I am familiar; and the design and arrangement of the plant, power-house, and all accessories are such that very cheap milling will be possible, and the results as to

milling costs, already achieved, indicate that our costs in this department will be considerably below our estimates.

The grade and quality of concentrate are proving to be what had been expected, and the smelting arrangement is, therefore, an economical one. The service of the Atchison, Topeka & Santa Fé railway in transporting ores from the mines to the mill and the concentrate from the concentrator to the smelter at El Paso, is proving entirely satisfactory. Power plant costs, even operating at small capacity, have already proved nearly as low as it was estimated they would be eventually at full capacity, and it therefore appears that this factor of cost will be substantially lower than had been expected. In fact, all elements in the situation warrant the assertion that, within the current year, the company will regularly produce copper at a cost substantially lower than has ever been stated in any official estimate or report.

Placer Mining in the Province of Quebec

By H. A. Ball

Placer gold was first found in the Province of Quebec 77 years ago, and mining has been carried on there in a desultory fashion ever since. The known area of gold-bearing gravel is small compared with the deposits of the Pacific Coast, although placer gold has been found in several counties of the province. These deposits have been examined, at various times, by men connected with the mining bureau of the Dominion, but they have had to work under great difficulties, chiefly owing to physical conditions resulting from glacial action, and no tenable theory concerning the origin of the placer gold found there has been advanced.

The principal district attracting attention at the present time is in the basin of the Chaudiere river, where the mining rights to 70,000 acres of land in the seigniory Regaud-Vaudreuil have been acquired by a Montreal company which has already done considerable prospecting and development work on the Gilbert, des Plantes, and Moulin rivers, the three principal gold-bearing tributaries of the Chaudiere, in the seigniory. The work of this company, the Champs d'Or Rigaud-Vaudreuil, has attracted considerable attention in eastern Canada, and has resulted in the locating, or blanketing, of all the available land in the neighboring Famine and du Loup rivers. The Quebec mining laws are very liberal, and for a fee of $10 an individual may take out a miner's license entitling him to locate 200 acres of land, patented or otherwise. The surface of most of the land is patented, but, as a rule, the patents do not include the mineral rights, which are still retained by the Government.

According to government reports, more than half of the placer gold won in Quebec came from shafts and drifts in a pre-glacial channel in the Gilbert River valley. Royalty was paid on over $1,000,000 in gold taken from a continuous strip of this channel, 1½ miles long. This strip escaped the destructive glacial movement which broke and displaced the rest of the gravel deposit in the Gilbert and elsewhere. Some of the mining companies working on the Gilbert paid small dividends, but owing to crude mining methods, poor labor, underground water and quicksand, irregularities of gold distribution, etc., reports show that the expenses generally exceeded the production, although some of the gravel was extremely rich. When the workings reached the point where the gravel was replaced by barren material, mining ceased on the Gilbert.

For eight months I directed the work of four drills in the Gilbert basin, searching for the continuation of the channel, but the pay-gravel seems to have been wiped out. At the upper end of the old workings I found a small block of virgin ground with four or five feet of rich bottom gravel capped by 40 ft. of clay, but persistent drilling upstream showed no further traces of this, although the valley was closely drilled from rim to rim. Drilling downstream was also unsatisfactory. Early in 1910 I started the prospecting work on Ruisseau des Meules, a small tributary of the Moulin, with good results from the beginning, and by means of shafts and drifts blocked out a sufficient area of channel gravel to warrant the placing of the present plant. This gold bearing gravel lies on a bench paralleling the supposedly original bed of the stream which is now filled with glacial débris. It consists of from 2 to 5 ft. of gravel lying on the bedrock. This gravel is peculiar, being composed mainly of clay-slate pebbles held in a mass of sticky yellow clay of the consistence of putty and rich in coarse, smooth, rounded gold. Over the gravel is a layer, several feet thick, of boulders and barren blue clay with a capping of boulders, loam, and sand, carrying a little gravel and fine flaky gold. The depth of this cap increased rapidly with the hill slope.

Ruisseau des Meules is flat and rather narrow, with steep hills on both sides. The bedrock grade is only 2.35%, which, with the limited supply of water, necessitates the elevating of the tailing. There is little water in the stream after the spring freshet, and in order to get water under sufficient head for hydraulicking it was necessary to tap Lake Fortin, nearly seven miles away. Across one end of the lake was built a plank-faced log-cribbed dam, 700 ft. long and 16 ft. high on the slope, making a splendid reservoir three miles long and one and one-half wide. From this the seven and one-half mile ditch delivers 1500 miner's inches of water to the penstock, 246 ft. above the bedrock at the mine.

The ditch digging was difficult and costly; nearly one-third of the line had to be blasted through tough slate bedrock; a large portion, passing through swamps and muck, had to be sheathed; over a mile of flume had to be built, the longest 700 ft. and the highest on a trestle 40 ft. high. For the work only 'jack-knife' carpenters were available, and labor new, even to the use of long-handled shovels. The ditch crossed dozens of the narrow little Quebec farms, and every foot, in fact every inch, of the right-of-way had to be bargained for and measured so closely that it was necessary to have a Government surveyor survey the ditch and the area to be paid for on each farm. All cuts over four feet deep had to be boxed, and the surface of the ground leveled; one to three bridges, of specified dimensions and material, had to be built on each farm; in many places the ditch had to be fenced on both sides; the slightest water seepage was sufficient to cause a claim for damages; even wheel tracks on frozen ground were made the basis of such claims. Many of these claims were so absurd that they would have been amusing if they had not been so annoying and expensive.

The pipe-line has a 42-in. intake at the penstock, tapering to 15 in. in 2000 ft., and it supplies water to two hydraulic giants working in the pit. It is tapped to furnish water-power for derricks, to prime the centrifugal pump of the elevator, and when the pump is not running, keeps a constant flow of water over the riffles in the sluice on the elevator. The sluice leading to the elevator sump is 3 by 3 ft., with a planed tongue-and-groove bottom. It is riffled longitudinally with second-hand steel—railroad rails laid bottom up and spaced with slip-blocks—thus making first-class riffles and an ideal surface for boulders to travel over.

The consulting engineer of the company and I planned the elevator to meet conditions existing on Ruisseau des Meules. It is really the digging end of a close-connected bucket dredge, with 3½-cu. ft. buckets. It has an hourly capacity of 180 cu. yd. of material raised 35 ft. above the bedrock, the buckets dumping into a riffled steel sluice which is lengthened as needed by wooden flume. The lower end of the ladder is in a bedrock sump at the end of the lower flume, which is fed by the hydraulic giants. The sump also accommodates the end of the suction pipe of the 12-in. centrifugal pump which supplies water to the upper sluice. The structural work of the elevator is of steel, built on an I-beam superstructure carried on four double-wheeled trucks. The wheels travel on heavy steel

rails, spaced 20 ft. apart. This arrangement was planned to facilitate the moving of the elevator, as the narrowness of the channel will necessitate at least one move in the middle of the water season, when time saved will be a great consideration. The elevator is run by electricity. Power is cheap, since coal is used for fuel and the powerhouse is on the railroad only $2\frac{1}{2}$ miles from the mine. It requires 30 hp. for the bucket-line and 110 hp. for the centrifugal pump. The mine is well lighted at night by arc lights, and the usual system of three shifts is used when there is water for hydraulicking.

With the exception of a few minor defects, and the mishaps usual when starting work with unskilled labor, which has to be trained to efficiency, the machine met all requirements in a satisfactory way. As the labor was ignorant of modern milling methods, and time was limited, it was necessary to send to California for three pipers so that work could start at the beginning of the water season. In opening the ground to the best advantage, the first season's work, 1911, had to be done in ground that had been worked in the best part of the channel by pick-and-shovel methods. This strip of partly worked ground, however, yielded an average of 36c. per cubic yard, and this season the work will be done in rich virgin ground which I tested thoroughly and for which the equipment was planned.

It would be difficult to predict the future development of placer mining in Quebec. Prospecting, as known in the West, cannot be carried on in a thickly settled country where the surface is jealously held by individuals, even if the prospector is licensed by the Government. Surface indications do not aid the prospector. He is hampered by the thick blanket of boulder clay which covers most of the country. This clay would render dredging unprofitable if otherwise possible, and shaft mining is expensive, owing to the large beds of quicksand and the great amount of underground water. Frequently this clay cap rests on the bedrock and replaces the gravel in the channels, and being barren it is a great obstacle to profitable mining in any case.

The climate is extremely severe, and surface mining cannot be profitably carried on during the long winters. The summers are short, and water fails early in spite of the abundant rains. Labor, while willing and cheerful, is untrained and very unreliable. This would be changed in time, but it is a serious drawback at present. On the other hand, some very rich beds of gravel have been found, and, with the expenditure of sufficient money, water can be obtained for working them, as there are many large lakes available for reservoirs. Canadian capital is generally willing to back Canadian enterprise and take a chance. The Champs d'Or Riguad-Vaudreuil Co. is a good example of this spirit, and it certainly deserves success. Outside of the work in the seigniory, little actual work or prospecting has been done. The locators of surrounding properties seem to be waiting to see if the one company succeeds in its venture, and I believe that the immediate future of placer mining in Quebec will be greatly influenced by this success or failure.

Precipitation of Gold by Colloid Gels

An interesting paper by E. Hatchek and A. L. Simon was read at the last meeting of the Institution of Mining and Metallurgy, describing experiments by Mr. Hatchek in the domain of colloidal chemistry. The object of the experiments was to explain the presence of gold in the middle of solid quartz, and also the banded form of quartz structure. Thomas Graham in 1861 discovered the difference between aqueous solutions of crystalline and colloidal substances, and the fact that the former would diffuse into and out of the latter. Subsequently R. E. Liesegang applied the principle in photographic work with the gelatine gel. He discovered that if a drop of an aqueous solution of silver nitrate was placed upon a film of gelatine containing bichromate of potash, the nitrate would diffuse and react to form bichromate of silver; and that the reaction would not spread as a uniform halo, but as a series of concentric rings. Bechhold, Ziegler, and Hatchek have continued investigations into this phenomenon by means of test-tubes, the gel containing one of the reacting components being placed in the lower part, and the other component in aqueous solution being poured on the top of the gel. Hatchek especially investigated the possibility of reducing gold salts contained in a gel of silicic acid. He half filled the test-tube with silicic acid to which 1 to 2 c.c. of 1% gold chloride solution was added, and allowed the mixture to set. In one set of experiments the reducing agent was then added in the form of aqueous solution such as oxalic acid or ferrous sulphate, and in another set the tube was introduced into an atmosphere of reducing gas such as sulphur dioxide, hydrogen, or carbon monoxide. The authors described the results obtained and showed how the gold is precipitated generally in layers in the gel, occasionally being deposited in crystalline form. They found that the best crystals were obtained with reagents not readily soluble in water. In some cases a black substance, probably carbon, was also precipitated. The authors discuss in detail the application of their researches to the formation of gold-bearing quartz veins. The reception was decidedly mixed and the comments were keen. The general opinion was that a watery gel had not the power to exert dynamic force, and that the loss of the water subsequently was a difficult point to explain.

Laramie Tunnel Record

In a recent paper in the *Bulletin* of the American Institute of Mining Engineers, D. W. Brunton gives the following details regarding the record work done in driving the Laramie Poudre drainage tunnel in Colorado.

During March, April, and May 1911 the record for distance driven, drilling, powder consumed, and cars of waste sent out was:

	1911		
	March.	April.	May.
Feet of completed tunnel	653	588	635
Number of holes drilled	1,965	1,759	1,985
Linear feet of holes drilled	14,330	12,510	15,263
Average linear feet of holes drilled daily	154	139	164
Sticks of powder used	14,803	16,171	18,311
Cars of waste sent out	4,983	4,765	5,156

Considering the hardness of the rock, the speed attained in drilling, as shown by the figures above, was exceptionally good; but even these averages fall considerably below what was possible with the equipment used. For instance, a number of the best drill-runners were able to average over 60 ft. of holes per shift, one of them making a monthly shift-average of 61.68 ft., another of 61.75 ft., and a third of 61.86 feet.

Siberian Gold Deposits

Siberian gold deposits are attracting the attention of capital, and two Russian engineers have received permission to form a company with $1,030,000 capital to operate in the Amur territory. Several French companies have been formed; the Compagnie des Mines d'Or Sayausk will invest large sums in Siberia; another company is prospecting on the shores of Lake Baikal, 40 miles from Irkutsk, an Australian dredge being already at work in this field; and large French investments have been made in the south Transbaikal goldfields, on the frontier of Mongolia. During the summer the Orsk Goldfields, Ltd., will begin production near Bolba on the Amur, in addition to its present output. The Imperial Geological Survey has sent two men to Yakutsk to investigate the discoveries near there. The Russian ministry has submitted to the Council a draft of a new mining law which provides that lands which are "manifestly gold bearing" shall no longer be open for prospecting, but shall be investigated by the Government and afterward sold at auction.

Metal Production in the Central States

Final figures covering production of lead, zinc, copper, and silver in Michigan, Wisconsin, Kansas, Arkansas, and Oklahoma in the year 1911 have been compiled by the United States Geological Survey and were distributed this week. The figures for Michigan were collected by B. S. Butler, and those for the other states by J. P. Dunlop. Summaries are presented below.

Michigan mines in 1911 produced 219,840,102 lb. of copper, valued at $27,480,013, and 497,281 fine ounces of silver, valued at $263,559, a total value for both metals of $27,743,572. This is a decrease in value of $715,698, or about 2.5%, from the 1910 production, due to a slightly smaller output of copper and a little lower average price for the metal. Owing to this slight decrease in the price of copper there was a decline from $2.54 in 1910 to $2.50 in 1911 in the average value per ton of ore treated. The recovery of refined copper per ton of rock milled in 1911 was 20 lb., compared with 20.5 in 1910. The quantity of silver recovered was 497,281 fine ounces, an increase of 166,781 oz. over that of 1910. Of the silver, 513 oz. was obtained as pickings and 496,768 oz. was derived from the electrolytic treatment of 43,755,777 pounds of copper. The mines of Houghton county produced 83.9% of the copper and 92.4% of the silver output in 1911. The value per ton of ore or 'rock,' according to Michigan usage, was $2.54 in 1910 and $2.50 in 1911. Further details are given in the table below.

PRODUCTION OF SILVER AND COPPER IN MICHIGAN IN 1910 AND 1911, BY COUNTIES

County.	Silver.	Copper.		'Mineral.'		'Rock.'
		Quantity.	Yield per ton of 'rock.'	Quantity.	Yield.	
1910.	*Fine ounces.*	*Pounds.*	*Pounds.* *Per cent.*	*Pounds.*	*Per cent.*	*Short tons.*
Houghton	293,387	191,955,538	21.2 1.06	317,444,169	60.5	9,061,790
Keweenaw	37,113	27,923,424	17.7 .88	39,189,881	71.2	1,580,026
Ontonagon		2,804,499	12.3 .61	4,206,497	66.7	227,745
Total	330,500	222,683,461		360,840,547		10,869,561
Average			20.5 1.025		61.71	
1911.						
Houghton	459,715	184,572,400	20.3 1.02	289,204,888	63.8	9,072,210
Keweenaw	37,053	32,079,885	18.5 .94	45,225,456	70.9	1,704,048
Ontonagon	513	3,187,817	15.7 .78	4,477,965	71.2	202,569
Total	497,281	219,840,201		338,908,309		10,978,827
Average			20.0 1.00		64.8	

In Wisconsin the value of the mine output of lead and zinc was $3,582,006. The value of the production in 1910 was $3,188,460, so that the increase was $393,546. The lead concentrates sold declined from 5608 tons in 1910 to 4359 tons in 1911. The sphalerite concentrates sold increased from 89,232 tons to 93,963 tons, and the zinc carbonate concentrates declined from 5269 tons to 5035 tons. The metal content of the lead concentrates was 1060 tons less than in 1910. The recoverable zinc content of the sphalerite and carbonate of zinc concentrates increased 284 tons over that of 1910 and the value was $480,120 greater. Benton, the largest producing district, had an increased output of both lead and zinc concentrates. The value of the output from the Hazel Green district doubled that of 1910 and placed that district ahead of Platteville. The production of lead and zinc and the tenor of the ore and concentrates in Wisconsin in 1911 are shown in the following tables:

TENOR OF WISCONSIN CONCENTRATES, 1910 AND 1911.

	1910.	1911.
Total crude ore, short tons	1,032,052	1,123,040
Total concentrates in crude ore, %:		
Lead	0.5	0.4
Zinc	9.2	8.8
Metal content, %:		
Lead	0.4	0.3
Zinc	3.2	3.1
Lead content, %	78.7	76.9
Zinc content of:		
Sphalerite concentrates, %	34.8	34.6
Zinc carbonate concentrates, %	29.9	33.1
Value per ton of:		
Lead concentrates	$51.09	$52.41
Sphalerite concentrates	$19.62	$20.53
Zinc carbonate concentrates	$13.21	$14.72

From Kentucky no galena concentrates were shipped to the smelters from the fluorspar district, and in consequence no production of lead and silver was reported. The production of zinc carbonate concentrates in the state amounted to 467 tons, valued at $10,604. The average zinc assay was 40%, and the recoverable spelter content of the concentrates was 158 tons. As only 30 tons of zinc concentrates was shipped in 1910, the 1911 shipments show a substantial increase.

In Kansas the value of the mine production of lead and zinc was $1,428,318, which is $212,670 less than the value

PRODUCTION OF LEAD AND ZINC IN WISCONSIN IN 1911, BY DISTRICTS, IN SHORT TONS

District.	Ore.						Metal content.			
	Lead concentrates.		Zinc concentrates.							
	Galena.		Sphalerite.		Carbonate.		Lead.		Zinc.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Benton	991	$52,985	32,453	$546,872	131	$2,454	779	$70,110	7,346	$837,444
Cuba City-Elmo	601	32,375	2,185	52,909			483	43,470	773	88,122
Dodgeville	70	3,880	263	7,084	60	1,080	60	5,400	126	14,364
Hazel Green	547	25,405	20,632	417,098			380	34,200	6,300	718,200
Highland	206	11,108	81	3,013	4,784	69,235	150	13,500	1,273	145,122
Linden	205	10,286	8,317	124,487			154	13,860	1,923	219,222
Livingstone	181	8,365	7,987	155,497			129	11,610	2,410	274,740
Mifflin	477	27,507	6,720	181,882			378	34,020	2,569	292,866
Mineral Point	40	2,000	684	9,614			30	2,700	167	19,038
Montfort	155	8,228	1,567	28,528			118	10,620	452	51,528
Platteville	268	13,288	12,748	395,425			200	18,000	5,338	608,532
Shullsburg	618	34,038	326	6,714	60	1,374	492	44,280	97	11,058
State, total	4,359	229,465	93,963	1,929,123	5,035	74,143	3,353	301,770	28,774	3,280,236
1910	5,608	280,493	89,232	1,750,574	5,269	69,588	4,413	388,344	25,927	2,800,116
1909	4,659	254,514	65,421	1,505,752	5,130	63,603	3,694	317,684	23,152	2,500,416

of the production in 1910. The production of lead concentrates in the Galena district was 3487 tons, compared with 2508 tons in 1910. The shipment of zinc concentrates (all of which was sphalerite except 122 tons) was 17,892 tons, a decrease of 3062 tons. The lessened value of the output of zinc in the Galena district should not be construed as an indication of a declining field, for the development of new mines and opening of old properties was more general than for several years. The decrease rather marks the transition stage of the field from one of many small operators to one having the active development centralized in individuals and companies financially able to mine on a more extended scale.

In Oklahoma the value of the mine production of lead and zinc was $812,190, a decrease of $132,506 compared with the production of 1910. The shipments of both lead and zinc concentrates were less than in 1910. The mines of Murray county, in the Arbuckle Mountain region, produced 25 tons of sphalerite and 195 tons of zinc carbonate, only a few tons more than in 1910. The rest of the year's production came from Ottawa county, in the extreme northeastern part of the state. The mines of the Peoria district shipped an increased tonnage of zinc carbonate and silicate, the high price paid having stimulated the production during the last few months of 1911. The production of lead concentrates in the Quapaw district increased slightly, but the shipments of blende concentrates declined 1676 tons, or over 40%. In the Miami district the production was less than in 1910, but development was very active. A lower run of ore was proved by systematic drilling on the land of the Miami Royalty Co. and the Emma Gordon Mining Co. New shafts were sunk to the orebody and some ore was hoisted from the lower levels. Work in the mines was hampered by water, which made it necessary to install pumps of large capacity. Several new concentrating plants were erected and others contracted for, so that operators predict a very much larger output from this district in 1912.

The Arkansas mine output of lead and zinc was worth $81,456, compared with $112,896 in 1910. While there was a decreased production of zinc, development was active and new milling plants were constructed, which are now in operation. The galena concentrates sold in 1911 amounted to 80 tons, containing 64 tons of recoverable lead, valued at $5760. The sphalerite concentrates sold in 1911 amounted to 1407 tons, and the zinc carbonate and silicate concentrates to 183 tons. The total recoverable zinc content (allowing for smelting losses) was 664 tons, valued at $75,696.

PRODUCTION OF LEAD AND ZINC IN KANSAS IN 1911, BY DISTRICTS, IN SHORT TONS

District.	Ores.								Metal content.			
	Lead concentrates.				Zinc concentrates.				Lead.		Zinc.	
	Galena.		Carbonate.		Sphalerite.		Carbonate and silicate.					
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Badger-Peacock and Lawton	134	$6,902	..	.....	2,517	$92,726	.....	.....	107	$9,630	1,333	$151,962
Galena	3,487	190,950	.....	.....	17,770	641,422	122	$2,916	2,752	247,680	8,939	1,019,046
State total, 1911	3,621	197,852	.....	.....	20,287	734,148	122	2,916	2,859	257,310	10,272	1,171,008
1910	2,973	144,284	61	$2,496	27,134	998,219	106	1,452	2,412	212,256	13,229	1,428,732

PRODUCTION OF LEAD AND ZINC IN OKLAHOMA IN 1911, BY DISTRICTS, IN SHORT TONS

District.	Ores.								Metal content.			
	Lead concentrates.				Zinc concentrates.				Lead.		Zinc.	
	Galena.		Carbonate.		Sphalerite.		Carbonate and silicate.					
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Ottawa County:												
Miami	2,848	$152,527	.....	.....	8,391	$247,530	.....	.....	2,230	$200,700	3,809	$434,226
Peoria	12	628	.....	.....	.....	.....	311	$8,330	10	900	116	13,224
Quapaw	329	18,202	.....	.....	2,245	82,571	6	85	261	23,490	1,154	131,556
Total	3,189	171,357	.....	.....	10,636	330,101	317	8,415	2,501	225,090	5,079	579,006
Murray County	.....	.....	.....	.....	25	842	195	2,801	.....	.....	71	8,094
State total, 1911	3,189	171,357	.....	.....	10,661	330,943	512	11,216	2,501	225,090	5,150	587,100
1910	3,637	188,021	1	$42	13,976	447,043	280	5,572	2,888	254,144	6,394	690,552

TENOR OF LEAD AND ZINC ORE CONCENTRATES PRODUCED IN OKLAHOMA, 1910 AND 1911

	1910.	1911.
Total crude ore, short tons	223,212	.....
Miami district:		
Total concentrates in crude ore, %:		
Lead	2.9	.....
Zinc	8.9	.....
Metal content of crude ore, %:		
Lead	2.4	.....
Zinc	4.3	.....
Lead content of lead concentrates, %	79.5	78.3
Zinc content of sphalerite concentrates, %	48.7	50.4
Value per ton of lead concentrates	$51.76	$53.55
Value per ton of sphalerite concentrates	$29.32	$29.50
Quapaw district:		
Total concentrates in crude ore, %:		
Lead	0.3	0.4
Zinc	3.7	3.0
Metal content of crude ore, %:		
Lead	0.2	0.4
Zinc	2.2	1.7
Lead content of lead concentrates, %	78.2	79.3
Zinc content of sphalerite concentrates, %	57.9	57.0
Value per ton of lead concentrates	$50.84	$55.32

Dividends

The TONOPAH EXTENSION MINING CO. has declared a dividend of 2½ per cent.

April dividend upon the shares of the MINES COMPANY OF AMERICA has been postponed.

The SEVEN TROUGHS COALITION MINES CO. has declared dividend No. 1, of 2½c. per share, payable July 1.

The AMERICAN SMELTING & REFINING CO. has declared a dividend of 1¾% on preferred shares and 1% on common shares.

Discussion

Readers of the Mining and Scientific Press are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this Journal

Australian Mining Laws

The Editor:

Sir—I notice some discussion in the San Francisco section of the Mining & Metallurgical Society of America with regard to Australian mining law. In a general way, the Australian law has one great advantage, and that one is the vertical side-lines. In America, 99% of the litigation has arisen over the extralateral right, and, with this one element eliminated, mining law becomes simplicity itself. On the other hand, the Australian form of claim, which is that of a lease contingent upon the continuous performance of labor requirements, is open to very deep-seated economic criticism. I have not the time to go into the matter thoroughly, but in a general way I may point out the main objection.

It fundamentally works to the disadvantage of the individual prospector and of the industry, because unless the prospector can get his claim on an immediately self-supporting basis, he is sooner or later compelled to abandon it. But of wider importance than this is the fact that it to a great extent bars the common miner in the district from becoming a prospector, for he must employ a large part of his time earning wages and, as the law requires continuous work on leases, obviously he could take no interest in prospecting. There are cases where a few working miners subsidized one of their number to do the prospecting, but this in turn works to their ultimate disadvantage as it makes for divided ownership and divided counsels and uncertain support. Given that a vein has been found which does not at once show up an ore-shoot, and as long as a vein has an owner he will, nine times out of ten, return to do more work. More especially is this the case among the miners who, as I have said above, can only devote a limited portion of their time to such effort.

It compels the capitalist, in the shape of the exploration company, to continue to spend money on development which may be perfectly useless and often at times which may impose particular hardship from a financial point of view. The result of this has been to drive the exploration companies practically out of the business of preliminary development, and such companies in West Australia are not now prepared to undertake anything that is not developed to a considerable extent by prospectors. On the other hand, as the prospectors must live, their tendency is to root out the ore as fast as possible, and they therefore have but a poor showing to make to the exploration company.

The result of this, to my mind, has been to greatly retard the development of such mining regions as Western Australia. Some years ago I had occasion to look into the matter, and at that time, so far as I recollect, over 12,000 claims had been pegged out and some 3000 of these had actually produced ore of payable grade, and at the present moment I doubt where, eliminating claims taken up merely to protect the large mines, there are more than 1500 leases to which the legal title is still sound. In other words, a large majority of the claims taken up have been absolutely abandoned and practically forgotten.

There is another point, the bearing of which is rather difficult to state, and that is that companies operating valuable mines, in case of strikes, for instance, might be unable to man their leases and therefore undue pressure could be brought to bear by the Government upon them. I do not know that this has ever occurred in Australia, but the possibility of such pressure might very well lead to injustice.

Altogether, with a considerable amount of experience in both America and Australia, my emphatic view is that the American system of giving a title in fee simple after a certain amount of limited work over a short period, is one of the best for the ultimate development of the industry, and the one in the best interest of the population as a whole, and especially of the working miner, who thus has an opportunity to improve his position from that of a wage-earner. It has to be borne in mind that the development of mines in the early stages, particularly over the first three years of their history by and large, is a losing business, and I imagine one in which actually 90% of the value of the labor and money expended is lost. Given that we have got such a state of things, from the very nature of our industry, if we are to get three years of preliminary work done, it has got to be in effect subsidized from some quarter, and this subsidy lies in the fact that the wage-earning miner will devote his own labor and some of his accumulated savings to this work. If, on the other hand, any form of law is put in force which discourages him from this, it means the ultimate curtailment of mining development at its very root, and to my mind that is the evil from which Australia is suffering today. That country is potentially one of the greatest mining countries in the world, and yet the proportion of new mines which have come forward during the past ten years has been ridiculously small. In other words, the population is not engaged in sowing the seeds of mining development which ultimately result in a certain definite new crop of substantial mines, such as in the United States.

It may be said in opposition to the above that under the Australian form of law, exemption is given sometimes from this continuous employment of labor, in order to encourage men or to meet their necessities. This, however, is a matter of favor; it is not a matter of right, and the exemptions are zealously guarded. In any event, although the actual administration of the law might be very liberal, the fear of its conditions has been sufficient to stifle the industry.

London, April 25. H. C. Hoover.

Government Bureaus and Potash

The Editor:

Sir—In your issue of May 11, J. D. Kennedy of Manhattan, Nevada, makes some allusions to the potash prospecting enterprise in Railroad valley, Nevada, which, whether intentional or not, are unfair and based upon error as to facts, and as president of the Railroad Valley Saline Co. I desire to state the facts. This company is now drilling a test-hole in the salt marsh of Railroad valley with the hope of discovering a valuable buried deposit of soluble potash salts. This hole is now about 600 ft. deep. This enterprise was started nearly a year ago as a result of the general potash agitation; but this location was decided upon partly because it was a matter of public record well known for the past thirty years, that the surface salts of Railroad valley carried a remarkable amount of potash, and partly because the examination of various engineers determined that the geological surroundings and drainage conditions of the Railroad valley marsh were at least as favorable as any other locality for a possible concentration of potash salts during former lake periods. It is only since last October that representatives of the U. S. Geological Survey and the Bureau of Soils have at different times examined Railroad valley as part of the general field of research of these bureaus. They have spent an aggregate of nearly three weeks in Railroad valley and taken over 200 samples of waters and soils, with results, so far as published, confirmatory of the earlier private reports. It still remains to be proved that there is any extensive deposit of potash salts in Railroad valley, or if there is, that these could be manufactured to commercial form and marketed at a profit.

The Railroad Valley Saline Co. is a Nevada corporation, a mutual association of many of the leading mining men of Nevada and their personal friends in San Francisco and the East, all of whom fully understand the nature of the

gamble taken, and at the very start marked off as a loss all moneys risked in the enterprise. The company's capitalization is 100,000 shares of assessable stock, and it publicly invited the support of "only those who would cheerfully lose if final results were adverse." Its weekly reports of progress and results are officially published in the *Tonopah Miner*, and all interested parties as well as the government bureaus have been invited to examine the drilling and its log samples, in the hope that scientific and other public benefits might be secured from the undertaking, even if no valuable deposit of potash was found. In the incidental results to date of starting a 'good roads' campaign and providing artesian conditions in a great valley, the enterprise has already justified itself even in a commercial sense.

We do not know of any parties in Manhattan or elsewhere who have invested money in Railroad valley in potash locations or otherwise without a full knowledge of the exact conditions and willingness to take a long chance as much for the spirit of public enterprise as for possible profit.

San Francisco, May 22. VICTOR BARNDT.

Experimental Work on Manganese Silver Ore

The Editor:

Sir—In testing some manganese silver ores in 1910 I had an experience similar to that of E. M. Hamilton published in the *Mining and Scientific Press* of December 4, 1909. From his results he summarizes the following in addition to a chloridizing roast as giving good cyanide extractions: (A) preliminary to roasting with sulphur in the absence of air, (B) preliminary treatment with alkaline sulphides, (C) preliminary treatment with hydrochloric acid, (D) preliminary treatment with sulphurous acid.

In the tests on the ore that came under my observation, it was discovered that the ore in place would give about 65% extraction, while the fillings with about the same manganese content yielded 85%. These fillings had been standing approximately 25 years and contained considerable organic matter. Calcium carbonate was the principal constituent of the gangue of both ores and fillings, but some small amounts of ore from near the surface contained no carbonate and were distinctly acid in character. In the chemical examination of the ore and filling it was found that in the ore the manganese existed principally as MnO_2, while in the fill it was mostly in some lower form of oxidation, possibly as MnO. With this as a basis I carried out the following experiments:

About 10 kg. of ore was crushed to ¼-in. mesh, half mixed with a little manure and ¼ kg. of sawdust dampened and allowed to stand with occasional dampening and stirring for 30 days. The organic matter was carefully screened and washed out, the sample crushed to 150-mesh and cyanided. This gave 75% extraction as against 67% for the untreated half of the sample. Reduction tests were tried with the following reagents:

$FeSO_4$. Liberated Fe_2O_3, coloring the yellow ore. The possible reaction being as follows:

$$3MnO_2 + 6FeSO_4 = 2Fe_2(SO_4)_3 + Fe_2O_3 + 3MnO$$

$FeCl_2$. Action similar. With NH_4Cl added, the reaction is apparently more complete, as MnO is soluble to some extent in NH_4Cl. (Comey's Dictionary of Chemical Solubilities.)

Sulphites gave no reaction.

Na_2S in 20% solution bleached the ore almost white. Treatment with a 1% solution showed a very small increase in extraction.

Alkaline oxalates gave no reaction.

Oxalic acid in presence of sulphuric acid on acid ore gave 90% extraction.

Hydrochloric acid gave (1) 71% extraction, (2) over 90% extraction.

$FeSO_4$ experiments: The $FeSO_4$ was allowed to act for 6 hours; 250 gm. ore used to 1000 c.c. of each strength solution. Ore ground to pass 150-mesh. This ore contained over 20% $CaCO_3$.

Number	Strength $FeSO_4$. Wt. (%)	Value Ore gm. Ag	Value Tailing gm. Ag	Extraction, %...	KCN cons'd kg.
1	3	418	101	75.8	3.75
2	2¼	418	105	74.8	3.45
3	1½	418	122	70.8	2.35
4	¼	418	132	68.8	2.23
5	⅜	418	123	70.5	2.04
6	untreated	418	146	65.0	2.06

TEST ON ACID ORE

Number		Ore, gm. Ag	Tailing, gm. Ag.	Extraction, %...
1.	Untreated	1211	673	44.4
2.	Reduction with oxalic acid in presence of H_2SO_4	1211	117	90.3
3.	HCl treatment	1211	350	71.0

In the above tests the ore was ground to pass 150-mesh. For No. 2 test 18 gm. oxalic acid was used with 500 c.c. of 1% solution of H_2SO_4. For No. 3, 500 c.c. of 1% solution of HCl was allowed to act 1½ hours.

I am inclined to think that the low extraction of No. 3 was due to an insufficient quantity of hydrochloric acid, as a test on another sample with a larger quantity of HCl gave an extraction of over 90%. In the untreated ores, the extraction of the gold varied between 65 and 84% without any apparent relation to the behavior of the silver. I hope others who have had more experience than myself will come forward with their results, and I would like to advance the following suggestion for discussion. That it is the state of oxidation of the manganese that is at least partly responsible for the poor results on these ores. That as the cyanide penetrates the manganese dioxide to the enclosed silver particle it is slowly oxidized to cyanate, carbamide, or perhaps carbonate (which have no action on silver sulphide) according to the well known equation representing the ultimate decomposition of cyanide exposed to air and moisture. At all events, it seems probable that, whatever the relation between the manganese and the silver, the addition of some suitable reducing agent would have a beneficial result on the silver extraction of these ores.

BYRON JACKSON.

San Francisco, April 8.

Copper Smelting in Siberia

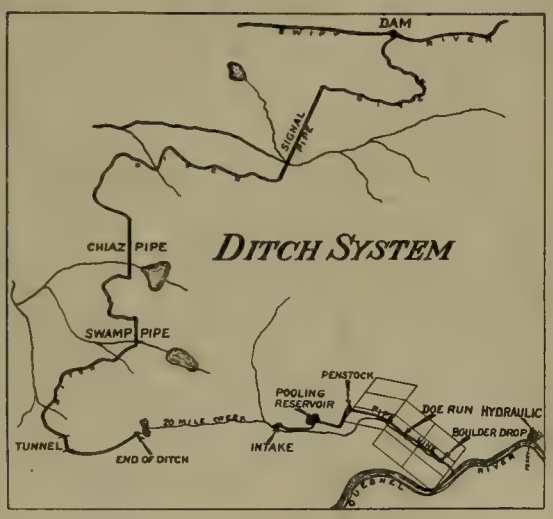
On September 10, 1911, a new copper smelting works was started in Siberia on the River Ulen in the district of Minusinsk of the Yenissei government. This business owes its existence to the energy of a young mining engineer, M. Ph. Delaru, who at his own risk began investigations in the year 1905. When, in 1907, he had acquired sufficiently encouraging results, some Moscow capitalists joined him and a modest plant was started. At present the smelter produces matte only; for, in consequence of the great difficulties in delivering the machinery, the plant is not yet quite finished. The correspondent of the *Gorny Journal* who makes this report says that he was particularly struck with the completeness and efficiency of the arrangements and plant as far as it was constructed and working in 1911. The great interest of the plant is because it is one of the first in Siberia.

Special Correspondence

BRITISH COLUMBIA

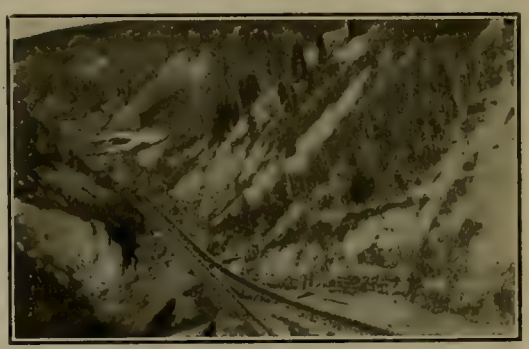
NEW COMPANIES IN THE FIELD.—PLANT OF THE QUESNELLE COMPANY.—MOTHERLODE BEGINS WORK.

The outlook for mining in British Columbia for the current year is more promising than at the corresponding period of recent years, as the following brief summary will indicate. Hydraulicking operations will be larger on the whole than for some years, for in addition to those in the Atlin division of the Cassiar district and the Cariboo division of the Cariboo district, there are those of the Quesnelle Hydraulic Gold Mining Co. in Quesnel division, Cariboo, which has not previously produced. Lode gold mining has had the addition of the operations of the Motherlode Sheep Creek Mining Co., which commenced crushing early in May, besides which the Hedley Gold Mining Co. may be expected to increase its output this year. Silver and lead also will probably show an appreciably large increase, for the Sullivan mine in East Kootenay promises in a large measure to compensate for the loss of output caused by the closing of the St. Eugene; while in Ainsworth division the Blue Bell and several smaller mines, non-productive in 1911, are on this year's list of producers; and Slocan will have the Rambler-Cariboo, Rio, Slocan Star, Standard, and several others to increase its production of these metals. Then the large copper mines—Granby, British Columbia, and Britannia—give promise of making an increased output, and will also add their quota of silver and gold. The Centre Star group and Le Roi No. 2, in Rossland district, are maintaining their production of gold-copper ores; indeed the former, now that the Le Roi has been added to it, is increasing its output. In the Coast district the Marble Bay mine, on Texada island, is the only noticeable producer in addition to the Britannia; its ore yields gold, silver, and copper, and its production continues to be satisfactory. Zinc is the only other metal produced in commercial quantity in the province. The provision of railway transportation facilities for the Lucky Jim mine, Slocan, which has been without them since July 1910, will allow of shipment of crude zinc ore from that property, while silver-zinc concentrate will continue to be shipped from two or three Slocan concentrating plants. Coal mining appears to have improved prospects, for working conditions are normal in the Crow's Nest district, southeast Kootenay, after the long strike of last year, and Vancouver Island collieries find the demand for coal active.



DITCH SYSTEM, QUESNELLE HYDRAULIC G. M. CO.

Mention has already been made of two new companies, the operations of which are expected to add to the mineral production of 1912. Further brief notices of these may be of interest. The Quesnelle Hydraulic Gold Mining Co. is financed chiefly by New York and Philadelphia capitalists. Its water-supply system, completed last summer, covers a distance of approximately 25 miles from the dam on Swift river to the dump on Quesnel river. An important feature is that it includes three inverted siphons of wood-stave pipe, 5 ft. diameter and aggregating 9000 ft. in length and having a capacity of 60,000,000 gal. of water every 24 hours. Another noteworthy fact is that high-carbon steel plates and manganese-steel rails have been placed in the sluiceways. Last winter 85 tons of plates and 25 tons of rails were hauled more than 200 miles, from the Canadian Pacific railway at Asheroft to the mine. The 40-lb. steel rails have been put in along 200 ft. of the sluiceways; eventually there will be a length of 300 ft. The steel plates are 58 in. square, and their carbon content varies from 0.80 to 1.20%. They are spaced 2 in. apart in the sluiceway and each plate is placed half an inch lower than the preceding one. The company's 10 hydraulic leases cover approximately 800 acres of gravel beds. It is estimated that there is, along a well-defined old river channel, a body of auriferous gravel approximating 100,000,000 cu. yd. in quantity. A preliminary run late last season allowed progress toward opening the pits; this season's operations were



SLUICEWAYS, QUESNELLE HYDRAULIC G. M. CO.

commenced on April 15, which is about a month earlier than is usual in Cariboo district.

The Motherlode Sheep Creek Mining Co., which commenced crushing ore early in May, is a Maine corporation, in which the principal shareholder is John McMartin, well known in connection with the Nipissing, La Rose, and Hollinger mines in northern Ontario. William Watson, of New York, is vice-president and general manager, and under his direction the mine has been developed to a depth of 500 ft. below the outcrop and a 3-years supply of gold-bearing ore for the 10-stamp mill blocked out. The mill and cyanide plant include a Blake crusher, ten 1250-lb. stamps, Merrill sizing cones, tube-mill, amalgamating plates, Dorr thickeners, Aldrich slime pumps, four 8 by 25-ft. Pachuca tanks, cyanide vats, Merrill clarifying and precipitation presses, etc. Water is brought in first by two red-fir continuous-stave pipe-lines, 2100 and 4500 ft. long, respectively, and then by 7000 ft. of steel pipe, grade 6 to 14 in., delivering water at the mill at 600 ft. effective head. Power is obtained from six specially designed Pelton water-wheels, which will drive all mill machinery and a compressor having a capacity of 1440 cu. ft. of free air per minute. The aerial tramway from mine to mill is 3600 ft. long, with about 1000 ft. difference in elevation of terminals.

LONDON

NICKEL IN EAST GRIQUALAND.—MODE OF OCCURRENCE.—THE STORY OF BROKEN HILL.

Attention has recently been drawn in London to the copper-nickel deposits in East Griqualand, South Africa. This district is part of the Cape Province and adjoins Natal and Basutoland, and the tract of country where the deposits are found is on the outlying spurs of the Drakensberg mountains. To be precise, the ore is found at Mount

Ayliff in the Insizwa range, 100 miles southwest of Pietermaritzburg in Natal, and 50 miles from the east coast of the Cape Province. The occurrence of copper ore in this district has been known for twenty years, and a limited amount of prospecting has been done, but without any satisfactory results. The examination of the district by the Cape Geological Survey has given a new impetus. The strata are bluish shales, flagstones, and thin sandstones, belonging to the Beaufort series of the Karroo system, and lying nearly horizontal. These beds have been penetrated by numerous intrusions of igneous rocks in the shape of sheets and dikes. Most of the igneous rocks may be classed as dolerite, but the great sheet of the Insizwa range and of the adjoining peaks and ridges partakes more of the nature of gabbro. The metamorphism of the strata caused by the igneous rocks is more pronounced than in the Karroo and Stormberg districts farther west. The copper-nickel ores are chiefly found at the contact of the gabbro and the altered sedimentaries. They are also found to a small extent as impregnations of the sedimentaries, but are more abundant in, and sometimes restricted to, the igneous rocks, of which they appear to have been an original constituent. The mode of occurrence is somewhat similar to that of the copper-nickel deposits at Sudbury, Ontario, and in Norway. Owing to the poor exposure of the base of the gabbro, the evidence of the presence of ore can only be obtained by sinking, and this has been undertaken where the rocks are stained with carbonate of copper or with silicate of nickel, in the presence of limonite, chalcopyrite, and pentlandite. The ores can be generally separated into two groups, one consisting chiefly of chalcopyrite, and the other richer in pyrrhotite and pentlandite, but the character of the ore varies so much and the minerals are so finely divided, that it is doubtful whether the nickel and copper minerals could be separated by ordinary ore-dressing methods. Bornite is also found in thin layers along joints in altered sandstone close to the contact. Niccolite, the arsenide of nickel, has been found in thin veins in the foot-wall in one of the workings. Platinum has been detected in varying amounts, and is considered to be in the form of sperrylite, the arsenide of platinum. In one case it has been found in a sample of ilmenite. The asasys of a large number of samples have shown the copper to average 4%, the nickel 3.8%, and the platinum 2½ dwt. per ton. The Cape government is affording every facility for further prospecting of this deposit.

The story of the British Broken Hill mine constitutes one of those romances that touch the imagination of the adventurous. Eighteen years ago the mine appeared to be on its last legs; the shares stood at half a crown, and there was talk of selling all available assets for 5s. per share, the capital consisting of 300,000 shares. Since then dividends to the amount of £412,500 have been paid, and the shares are now quoted at 60 shillings. At the time of reorganization, in 1894, the working capital had been reduced to £40,000 and the mine was only opened to the second level. After the oxidized orebody had been exhausted, the prosperity of the mine seemed at an end. The metals that rendered the ore valuable had fallen in price, the treatment of the complex sulphide ores was a problem then unsolved and apparently unsolvable, a drought was impending, and the labor position was unfavorable. A turn for the better came with higher metal prices in 1905, the production being greatly increased by solving the zinc problem and the consequent sale of tailing to the Zinc Corporation. This interval of prosperity proved brief. In 1907 the base metals declined in price, the grade of the ore was low, and the mill extraction was disappointing. The next two years were gloomy. It is true that in 1909 a new orebody was cut at the No. 8 level on Block 16, but further exploration appeared to indicate that it was unimportant. Conditions were so hopeless that the mine was then shut down. In June 1910 mining and milling were resumed, and early in 1911 exploratory operations were again started. This was rendered possible by the issue of £30,000 in debentures. Good fortune waited on technical skill, backed by financial courage. A magnificent orebody was found by cross-cutting and diamond-drilling. Bore-holes on the No. 6 level first cut into the ore, the maximum width being 153 ft. Since then it has been proved from the No. 3 to the No. 9 levels. Not less than 2,000,000 tons of ore, calculated to yield a profit of £1 per ton, is said now to be available. At the annual meeting it was proposed that a bonus be given to the mine officials, and that the directors be invited to resume the receipt of the full fees authorized. No man is more deserving of thanks from the shareholders than W. H. Woodhead, the managing director of the British Broken Hill.

BLACK HILLS, SOUTH DAKOTA

AUTOMATIC ELECTRIC PUMPS AT THE HOMESTAKE.—RICH ORE IN THE WASP.—PROGRESS NOTES.

Installation of electric pumps to handle the underground water at the Homestake will be the next matter taken up in the electrification of the plant. Under the plan as outlined, water from all the levels will be drained to the Old Abe shaft, and in the stations of this shaft at the 500, 800, 1100, and 1400-ft. levels electric-driven pumps will be placed, with a capacity of 1000 gal. per minute each. These will hoist the water to the 200-ft. level, from which point it will be conveyed in a flume, by gravity, to the surface. Should it be needed in the mills, a pump installed at this point will raise it to the mill tanks. Eight pumps in all will be placed on the lower levels, as at each of the four levels they will be in duplicate. Worthington pumps, driven by Westinghouse motors, will be used. The switch controlling the motors will be operated by a float resting upon the surface of the water in the sump; the raising or lowering of the water-level thus starting or stopping the pump. The sumps are of a uniform size, 23 by 23 ft., roofed over with steel I-beams and reinforced concrete. Upon these roofs will be placed the pumps and motors. This electrically-operated pumping equipment will make it possible to dispense with a Cornish pump at this shaft that has operated efficiently for a third of a century. The Old Abe shaft is being deepened, sinking having been in progress for nearly a year, and it is now the intention to keep it always a little deeper than the Ellison, which is the principal hoisting shaft of the Homestake.

Although considerable secrecy was maintained in connection with the arrangements, it is now definitely stated that it was J. T. Milliken, president of the Golden Cycle Mining Co., of Cripple Creek, who furnished the money for liquidating certain obligations of the Columbus Consolidated company. The obligations were for delinquent taxes in Lawrence county, $16.235; judgment to Fred Rossiter, $10,032; judgment to C. D. Taggart, $5018. The time for redemption of these judgments expires on October 5, 1912, and unless they are cancelled, Mr. Milliken will secure the property. The tax certificates have a longer time for redemption. The property covers over 600 acres, adjoining the Homestake on the north.

A recent discovery of high-grade ore has been made at the Wasp No. 2, where, under the quartzite, a 2-ft. vein that assays $21 to $417 per ton in gold has been found. The management is confident that the ore will average above $200 per ton. From appearances it is a segregated shoot, and may or may not continue for any great distance. The ore is being sacked for shipment to a smelter. The mill is running steadily at a capacity of nearly 500 tons per day, on ore that goes a little better than $2 per ton. At the director's meeting held on April 15 a dividend of 2c. per share was declared.

Mining men of this section were gratified to hear of the action of the House of Representatives in appropriating funds for the maintenance of the United States assay office at Deadwood. This office is doing valuable work for the local miners, and they would regret to see it closed. Some very rich ore, some of it liberally sprinkled with free gold, has lately been found on the Evans Consolidated property.

where development is under way in charge of C. C. Forester. The ore comes from a vein in the porphyry, and has every indication of permanency. Del Cantield is running the Golden Summit mill, at Hill City, on ore that will average $25 per ton, free milling. This is taken from the vein containing the phenomenally rich streak, 2 in. wide, which was sacked for shipment. Returns from this shipment have not been received, but it is believed that the ore was worth a dollar a pound.

TORONTO, CANADA

GOLD PRODUCTION OF PORCUPINE. — SHORTAGE OF WATER AND COAL. — NEW DISTRICTS ATTRACT ATTENTION.

The estimated gold production of Porcupine to May 13 is as follows: Dome, $58,568; Vipond, $6000; Hollinger, $46,082; McIntyre, $30,000; total, $140,650. The Dome mill is still operating under difficulties as regards the supply of water, and has been working at less than half its capacity. The hummock of quartz from which the mine takes its name has practically disappeared, having been leveled down in the course of mining operations. Work on the Vipond and Hollinger mills, both of which were expected to open about the first of June, has been delayed by the breaking of the railway bridge over the Boston river, delaying the delivery of material. The plans of the Hollinger have been changed in consequence, and instead of waiting for the big crushers, the mill will be started with a small crusher now on hand, as soon as the tube-mills and cyanide plant are ready. The West Dome has laid off part of its day shifts only, owing to the shortage of its fuel supply. The company will be compelled to ship in coal at great expense in order to carry on the work. The Dome Lake will construct a mill of 10 stamps to be operated with tube-mills which will give a capacity of 100 tons per day. One shaft is down below the 100-ft. level, and another nearly to that depth. Driving has been done for several hundred feet, the vein showing a width of 4 ft., and sufficient ore to supply the mill for a year has been blocked out. At the McIntyre a quartz vein has been found in drilling at the west end of Pearl Lake on the strike of the extension of the Hollinger vein system. Shafts No. 1 and 4 are both down below the 200-ft. level in good ore, and stoping operations have been begun. The new orebody at the Davidson, operated by the Crown Chartered, is showing up well. It has been driven upon for 30 ft. with good ore in both faces and cross-cut for 20 ft. in ore. The Hughes will shortly install a compressor. Driving is being done at the 50 and 100-ft. levels, and the shaft will be sunk to 200 ft. Work at the Rea is to be resumed; a number of the shareholders also recently visited the mine and are satisfied that under proper management it will 'make good.' In case the necessary funds for development cannot be raised by a loan or a re-issue of stock, the property will be leased.

Many prospectors and mining men are going into the Kienawisik lake district, about 160 miles east of Cochrane, in Quebec province, and some 45 miles south of the new town of Hurricana on the Grand Trunk Pacific railway. It is reached from Hurricana by water, and a number of gasoline launches have been put on the route. A rush is anticipated as soon as the season is a little farther advanced. It is stated that good free gold discoveries have been made, and many well known mining men have acquired interests in the new camp. The extent and value of the deposits are so far largely conjectural. Another new field in which considerable staking has been done and which is attracting many Porcupine prospectors is Turnbull, some 15 miles to the southwest of Porcupine.

Bullion shipments from Cobalt for the current year to May 12 total 2,937,913 oz., valued at $1,698,820, of which the Nipissing mine furnished 1,376,939 oz. The yield of the Meyer shaft during April was valued at $184,271, and work at the third level shows that at places in the vein there are 10 to 12 ft. of milling ore. The adit at 60 ft. in shaft 122 is in 6-in. of ore almost half silver. Hydraulic prospecting has been begun on the big Nipissing hill with a pump throwing a stream of 4800 gallons per minute, with the object of discovering veins which may have been missed in trenching. As soon as the water in Cobalt lake has sufficiently subsided, the Right of Way will begin work in its No. 2 shaft near the La Rose. A concrete bulkhead will be put in to keep the mine dry. Good ore is being taken from No. 4 shaft. The Nova Scotia will be offered for sale by auction on May 20. The controlling directors, J. A. Jacobs, D. N. Steindler, and M. B. Davis, endeavored to effect a compromise with the creditors, offering to advance $60,000 to alter the mill and meet running expenses, but the creditors forced a sale.

SALT LAKE CITY, UTAH

OHIO COPPER AND THE WALL ROLLS.—EXPANSION AT PARK CITY.—END OF THE CONSOLIDATED MERCUR.

The Ohio Copper company is being watched with a great deal of interest in Utah, but just when it seems about to solve satisfactorily all its metallurgical and financial problems, something invariably happens to set it back. A short time ago glowing reports were being given out about the wonderful success of the Wall rolls, portraying remarkable economies and picturing immense profits in the future through their general adoption throughout the mill. Later came rumors that the corrugated rolls were a complete failure and that the Ohio Copper would sue E. A. Wall, the inventor, for damages. The truth lies between the two extremes. Those who have been watching closely the performance of the

OHIO COPPER CO. MILL

rolls say that they have many strong points, but they are far from perfect. The inventor has not been inclined to act on suggestions of other millmen as to possible improvements, and for some time he has been under treatment for his eyes and unable to give personal attention to the experiments. As a result, little has been accomplished toward perfecting the rolls and bringing them nearer the standard hoped for. Meanwhile the mill is doing fair work, handling close to 2000 tons daily, and the property is making money each month.

The Dern interests, peviously identified with numerous large mining ventures, are turning their attention toward the old Ontario at Park City. The property has been under lease for some time to Henry W. Crowther and associates, and now the Derns have joined Mr. Crowther in the Mines Operating Co. to handle the property on a larger scale. George H. Dern, manager of the Consolidated Mercur, is in charge of the property. The capacity will be increased to 150 tons at once, and later to 300 tons. It is estimated by the engineers of the Mines Operating Co. that there are 700,000 tons of ore, worth $6,000,000, available for treatment by concentration and cyanidation. This is ore which was left years ago because it was unprofitable under the old metallurgical methods.

The Consolidated Mercur has been dying a slow death for years. A year ago the directors warned the stockholders that if there were not more favorable developments, it would be necessary to abandon the property. After a

year of effort to develop new and profitable orebodies, the management now recommends the sale of the equipment and the abandoment of the mine. This will probably be done. The Consolidated Mercur was one of the pioneers in America in the adoption of the cyanide process, and was highly profitable for years. It has been kept in operation so long as it paid expenses out of consideration for the employees and the town of Mercur, but the management objects to running at an actual loss, without visible encouragement for the future. Lead producers are somewhat handicapped by the strike at the American Smelting & Refining Co.'s plant at Murray. Pending a settlement of this difficulty, the company is holding back lead ore shipments. The Daly-Judge at Park City is steadily improving its earnings. The report for the first quarter of 1912 showed net earnings averaging $27,700 per month, or $12,700 above the regular dividends. The cash surplus on April 1. was $469,700.

NEW YORK

MINING COMPANIES AND THE INCOME TAX.—NEVADA HILLS REPORT.—HEINZE SUED.—MEXICAN MINES STILL WORKING.—ZINC MINES PROSPEROUS.—GUGGENHEIMS AT MIAMI.

The matter of greatest interest to mining operators generally throughout the country transpiring during the past week in the East was the decision of Judge Lacombe in the United States Circuit Court in the matter of the United States Government *v.* The Nipissing Mines Co. The suit was based on the refusal of the Nipissing Mines Co. to pay $8000 which the Government claimed to be due for 1909 under the corporation tax law. This tax is levied as 1% on the net income, and is computed by taking the gross income—in the case of a mining company being the value of the ore taken from the ground—and deducting items of expense and depreciation, and also deducting $5000 which is exempt, only those incomes which are in excess of $5000 being taxable. In the year 1909 the Nipissing company paid $5000 under protest and refused to pay the additional $8000 which the Government demanded. The matter was not of supreme importance to the Nipissing company except in so far as it was a test case, the effort being to establish, one way or the other, whether all mining companies must stand taxation on the present estimate of income. The point raised by the mining company was that its dividends are, as a matter of fact, a partial liquidation of assets and that the net income cannot be computed without allowing for depreciation an amount equal to the ore taken from the ground. One of the arguments of the Government, in the particular case under discussion, was that this contention could not be set up because the Nipissing company is a holding company. Judge Lacombe, however, accepted the theory that, for all purposes involved in the case, the two concerns are identical. Richard T. Green, the secretary of and general counsel for the Nipissing Mines Co., said in a recent interview regarding the case: "If we were to pay the tax on the dividends, it would be a double tax, a tax on principal as well as income, since the dividends—ore turned into money—are part of a constantly lessening principal." Judge Lacombe held that it was obvious that there was a depreciation as the ore was taken out. Some of the best posted mining men in New York claim that the Government will lose between fifteen and twenty million dollars of revenue if the position of Judge Lacombe is sustained by the United States Supreme Court. Officers of the Internal Revenue Bureau in Washington decline to make any estimate of the amount which would be lost in this way, but pointed out the fact that mining companies are one of the smallest branches of industry listed among those corporations which contribute in this manner. The point which is raised by the mining companies does not apply to the other industries—steel and cotton mills and similar industrial plants—and the mining industry pays but a small percentage of the total revenue so raised.

The Eastern share markets have been irregular, and there has been an entire lack of anything approaching cohesion in the list. This holds true in large part as to copper shares as well as the various precious metal mines. Pittsburg Silver Peak has re-enlisted a part of the public following it once had, on the news that the long litigation—begun some 12 years ago—has been decided in favor of the present company by the Supreme Court of Nevada. If there is further litigation, the suit, as it now stands, must be taken to the United States Supreme Court. There has been quite a little activity in the various Tonopah issues. The leader in this market for some weeks has been the Tonopah Belmont, this issue having usurped the place so long occupied by Tonopah Mining of Nevada. The declaration of a dividend of 2½% by the Tonopah Extension Mining Co. is glad news to the many holders who long ago despaired of ever realizing anything on their investment. Tonopah Extension was much skyrocketed at one time, and through its connection with Mr. Schwab—the steel magnate of South Bethlehem, Pa.—gained a great deal of notoriety and a very large market following. It is stated, on apparently good authority, that Mr. Schwab still holds the greater part of his stock, not having liquidated it when he again turned his attention to the manufacture of steel products. Mr. Schwab is a striking example of the captain of industry who can step out of the harness, and later, on occasion, show ability to 'come back.'

It is a sign of general mining progress when a property such as Tonopah Mining, instead of working out its property and then going into final liquidation, takes up the examination of a further mining ground with the intention of continuing profitable operations for its shareholders. This has long been the idea carried out by English companies, and if it can be done on this side of the water without arousing criticism such as followed the purchase of the North Dome by the Temiskaming, or the purchase of the Santa Gertrudis by the Camp Bird, it will do much to increase interest in mining investments on the part of the general public. It rarely transpires that final liquidation of a mining property is carried out in a way that satisfies the stockholders. The Tonopah M. Co. management is making every effort to purchase a promising mining property which can be put in process of development while the present property is still a profitable producer.

The annual report of the Nevada Hills had a distinctly adverse effect upon the market, inasmuch as the depreciation, which was figured at $42.67 per ton for the ore taken out, made a showing of a net loss of $458,000. Nevada Hills has a large Eastern following, and if conditions are bettered, as the president, Mr. Wingfield, promises, it will be a great relief to those who have held the shares for several years without return or market action.

The Heinze troubles multiply. Recently F. Augustus Heinze made a determined effort to regain possession of a large amount of securities which he pledged as collateral with one A. D. F. Adams of Boston, attempting to reach by legal proceedings brokers who disposed of the securities for Adams to innocent holders. In this Heinze was unsuccessful, there being an entire failure of proof of any conspiracy to defraud on the part of the brokers who so acted for Adams. The loss so sustained by Heinze is said to amount to something more than a quarter of a million dollars. In addition to this loss, Edward J. Carter, director of the Stewart Mining Co., has brought suit against F. A. Heinze charging that Heinze has transferred 225,000 shares of the stock of the Stewart Mining Co. out of the treasury of the company without reimbursing the company, and that Heinze has appropriated $40,000 of the company's funds without proper accounting. It appears that Heinze has difficulty in distinguishing between doing business and laying up a lot of trouble. Spectacular as his career has been, and profitable as it has been at times to himself, it appears now to be difficult to point to a single success that has not been snarled up beyond hope of disentanglement.

The old La Rose crowd have recently brought to the New York market the promotion of a mining enterprise from the Kootenai country in the southern part of British

Columbia. The new promotion is known as the Motherlode Sheep Creek Mining Co. The properties are about 12 miles from the village of Salmo on the Spokane & Nelson, a branch of the Great Northern railroad. The property has a 10-stamp mill, is equipped with tube-mills, steel tanks, and a hydro-electric plant owned by the company. It is a gold producer, the process consisting of fine grinding and cyaniding.

Not all of the Mexican properties are greatly disturbed by the revolution. The Amparo reports for the period from January 1 to March 25 a crushing of 21,343 tons and a profit of $82,614. The Greene-Cananea is breaking its best previous records. In April it turned out 4,654,000 lb. copper, with 154,597 oz. silver, and 627 oz. gold, and is expected to turn out an additional 1,000,000 lb. of copper in May. The Batopilas property has operated without interruption and produced for the first two weeks in April 14,600 oz. of silver. The various properties at El Oro have suffered no interruption by reason of the disturbed conditions. El Oro Mining & Railway Co., Ltd., reports a profit of $62,510 from its operations in the month of April. It is announced that the Shattuck Arizona people have so far progressed with their plans for the erection of a smelter as to purchase some 250 acres of land at Douglas, adjoining the lands occupied by the Copper Queen and Calumet & Arizona smelters, for the erection of their new plant.

The zinc mines in and about Joplin and Webb City, Missouri, and in the Quapaw reservation in Oklahoma, are experiencing a hitherto unknown degree of prosperity. Zinc ores are selling in the neighborhood of $60, which is about the best previous record.

The copper situation shows no new development beyond a further fractional advance in price to around 16½c., some sellers of copper even quoting above this figure. It is quite apparent that the producers feel that they have the situation entirely in hand and propose as far as possible to make up for some of the 'hard sledding' which they have had since 1907. Increased dividends are looked for in many instances. Calumet & Hecla, North Butte, Quincy Mining, Old Dominion, Tennessee Copper, and others are expected to increase disbursements. It may be considered certain that dividends will be increased where it can be done. There is much accumulated stock to be distributed to the public, and dividends constitute one of the best inducements to bring the general public into the market.

The Guggenheim interests are said to have taken an option on the Needles group and thirteen adjoining claims in the Miami district, near Globe, Arizona. The New York and London markets are both much interested in the rumored possibilities of the dissolution of Amalgamated Copper and the absorption of its assets by the Anaconda. There has been a great deal of interest in the recent silver market, the price on April 30 being higher than at any time since 1907.

GLOBE, ARIZONA

MIAMI APRIL RECORD.—RECONSTRUCTION OF OLD DOMINION SMELTER.—DEVELOPMENT NOTES.—PROGRESS AT INSPIRATION.

The Miami Copper Co. produced during April, 2,688,790 lb. of copper concentrate. There were mined 83,465 tons of ore, of which about 29,000 tons came from development work, 32,000 from square-setting next to the capping, 14,000 tons from the shrinkage stopes, and 8000 tons from the old dump at No. 2 shaft. Development work for the month amounted to 6602 ft., comprising 4492 ft. of driving and 2110 ft. of raising, virtually all in ore. One churn-drill was in continuous operation exploring the northeastern part of the property. The erection of the steel tailing-tower is finished and it is being equipped with four 60-ft. bucket-elevators, all of different make, it being intended to make a test of their wearing qualities. In the concentrator, the 100-hp. motors that drive the intermediate crushing machinery are being replaced by 150-hp. motors, and a small experimental section is being run in connection with the sixth unit. Another water-tube boiler will be added to the power house equipment, after which both compressors can be run to capacity and furnish air for hoisting, that work being now done by steam generated in the hoist-building. A diamond-drill will soon be rigged up on the 570-ft. level and the ground below that level explored. J. Parke Channing was at the mine recently and has gone to New York by way of Nevada.

The smelter production of the Old Dominion for April was 2,150,000 lb. of copper. The management does not expect to materially increase the production until the milling capacity has been increased. Appropriations have been made for construction work that will involve the expenditure of $600,000 during the next two years. The work includes the improvement and enlargement of the concentrator to increase its capacity from 500 tons to 1000 tons per day, and the construction of a new crushing and sampling mill, all to be of steel and concrete. H. Kenyon Burch, designer of the Miami, and other large concentrators, will have charge of the work. Changes will also be made whereby ore will be hoisted in skips instead of cages, thereby increasing hoisting capacity. The erection of the new flue and dust-chamber for the converter plant will be started in about ten days. The shaft is being sunk from the 16th to the 18th level. About 1150 men are employed.

The Superior & Boston is shipping ore to the Old Dominion smelter at Globe, but has difficulty in getting enough cars. The ore is all coming from the stope below the sixth level on the Great Eastern vein and local officials say that a carload per day could be shipped if the cars could be obtained. Shipments were started on April 22, and four cars were shipped during that month, the first three averaging 9½% copper and the fourth 7½%. Six cars were shipped during the first two weeks of May upon which smelter returns have not been received. Development continues on the 12th level, where the southeast cross-cut is being advanced, but nothing new of importance is reported.

About 20 men are employed at the Gibson mine, nine miles west of Miami, and ore is being hauled regularly to Miami and shipped to the Old Dominion smelter at Globe. Work is confined to the fourth and fifth levels on the Pasqúale vein and all ore mined at present is coming from the fourth level, where five stopes are being worked. Cross-cuts driven a few feet into the hanging wall have disclosed shoots of ore as wide and of as high a copper content as those now being stoped, and stoping will be started on these. The south drift on the fourth level is being advanced and drifts are being driven north and south on the fifth level. Shipments assay from 16 to 18% copper.

High-grade gold-lead ore is being hauled from the Duquesne mine, seven miles northwest of Miami, to the town of Miami, preparatory to shipping to the El Paso smelter. Four men are now employed at the mine and are reported to be mining about ten tons of ore per day. The last shipment assayed about 15% lead and over an ounce per ton in gold, and the present shipment is expected to run even better. The development of the New State mine, seven miles northwest of Miami, is under the supervision of John Shaw. Five men are employed and work is at present confined to sinking the shaft, in which 4 ft. of lead-molybdenum ore was recently found. The shaft is 45 ft. deep, and while the vein is of varying width, the ore is reported to be of better grade as depth is gained.

The development of the Inspiration Consolidated mines is proceeding steadily and the number of men employed is being gradually increased. Shafts No. 1 and 2 at the Live Oak mine are being sunk and preparations are being made to resume sinking at the Scorpion shaft. Ore from development is being extracted through the Joe Bush shaft. The tests on the concentration of the ores, that J. M. Callow has been conducting in the experimental mill for the past five months, are completed and some of the results will probably be made public soon. The survey of the Black Warrior ground for a possible millsite continues.

General Mining News

ALASKA

Cordova

The Alaska Consolidated Copper Co., owning the McCarthy properties at the foot of Kuskulana glacier, has sent in A. D. Iles to build a wagon-road from Mile 158 on the C. R. & N. W. railroad.

Fairbanks

The Fairbanks Mining & Reduction Co. has been organized to furnish facilities for custom milling on the various creeks near Fairbanks. Batteries of five stamps of standard make will be purchased this season. W. B. Vanderlip is manager. Strong efforts are being made to interest Congress in the building of an automobile road from Chitina to Fairbanks, so as to provide adequately for mail service the year around.

Ketchikan

Fourteen additional lights, numerous buoys, and several wireless stations have been authorized, and most of them will be erected in Alaskan waters this summer. Martin Bugge is working eight men at Smugglers Cove and has driven an adit 100 ft. on his property. B. A. Earldey is erecting a 10-stamp mill at the Dolomi.

Koyukuk

A stampede is on to Hammond creek, a tributary of Koyukuk, a short distance above Coldfoot. It is said that $30,000 in nuggets was taken from one thawing of three feet on the Hastings ground.

Seward

Repairs along the line of the Alaska Northern are being made. The motor car has been running as far as Mile 49 since May 8.

Valdez

Members of the Valdez chapter of the American Mining Congress have addressed a letter to the secretary, J. F. Callbreath, at Washington, expressing opposition to leasing Government coal lands. Much satisfaction is taken in the fact that the current appropriation bill at Washington provides for the building of a dike to protect Valdez from floods from the glacier.

ARIZONA

Gila County

(Special Correspondence.) — The Southwestern Miami has three churn-drills in continuous operation, but none of the holes are yet deep enough to reach the orebody. One churn-drill is working on the Barney group, on hole No. 3, which is 485 ft. deep and in dacite. The large churn-drill on the Schultze group, under option to the South Live Oak Development Co., is running steadily and is drilling a 17½-in. hole, which is now over 100 ft. deep and in the granite porphyry. Lessees at the Black Warrior mine, near Miami, are still shipping copper silicate ore to the El Paso smelter. The shipments have been averaging about 9% copper.

Globe, May 15.

Greenlee County

The Kinney bill, providing that only English-speaking workmen may be employed in mines and smelters in Arizona has passed the Senate. The Twin Peaks M. Co. has bought the 10-stamp mill of the North American Copper Co., formerly operating near Lordsburg.

Mohave County

The Frisco Mines & Power Co. is shipping about $15,000 in bullion each month, working seven men underground. The George Washington mine, at Mineral Park, is putting in machinery and will soon have forty or fifty men at work. Good orebodies running as high as $80 per ton in gold and silver are being found. Rich ore has been found in the adit of the Nevada-Arizona Mines Co.'s property, at Music Mountain.

Pinal County

Milling costs for the first quarter of the year at the Ray Consolidated were 56c. per ton, while mining costs were 85c. per ton. During the quarter 301,000 tons was milled, producing 7,125,000 lb. of copper in concentrate. Four units of the mill are now in operation, treating 4100 tons per day, and the fifth unit is expected to start by July 1. Of the shares of the Ray Central M. Co., nearly 97% have been exchanged for Ray Consolidated shares. The smelter at Hayden was blown in last week, but no reports have been given out as yet.

CALIFORNIA

Amador County

(Special Correspondence.)—Sinking on the 1400-ft. shaft of the Keystone has been resumed. It is said it will be sunk 500 to 600 ft. more, in the hope of finding the downward extension of the veins. This property recently passed under the control of the New Keystone Mines Co., composed largely of local and San Francisco people. The new vein recently found in the Central Eureka is said to be nearly 10 ft. wide at the 2800-ft. point. All the ore is of milling grade. The 40-stamp mill is running steadily, and the April clean-up is reported to have yielded about

KEYSTONE MINE.

$13,000. This leaves net profits of about $5000. Ore is coming from the 2700 and upper workings. The Bunker Hill paid its regular monthly dividend of 7½c. per share May 15. Conditions at the mine are reported particularly satisfactory, with a large percentage of the tonnage coming from the 1950-ft. level. E. Hampton is superintendent. San Francisco people have resumed work at the Defender. The 300-ft. shaft will be deepened and efforts made to economically treat the large veins of low-grade ore. The property is equipped with a 10-stamp mill. The company plans to employ electric power. It is reported that J. J. McSorley and associates contemplate reopening the Alma mine, within the city limits of Jackson, if sufficient funds can be obtained. The California Exploration Co. has arranged to install two electric pumps at the 1040-ft. point in the shaft of the Plymouth Con. mine at Plymouth. The mine has been unwatered to the 1000-ft. level and the 1040-ft. point will soon be clear. Motors and other equipment have arrived.

Jackson, May 20.

Nevada County

It is reported that the Kenosha mine will be reopened by July 15. R. E. Sutherland, the secretary of the company, will move to Grass Valley soon. G. W. Roote will be in charge. J. C. Low and William Gregory have found rich ore in a raise on the Black Bear group, near Moores Flat, some of which assays $40 per pound.

Sierra County

A 3-ft. vein of good ore has been opened in the Bonanza Queen, according to press reports. Rich ore is also being found at the Sixteen-to-One. All the buildings on the North Fork mine near Forest City, were destroyed by fire recently; the loss is estimated at $3000. C. W. Morse and J. W. Greenbank have taken an option on the Oxford mine, 1½ miles north of Downieville. The directors of the Rio Antigua mine visited the property this week with a view to planning further development. The Kate Hardy

mine has been sold under a deed of trust, and it develops that when J. W. Morrell and W. M. Biggs bought the mine three years ago they borrowed the money to make the purchase and failed to repay it.

TRINITY COUNTY

(Special Correspondence.) The Craig Mining Co. has purchased 30 stamps from the old Fairview mill and is arranging for their installation at the Mason & Thayer quartz mine near Dedrick. Vigorous development of the Mason & Thayer and Globe properties is projected. An electric-power plant will be erected at Canyon creek. R. K. Clancey is manager. The Trinity River M. Co. has arranged for increased activities at its gravel deposits near Lewiston. The new 11-cu. ft. dredge has been practically completed and will go into commission early in June. The electric-power plant is rapidly nearing completion, and an excellent water-supply system has been provided. Eastern people are heavily interested. N. L. Smith is president. The Trinity Hydraulic M. Co. is arranging for resumption of operations. The property has been idle several months, owing, it is said, to the death of a leading stockholder. The holdings embrace 200 acres near Minersville. The property was worked about forty years ago by French capitalists, but recently passed under the control of M. V. Whipple and associates of Minneapolis. M. A. Singer is general manager. Lack of early snow will probably result in shortening the placer season in this county. The late storms have temporarily relieved the situation, but the snows came too late for a long season. La Grange and other large companies have fairly dependable water supplies, but smaller operators are less fortunate. It is reported the Trinity Mining & Reduction Co. is arranging for an increased production at the Headlight mine.

Weaverville, May 19.

TUOLUMNE COUNTY

The mill at the Providence has begun work, and operations have been resumed at the Springfield Tunnel & Development gravel mine. Ten stamps are dropping at the Mammoth mine, Jacksonville. The Van de Weerdt mine, near Columbia, has been bonded to Freeman & Watson. Forty stamps are dropping at the Dutch mine, of which C. H. Segerstrom is manager. New compressors and transformers have been installed and 60 men are employed. B. T. Heckman has been arrested for failure to pay the miners in his employ and is endeavoring to effect settlement by offering them oil stock.

W. N. Sledge and others will explore by drilling the old river channel 2½ miles east of Sugar Pine, with a hope of finding rich gravel.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—Work will be resumed on the Morning Star property on Saxon mountain during the next few days. A 2-ft. body of ore is exposed that mills 55% zinc and 50 oz. silver per ton. E. J. Butts is constructing a cabin and blacksmith shop on a property near Clear lake, on Alpine mountain. An adit is to be driven to intersect a series of veins lately found. Chicago capitalists are interested.

Georgetown, May 17.

(Special Correspondence.)—The shaft-house at the Gem mine on Seaton mountain was destroyed by fire on Saturday, May 11. The loss amounts to $30,000, with insurance of $12,000. Lessees at the Gem mine are maintaining heavy shipments. Varney & Co. are sending out four to five carloads of milling ore per month. Von Tilborg & Co. are stoping on a body of $18 ore that is 11 ft. wide. Shipments are being made to the Newton mill.

Idaho Springs, May 17.

GUNNISON COUNTY

The Blaine M. Co. will resume operation in its mine this summer, and the mill will be repaired. The Hard Cash has been leased and bonded to Denver people. Work will be resumed soon upon the Mountain King properties in Rustler gulch and on the Galena Mountain adit, as well as at the Doctor mine on Spring creek. The snow still lies heavy in many places, but is rapidly going off.

OURAY COUNTY

An electric zinc concentrator will be built on the site of the Beaumont sampler during the coming summer, according to David Foerster of the American Zinc Ore Separation Co. The Brown Mountain company's smelter is progressing rapidly. T. B. Crawford is general manager and George Lowe will be smelter superintendent. The Senorita at Camp Paquin is shipping ore that runs as high as 100 oz. silver. H. A. Lee is negotiating for the sale of the Slide-Newsboy group of mines at Camp Paquin. Lessees at the Newsboy have been shipping silver ore which runs as high as $50 per ton. Ed. Arps and others of Ouray have taken a lease on the Frank Hough mine, above Animas Forks. The Boston people, who last year bought the Emma mine in Ice Lake basin, will resume work soon. Ten stamps are at work at the Atlas on ore from development work, and ten more will be started as soon as water enough is available.

TELLER COUNTY (CRIPPLE CREEK)

The Abe Lincoln shaft, in Poverty gulch, has been leased by the Stratton estate to A. Hahnewald. J. L. Nichols has been elected to fill the vacancy on the directorate of the Mary McKinney, left vacant by the death of his father. It is reported that E. A. Colburn has an option on the Mary McKinney and that if it is taken a mill will be constructed embodying the Warwick-Clancy process. The ore-body has been proved on the 1500-ft. level of the Vindicator. A new ore-shoot has been found on the 600-ft. level of the Ajax, south of the shaft. It is 2½ to 3 ft. wide and assays $30 per ton. The Colburn mill is treating 140 tons per day. The site has been selected for the Gaylord mill and work has started.

IDAHO

IDAHO COUNTY

The 2-stamp mill in the Last Chance, near Elk City, was started last week. The mill is now running on ore taken from development work in the adit in the north vein. The adit is in 260 ft. on the south vein, which is 30 in. wide and yields $30 per ton. The mine is owned by J. P. Larsen of Elk City and Wilson brothers of Spokane. The Golden Rule placer mine started work early in May; the Golden Scale is already at work. At both properties good clean-ups are expected this season.

SHOSHONE COUNTY

The option on the Idora Hill M. Co. property for $225,000, held by J. F. Howarth has been allowed to lapse and the owners are planning to work it themselves. The Bunker Hill & Sullivan has ordered a number of first-aid kits, and the miners are being drilled in first-aid work. This company has paid its 176th dividend, a total of $13,453,950 to date. At the Black Horse mine the winze has reached a depth of 30 ft. and has 3 ft. of ore in the bottom. The Caledonia has purchased new equipment. This company has blocked out a large supply of ore and the stopes and dump are asserted to carry 15 to 40% lead and 40 oz. silver per ton. Charles McKinnis is manager.

A new pump has been put in place at the Nellie, and one shift is at work under Jack Alger and Cap Horton, the owners. The Jack Waite lower adit has reached a point within 100 ft. of the vein. The Knickerbocker is about to commence regular shipments. Work has begun on the project for hydro-electric development at Thompson's falls, and the auxiliary plant at Prospect creek is already under construction.

MONTANA

SILVERBOW COUNTY

The Tuolumne company will double its output this month, and next month will do even better than that. For several months past the company has been shipping 150 tons per day, but during the first week of this month the output was increased and is now averaging 300 tons per day. The new Gagnon four-compartment shaft has been completed to a depth of 2200 ft. When shaft-sinking was going on, sta-

tions were not cut on the various levels. This work is now in progress and will require two months. As all the ore of the Gagnon mine is hoisted through the Original shaft, this new shaft will be maintained only for ventilating purposes. Shaft sinking in the Pilot Butte is going on at the rate of 85 ft. per month, and a depth of 1080 ft. has now been reached. The mines of the Anaconda Copper Mining Co. produced 384,070.20 tons of ore and 4602.61 tons of concentrate during the past year, making a total of 3,848,672.81 tons.

LINCOLN COUNTY

At the Shaughnessy group of claims it is reported that 10 ft. of clean shipping ore has been found.

NEVADA

HUMBOLDT COUNTY

(Special Correspondence.)—The Seven Troughs Coalition Co. is developing several small shoots of quartz. A 12-in. shoot of $60 ore is reported in the west drift. It is understood the company has earned good profits for the first four months of 1912. D. R. Dwyer, of Seattle, has purchased the Hanks lease on Charleston Hill estate, National district. Twenty-five tons of concentrate from the National Mines plant was recently shipped to Winnemucca. The product came from the old Stahl lease dump, estimated to contain 3000 tons of ore averaging $80 per ton. This is at present being crushed by the National mill. The National mines have paid dividends of $570,000 to date. R. M. Edmonds has purchased the holdings of W. Critchfield, and states active work will soon start.

Winnemucca, May 18.

LYON COUNTY

It is reported that the second furnace at the smelter at Thompson will have a length of 30 ft. The furnace now in operation has a length of 25 ft. and is smelting about 700 tons per day. Receipts of ore at the smelter for the week ended May 9 were 2662 tons from the Nevada Douglas, 1954 tons from the Mason Valley, and 562 tons of custom ore. The Yerington Malachite is shipping 30 tons of ore daily to the furnace. The annual meeting of the Nevada Douglas was held at Salt Lake City May 15. During the year ended April 1 the company was producing only part of the time, but yielded 2,385,000 lb. of copper, the net earnings being $79,930.

The average of the ores shipped from the Ludwig property was 5.62% copper; from the Douglas Hill, 5.24%, and from the Copper Basin, 5.06%. The ore reserves of the property, as reported at the meeting, now total 869,000 tons, divided as follows: Ludwig, 469,000 tons; Douglas Hill, 350,000; Copper Basin, 50,000 tons. The gypsum deposit is valued at $750,000, while the half interest in the Nevada Copper Belt Railroad Co. is valued at $500,000. The auditor's report shows a first mortgage bonded indebtedness of $600,000, $160,000 in convertible notes and $93,530 in current items, to offset which are due on settlements for ore $61,001 and notes receivable for $40,342.

An interesting development at the meeting was the appointment of a special committee of directors to investigate the feasibility of the Nevada Douglas company erecting its own smelting plant at the expiration of the prseent contract with the Mason Valley company. Another committee of directors was appointed to investigate the question of erecting a milling plant to treat the gypsum deposit of the property.

WHITE PINE COUNTY

(Special Correspondence.)—A record run was recently made from the steam-shovel pits of the Nevada Consolidated mines, when 14,168 tons of ore was taken out in a single day; 253 cars transported the ore to the smelter at McGill. A daily average production of over 10,000 tons is being maintained, and the plant is running at full capacity. The Veteran mine is contributing 1100 tons per day to the total output. On the 400-ft. level workings the ore recently uncovered is said to average 4 to 10% copper. A small flow of water has developed near this point, and a pump has been installed. Five steam-shovels are working. The Coppermines company reports the discovery of a new body of ore, samples assaying about 10% copper. It is reported the Nevada Northern railway may build a spur track from its road to the mines to facilitate shipments. Shipments of lead ore from the Lead King and Ely Gibraltar mines have commenced. The product is going forward to Salt Lake smelting plants. The ore is estimated to average nearly 70% lead, with some silver. It is rumored the Ely Central has found sulphide ore of workable grade in a churn-drill hole on its Chispy claim.

COPPER FLAT, ELY.

The claim lies south of Copper Flat, but is largely in the rhyolite.

Ely, May 17.

The Nevada Copper Co. produced 6,116,000 lb. of copper during April. The company has made arrangements to pump water from the Zack shaft of the Ely Central for the steam-shovels and locomotives and 250,000 gal. per day will be secured.

OREGON

BAKER COUNTY

The new electrically-operated mill at the Highland gold mine, near Haines, is treating 50 tons per day. The Three Links group on Trail creek has been bonded for $20,000 to a group of mining men. H. R. Barr has sold his one-fourth interest in the Eureka Dei Gratia group on Granite Boulder creek, near Greenhorn, to S. F. Brauson.

JOSEPHINE COUNTY

John Carlson, George Colvin, and Oscar Shattuck have found rich free-milling quartz on the old Victor mine, which was formerly owned by Sanders Brothers, having taken out about $900 in five days. The Minnehaha Gold Hydraulic & Dredge Co. has sold its first issue of shares and will install a $50,000 dredge on its property at Tyhee bar, on Rogue river, a mile below Whiskey creek. Erection of a 500-ton mill at the Alameda copper mine, on Elk creek, is contemplated. A 100-ton concentrator will be erected by the Three Lodes, which has taken in the Golden Pheasant property on Galice creek. The concentrates, which assay as high as 12% copper, $5 to $28 in gold, and 11 oz. platinum per ton, will be shipped to Sweden for treatment.

TEXAS

BREWSTER COUNTY

(Special Correspondence.)—Two of the recent discoveries of gold and silver in the vicinity of Alpine are within the town limits. One outcrop of silver and gold ore that was found at the edge of the city is being explored with splendid results. An assay of the ore shows 1101 oz. of silver and 3.52 oz. of gold per ton. This is causing much prospecting to be done upon other properties near the town. On the opposite side of town from this discovery, another vein is being exploited. In the mountains about four miles from Alpine a recently located claim is being developed with good results.

Alpine, May 15.

UTAH

TOOELE COUNTY

Work will soon be under way for the construction of a

third blast-furnace at the Tooele plant of the International S. & R. Co. A subsidiary company known as the International Lead Refining Co. and capitalized at $500,000, will be organized to take over the lead refinery now under construction in Indiana. The shares of the Utah Metal Mining Co., which is tunneling the divide between Bingham and Tooele, were listed on the Boston Curb recently. The tunnel is 11,000 ft. long, and 2400 ft. still remains to be driven.

WASHINGTON

Spokane County

Graham B. Dennis, chairman of the Spokane section of the American Mining Congress, has appointed W. J. Nicholls, J. H. Tilsley, and W. J. Harris as a committee to raise $10,000 for the convention of the American Mining Congress in Spokane next November. The Spokane Chamber of Commerce guaranteed $5000 to the congress, and it is the intention of the local section to use any funds in excess of that amount in providing excursions to adjacent mining districts. One of the jaunts will be to the Coeur d'Alene. From there the special train will run to Republic by way of Spokane.

CANADA

British Columbia

(Special Correspondence.)—Railway building in British Columbia is active. On Tuesday, May 14, Louis W. Hill, president of the Great Northern railway, with C. R. Grave (who soon is to succeed to the presidency), H. J. Jackson, general passenger department, and M. J. Cortello, railway contractor of St. Paul, drove into Merritt from Penticton by automobile in ten hours, the total distance of 155 miles of British Columbia mountain roads. The party left the next day for Vancouver, where work will be commenced immediately on the construction of the V. V. & E. railway terminal. The Great Northern railway is now pushing construction over the Hope mountains from the Tulameen valley to the coast. The Kettle Valley railway (C. P. R.) is also racing with the Great Northern in building into the Similkameen for a share of tonnage from this rich mineral district. Mining is being stimulated by this railway building. The B. C. Copper Co. has taken up the bond on the Voight group of 62 claims on Copper mountain, having opened up a large deposit of self-fluxing ore. Mr. Campbell, of the Granby company, is in the Similkameen examining copper properties with a view to bonding. J. R. Leckie has taken a working option on the United Empire group of claims near Princeton for the Crown Reserve company of Cobalt. Mr. Tumbull is examining properties in the Similkameen with a view to bonding for the Consolidated M. & S. Co. of Trail, B. C. A number of properties in Camp Hedley are being developed by American capital. The Hedley M. Co. continues to pay regular quarterly dividends of 25% on a capitalization of $1,200,000. M. K. Rodgers is developing the Oregon group. A rich gypsum deposit is being developed near Granite creek. The platinum gravels of the Tulameen river will be developed this summer by four different companies. Coal mining in the Nicola valley is picking up again and coke-ovens are to be erected by the Nicola Valley Coal & Coke Co. The Diamond Vale collieries have not been opened since the big gas explosion and disaster in which five men lost their lives on March 7.

Merritt, May 15.

The Standard Silver-Lead Mining Co. of Spokane, operating a shipping property in the Slocan district, has just paid its second dividend, the amount disbursed being $50,000. Dividend No. 1, of $25,000, was paid April 10. Charles Hussey, secretary-treasurer, announces that the company expects to pay regular monthly dividends from now on. These officers were elected at the annual meeting: president, W. J. C. Wakefield; vice-president, John A. Finch; general manager, George H. Aylard; secretary-treasurer, Charles Hussey. Patrick Clark and the officers constitute the board of directors. It is announced there will be no change in the company's general policy. The mine is in excellent condition, and development is to continue as during the last several months.

White Horse

The railway spur to the copper mines near here is being repaired and 45 men are at work at the mines.

Yukon

A pay-streak 200 to 300 ft. wide, 1 to 5 ft. deep, and averaging $1 per yard, is reported on the Harry Iseman poperty at the mouth of Hunker creek. The Canadian-Klondyke Company expected to start its big dredge about May 1, on which date also the Klondike Mines Railway was planning to resume service. The first train should run through to Dome by May 20. The Northern Navigation Co. has arranged to dispatch five more boats from Dawson this season than last. The first boat of the season scheduled to leave St. Michaels is the *M. L. Washburn*, which is to sail June 18. Plans are being made for a Yukon Exposition at Dawson August 14 to 17.

COLOMBIA

The department of public works has issued a circular calling attention to the fact that foreigners have the same right to acquire mines as Colombians, and that all that is necessary is to comply with the provisions of the mining code. Free instruction in mining is provided at the school of mines at Medellin.

MEXICO

Sonora

April shipments of ore and bullion, by properties in this state, passing through Agua Prieta, were as follows, as shown by the report of the Collector of Customs at that place.

Property.	Cars.	Tons.
Moctezuma Consolidated	250	10,696
El Tigre	8	359
Churunibabi	30	966
San Pablo	1	19
Good Enough	1	33
Tijera	1	30
La Fortuna	1	29
Bellota	1	31
Caridad	1	22
Los Metates	1	8
Vaquero	2	15
Noria	1	15
La Piedad	1	5
Totals	299	12,264

High-grade and bullion: Gueriguito, 28 sacks, 2081 lb.; Los Tajos, 2 bars bullion, 85 lb., 14 sacks ore, 1386 lb.; Batue, 2 sacks ore, 238 lb.; Luz Roja, 40 sacks, 3916 lb.; El Tigre, 56 bars, 5005 pounds.

The total value of all shipments of ore is as follows:

Copper	₱741,900
Silver	369,200
Gold	127,700
	₱1,238,800

NICARAGUA

(Special Correspondence.)—In the Matagalpa district, F. W. Nols, formerly manager of the Babilonia mines of the Arroya Limited, has been appointed general manager of all the Arroya properties in Nicaragua, with headquarters at Matagalpa. George Fairbairn, manager of the Santa Francisca mine, has resigned and accepted the position of superintendent of the Babilonia mine of the Arroya Limited, of which H. W. Coe is manager. Considerable activity in this district may be expected once the financial tangle is settled. The first loan of $1,500,000 to reform the currency has been authorized in the *Assemblea*, and the national bank will now be established. The new monetary unit will probably be the 'cordoba', equivalent to $1 U. S. currency, but this has not been definitely settled as yet.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

J. W. Abbott is here.

A. C. Veatch is at the Palace.

Edmund Juessen is in Nevada.

P. Bouery is at the St. Francis.

T. H. Leggett is in San Francisco.

James T. Wall is in San Francisco.

John B. Farish is in San Francisco.

Louis A. Wright was here during the week.

J. E. Spurr visited the Mother Lode recently.

Charles Janin will leave for Nome, June 1.

F. C. Newton will go to New York next week.

Frederick G. Clapp has gone to western Canada.

J. F. Newsom will leave for Alaska during the week.

Victor Barndt was in San Francisco during the week.

H. F. Lefevre has gone to Honduras, returning in July.

Thomas T. Read has gone to Jackson and Amador City.

H. S. Chapman is now at Arroroy, Masbate, Philippine Islands.

E. H. Simonds has gone to Alaska on professional business.

R. B. Stanford has gone to Honduras, to be absent for six weeks.

R. P. McLaughlin has returned from Plumas county, Nevada.

A. W. Allen has joined Francis Drake at Bulawayo, Rhodesia.

F. C. Devereux has returned to Minneapolis from Durango, Mexico.

W. H. Landers has gone to Inyo and Mono counties on professional business.

J. J. Stevenson's address will hereafter be 215 West 101st street, New York.

C. T. Nicholson has returned from Burma and will go to Dawson in a few days.

A. P. Flagler was at Nevada City recently, and has gone to Palm Beach, Florida.

Gelasio Caetani will go to the Bunker Hill & Sullivan mine at Kellogg, Idaho, next Wednesday.

J. P. Channing was in San Francisco during the week and has gone to Oroville, on his way to New York.

D. M. Folsom has accepted a position on the editorial staff of the *Mining and Scientific Press* for the summer.

Arthur Feust has resigned as superintendent of the Esmeralda mine and is now in general consulting practice in Nicaragua.

Ross B. Hoffmann is in charge of field operations for the Pioneer Company of Siberia, Ltd., and left London for Nikolaievsk this week.

Obituary

O. H. Packer died at his home in Berkeley, California, on May 14. He had long been engaged in mining in California and was well known on the Pacific Coast.

Donald M. Scott died at Laurium, Michigan, April 29. He was born in England, went to the Lake Superior country some fifteen years ago, and was employed by several of the large copper mines.

Market Reports

LOCAL METAL PRICES

San Francisco May 23.

Antimony	11—11½c	Quicksilver (flask)	$42
Electrolytic Copper	16½—16¾c	Tin	60—61¼c
Pig Lead	4.45—5.40c	Spelter	7¼—7¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, May 23.—Attention of metal dealers has been mainly centred this week on copper, which was in strong demand. A large business was done both for the home trade and for export. Lead was quiet this week. The demand for spelter has lessened and the market was lifeless. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
May 16	16.63	4.20	6.70	61⅜
" 17	16.10	4.20	6.70	51⅜
" 18	16.20	4.20	6.70	61¼
" 19	Sunday.	No market.		
" 20	16.30	4.20	6.75	61⅜
" 21	16.33	4.20	6.75	61⅜
" 22	16.35	4.20	6.75	61¼

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	May 23.
Camp Bird Ltd	£ 7
El Oro	4½
Esperanza	7½
Oroville Dredging	1¼e
Santa Gertrudis	6½
Tomboy	5½

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, May 23.		Closing Prices May 23.
Adventure	$ 8¼	Mohawk	$ 62½
Allouez	44	North Butte	28½
Calumet & Arizona	71½	Old Dominion	55½
Calumet & Hecla	480	Osceola	118
Centennial	24	Quincy	88
Copper Range	58½	Shannon	14¾
Daly West	5	Superior & Boston	2
Franklin	12¼	Tamarack	42½
Granby	54	Trinity	6¾
Greene Cananea, ctf.	9¼	Utah Con	13¾
Isle-Royale	27¾	Victoria	4
La Salle	6¼	Winona	6¼
Mass Copper	7	Wolverine	109

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, May 23.

Atlanta	$ .28	Mayflower	$ .02
Belcher	.65	Mexican	2.80
Belmont	10.05	Midway	60
B. & B.	.07	Montana-Tonopah	2 87
Booth	.11	Nevada Hills	2.15
Chollar	.05	Ophir	1.35
Combination Fraction	.18	Pittsburg Silver Peak	1.37
Con. Virginia	.60	Round Mountain	.45
Florence	.98	Savage	.06
Goldfield Con.	4.05	Tonopah Extension	2.15
Gould & Curry	.06	Tonopah of Nevada	7.00
Jim Butler	.56	Union	.95
Jumbo Extension	.40	Vernal	.18
MacNamara	.30	West End	2.07

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. May 23.		Closing Prices. May 23
Amalgamated Copper	$ 83	Miami Copper	$ 26
A. S. & R. Co.	86¾	Mines Co. of America	3⅛
Braden Copper	5¾	Nevada Con	22
B. C. Copper Co.	4¼	Nipissing	8
Chino	30¾	Ohio Copper	1⅜
First National	2¾	Ray Con	19¾
Giroux	5¾	Tenn. Copper	45¾
Goldfield Con.	4	Tonopah Belmont	10¼
Greene-Cananea	9¼	Tonopah Ex.	2¼
Hollinger	10¾	Tonopah Mining	7
Inspiration	19¼	Trinity	6¾
Kerr Lake	2¼	Tuolumne Copper	3¼
La Rose	2⅜	Utah Copper	65
Mason Valley	12¾	West End	2
McKinley-Darragh	1¾	Yukon Gold	3⅜

Company Reports

NEVADA HILLS MINING COMPANY

This company, operating at Fairview, Nevada, has an authorized capital of 1,250,000 shares of $5 each, of which 1,065,051 shares have been issued. Construction of the company mill was started in the autumn of 1910, was completed and operation of the mill started September 12, 1911, and closed down on January 13, 1912, on account of lack of hydro-electric power. The operations for the year ended March 31, 1912, during which the mill ran four months, are summarized below. The mill resumed operation April 15, 1912. During the four months of operation, ore from cleaning out old stopes was used, of a character unsuitable for the highest recovery, with the result that the operating cost was abnormally high and the recovery abnormally low. The earnings for the year were $249,873, and the operating expenses $184,235, leaving an operating profit of $65,638. The sum of $48,000 was charged off as depreciation on plant and property, and depreciation was charged off upon the mine at the rate of $42.67 per ton of ore extracted in order to make the accounts comply with the requirements of the Federal income tax assessors. It should be noted that the ore treated during the year averaged $27 per ton, and the unit $42.67 represents the estimated cost per ton to the company of its whole estimated tonnage. An indebtedness of $495,000 was incurred, but it is hoped to repay this quickly from the profits accruing from regular operation.

PRODUCTION

	Tons	Value	Average per ton
Development	1425	$ 27,787.50	$19.50
Stoping	5081	127,255.40	25.04
Dumps	4450	141,000.00	31.69
Totals	10956	$296,042.90	$27.02

PRODUCTION BY MONTHS

1911	Tons	Per Ton	Gross Value	Recovered	Per Ton	Per Cent Recovery
September	1138	$24.35	$27,713.00	$25,505.00	$22.41	92. %
October	2735	28 77	78,701.88	71,776.88	26.24	91.2
November	2715	23.74	64,463.42	56,675.66	20.87	87.9
December	2930	27.56	80,738.73	70,403.73	24.03	87.2
1912						
January	1430	29.60	42,328.34	36,589.04	25.59	86.4
Totals	10948	26.85	293,945.37	260,950.31	23.84	88.8%
ORE SHIPPED:						
1912						
January	8	262.19	2,097.53			
Total Prod'c'n.	10,956	27.02	296,042.90			

OPERATING COSTS

ITEM	Per Ton		Total	
Mining 6506 Tons:				
Labor	$6.68		$43,491.93	
Supplies	1.88		12,216.48	
Power	.77	$9.33	5,038.87	$60,747.28
Milling 10,948 Tons:				
Labor	$1.70		$18,583.15	
Supplies	2.37		26,005.38	
Power	.81	4.88	8,923.33	53,511.86
Moving Ore from Dumps (4450 tons):				
Labor	$1.16		$5,177.30	
Supplies	.03		142.32	
Power	.06	1.25	241.58	5,561.20
Total Operating				$119,820.34

SUMMARY

Total Production 10,956 Tons.

	Per Ton	Total
Labor	$6.14	$67,252.38
Supplies	3.50	38,364.18
Power	1.30	14,203.78
Total	$10.94	$119,820.34

LA ROSE CONSOLIDATED MINES CO.

This company, organized under the laws of the state of Maine, has an authorized capital of 1,500,000 shares of $5 each, of which 1,498,627 have been issued. The assets of the company consist of the entire capital stock of the La Rose Mines, Ltd., the Lawson Mines, Ltd., and the Violet Mining Co., valued at $7,474,990, and 7262 shares of University Mines, Ltd., valued at $18,145. The income of the company for the year ended December 31, 1911, was $627,000 received as dividends on 6,000,000 shares of La Rose Mines, Ltd. Of this $599,450 was paid out in dividends of the La Rose Con. Mines Co. and $33,319 expended on administration, thus cutting down the surplus of the holding company to $7591. This company is merely a holding company and has no physical assets. Of the companies of which the shares are held, only the La Rose Mines, Ltd., is a source of profit. No work was done on the University Mines during the year, and in the Violet mine only a small amount of exploratory work was done, without finding ore. The Lawson mine produced 1,221,000 oz. of silver during the year, but the profit from this mine is not separated from that of the La Rose in the accounts. Some details of operation follow. Shipments during the year amounted to 3561.4 tons, containing 4,092,709 oz. of silver, of a net value of $2,014,391, or $441 per ton. The average price received for silver was 53.55c. per ounce. The freight charges amounted to 2% of the gross content of the ore, treatment 1.32%, and smelter deduction on silver 5.14%, sampling, assaying, and other charges 1.04%, a total of 9.5%. In the concentrating plant a recovery of 75.4% is made on a concentration of 32 tons into 1; 36,264 tons having been milled. The cost of milling is given as $3.02 per ton of ore milled.

DOBIE MINES, LIMITED

This company has an authorized capital of 300,000 shares of $5 each, of which 240,000 have been issued, and owns three patented claims, purchased from the Tisdale Mining Co. The report of George E. Farish, the general manager, for the year ended March 31, 1912, concludes as follows:

"It will be noted that upon the 60-ft. level, as shown in the incline raise, the vein has an average width of 2.5 ft., with an average value of $3.94 over a length of 33 ft. On the 90-ft. level, while the hanging wall is well defined, the vein is narrow, and at no point over a length of 151 ft. does the most careful sampling and panning disclose profitable ore. * * * Though this vein may widen, forming mineralized lenses both along the strike and dip, and though it is also true that other lenses may occur along possible fracture planes in the more schisted area encountered in the north cross-cut at the 90-ft. level, there is nothing to indicate that they will be of commercial size or value. From the development done and a careful consideration of the conditions here presented, I consider that the prospects of finding ore-shoots of sufficient size and value to make this a paying property are not encouraging enough to warrant further expenditures, and I have therefore recommended that the property be closed down. While it is possible that development upon the adjoining properties may at some future date make it advisable to further prospect the ground, there is nothing at this time to warrant further expenditure upon the property."

The balance sheet of the mine office books is as follows:

ASSETS AND EXPENDITURES

Properties	$1,073,500.18
Buildings	4,153,97
Plant and equipment	9,619.83
Fuel	1,920.04
General supplies	938.49
Boarding-house supplies	594.45
Accounts receivable	25.25
Cash in bank	2,424.59
Development	46,130.59
Roads	723.17
Expense accounts	12,069.44
	$1,152,100.00

LIABILITIES AND RECEIPTS

Montreal Office—Current acct. (remittances to mine office)	$ 52,100.00
Montreal Office—Special acct. (property account)	1,100,000.00
	$1,152,100.00

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

TREATISE ON HYDRAULICS. By Mansfield Merriman. Pp. 565. John Wiley & Sons, New York, 1912. For sale by the *Mining and Scientific Press*. Price $4.

This is the ninth edition of a standard work, revised and reset with the assistance of Thaddeus Merriman. The eighth edition was published in May 1903. Much new matter will be found on hydraulic instruments, methods of measuring water, oblique weirs, submerged tubes, regulating devices for pipes, conduits, dams, backwater, rainfall, evaporation, and run-off, bringing the subject matter up to present-day practice in hydraulics. The tables of coefficients for orifices, weirs, pipes, conduits, and channels have been revised and extended to embody the results of recent experiments. A new and simplified method of designating numerals has been employed, facilitating ready reference to formulæ discussed in the subject matter. A thorough subject index has been included, and the book is in every way up to the standard that has made nine editions and many reprints necessary since its first appearance in February 1899.

CENTRIFUGAL PUMPING MACHINERY. By Carl George de Laval. Pp. 180, index. McGraw-Hill Book Co., New York, 1912. For sale by the *Mining and Scientific Press*. Price $3.

The author's preface remarks that "A writer upon centrifugal pumps has said that they defy the mathematician and possess more tricks than a circus mule." The reference to the mule is a particularly apt simile as applied to a centrifugal pump, as, with all its idiosyncrasies and occasional defiance of all known rules, it fills a function in the world's work for which there is no adequate substitute. Mr. de Laval is general manager for the Henry R. Worthington Co., and as such has had an exceptional opportunity for the compilation of a vast amount of data taken from the actual performance of centrifugal pumps under all sorts of conditions, and, aided by a trained mind and a thorough grasp of the subject, he has brought together the result of many years' experience for the benefit of investigators in the same field. Design, operation, and the factors bearing upon them, as well as the limitation of the adaptability of this style of pump, have been treated exhaustively. In fact, the thoroughness and practicability of this book make it infinitely more valuable than any mere discussion of abstract theory, however learned. In addition, Mr. de Laval has exhaustively discussed, analyzed, and correlated the theory and practice in such a way as to clear away much of the fog that hangs over this subject, and proves that, after all, it is indeed an obstinate pump that can long continue to "defy the mathematician."

TEXT BOOK OF CYANIDE PRACTICE. By H. W. MacFarren. Pp. 291. Ill., index. McGraw-Hill Book Co., New York, 1912. For sale by the *Mining and Scientific Press*. Price $3.

This book covers both the principles and practice of cyanidation, though no attempt is made to describe the treatment at individual mills. It is an excellent general statement; simple, accurate, and well written. Following chapters devoted to history and chemistry of the process, the usual steps in practice, including percolation, agitation, decantation, filtration, precipitation, cleaning-up, etc., are described in detail. The information is fresh and generally accurate, though we do not believe that investigation of the relative efficiencies of various machines has been thorough enough to warrant some of the statements made. Many excellent devices have been perfected and patented for use in cyanidation, but the range of use for most of them is still largely undetermined and their relative value is a factor for determination in each particular situation. Mr. MacFarren is sound in his discrimination between slime and sand, reserving the latter for crystalline particles no matter how fine, and his discussion of slime treatment is one of the best things in the book. Another excellent feature is a bibliography of cyanidation, much the most complete that we have seen. The book closes with a series of conversion and mensuration tables that adds greatly to its usefulness. Several chapters will warrant expansion when a second edition of the book becomes necessary, but Mr. MacFarren has given an excellent epitome of cyanidation as it now is.

THE ELEMENTS OF STRUCTURES. By George A. Hool. Pp. 182, index. McGraw-Hill Book Co., New York, 1912. For sale by the *Mining and Scientific Press*. Price $1.75.

This is the first of a series of books on engineering subjects prepared for students in the University Extension correspondence courses conducted by the University of Wisconsin, at which the author is assistant professor of structural engineering, and deals with the fundamentals of structural engineering in a clear and lucid manner that bespeaks a comprehensive grasp of the subject as well as the ability to impart knowledge to others. The book is prepared for those men who, having an ordinary knowledge of arithmetic, algebra, plane and solid geometry, logarithms, trigonometry, mechanical drawing, and strength of materials, are desirous of continuing their studies on engineering construction. Until the advent of the various excellent correspondence schools, the young man who was ambitious to obtain an education along engineering lines, and was unable to avail himself of a regular university training, had no means of study available other than such books as were prepared for engineers and advanced students. These were so technical as to do little more than confuse and discourage the seeker after knowledge and make his ambition to better his condition seem impossible of accomplishment. Such books as Mr. Hool has given us afford an opportunity for any man possessing a rudimentary education plus a goodly amount of application and ambition, to overcome the lack of a university training and qualify himself to enter the engineering profession.

POWER HOUSE DESIGN. By John F. C. Snell. Longmans, Green & Co., London. Pp. 448, index. For sale by the *Mining and Scientific Press*. Price $6.

The title to this book is somewhat misleading, from an American standpoint, as the proper assembling of apparatus, and the factors governing its selection, installation, and use, form the dominating feature of the subject matter rather than the buildings in which they are enclosed. Practice in many localities is covered thoroughly and comprehensively. Systems, preliminary notes on the choice of site and type of plant, buildings, steam-raising plant, steam and feed-pipe systems, steam generators, various types of condensers, cooling towers, and auxiliaries, internal combustion engines, gas and oil engines, producers, waste-heat stations, hydro-electric power-houses, power-house switchgear, practical notes on electrical plants, small power-houses and substations, form the titles of the chapters into which the book is subdivided, and there are appendices covering water-tube boilers, velocities in circulating water-pipes, British electricity regulations for factories, chimney cooling towers, and tests of feed pumps. These show the comprehensiveness of the text and the variety of types of power-plant installations covered. Seventeen plates illustrating typical power-plants in various parts of the world afford an excellent opportunity for the engineer to study the characteristics in practice both at home and abroad. Many formulæ and much statistical data on performance and operation are presented; in fact, the book is practically an encyclopedia on power-plant design and construction, and the absence of superfluous padding greatly enhances its value as a book of reference and facilitates ready reference to the subject upon which information is desired.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

RELOCATION by the original locator of a claim or any part of it within three years of his failure to perform development work as required by United States statutes, is forbidden by the California statute.

CHEMICAL mixtures—the so-called 'unknowns' of the teachers of chemistry—of predetermined composition can now be obtained from some of the principal dealers in chemicals, accompanied by an accurate analysis, and the labor of preparing and analyzing such mixtures is thereby saved.

RIPARIAN rights exist in Montana and are recognized. An appropriation is made by posting a notice in writing at a conspicuous place at the intended point of diversion, stating amount claimed, purpose of appropriation, place of intended use, means of diversion, date of appropriation, and name of appropriator. Within twenty days file with the county clerk a notice of appropriation containing in addition the name or a description of the stream, description of the point of diversion, and reference to a natural object or permanent monument. Notice must be verified as an affidavit. Work must be commenced within forty days of posting notice and must be conducted with reasonable diligence to completion.

BONUS systems of payment are of great advantage where speed is important. At the Laramie tunnel in Colorado the system finally adopted was as follows: When the rate of driving for any calendar month exceeded 400 ft. and was less than 500 ft., each underground employee was paid $10 extra; between 500 and 600 ft., the bonus was $15; and between 600 and 700 ft., $20. This bonus should have been paid to the men in currency, so as to distinguish it from the earnings under the wage schedule, but as this was impracticable, money earned under the bonus was paid with a separate check, thus giving the men a better opportunity to realize what speed meant to them as well as to the contractor.

MONAZITE and zircon are minerals containing rare-earth metals, whose property of becoming incandescent when heated render them valuable in certain forms of gas and electric lights. Monazite is employed in the manufacture of incandescent gas-light mantles of the Welsbach type, and the oxide obtained from zircon enters into the composition of the glower of the Nernst electric light. Both minerals are found in the United States and have been produced to a considerable extent. During 1911, according to the U. S. Geological Survey, no monazite was marketed, although 13,132 lb. of crude sand or 'ore' is reported as mined in North Carolina and South Carolina. Zircon was produced in 1911 to the amount of 3208 lb., valued at $802.

WISCONSIN, New Jersey, and Nevada are the only states in which a heating value requirement for gas has been made by the state authorities. By the ruling of the state commissions, the monthly average 'gross' heating value demanded in the first two is 600 b.t.u. per cubic foot of gas, with a minimum value of 550 b.t.u. allowed; in the last named the values specified are 550 and 500, respectively. The public-service commission of the second district of New York has urged such amendments to the state law as will allow the desired thermal requirements to be made by the commission. They are already making extended tests in co-operation with the companies of their district to determine the desirable standards to establish. The public-service commission of Maryland is not yet prepared to establish a requirement as to heating value for the entire state.

Recent Publications

IRON ORE RESERVES OF MICHIGAN IN 1911. By C. K. Leith. U. S. Geol. Surv. Advance Chapter from Mineral Resources of the United States, 1911. Pp. 18. Index, ill., map. Washington, 1912.

A RECONNAISSANCE OF THE JARBIDGE, CONTACT, AND ELK MOUNTAIN MINING DISTRICTS, ELKO COUNTY, NEVADA. By F. C. Schrader. U. S. Geol. Surv. Bulletin 497. Pp. 162. Index, maps, ill. Washington, 1912.

THE PRODUCTION OF BAUXITE AND ALUMINUM IN 1911. By W. C. Phalen. Advance Chapter from 'Mineral Resources of the United States.' Calendar Year 1911. 19 pp.; tables. U. S. Geol. Surv. Washington, 1912.

VENEERS: 1910. FOREST PRODUCTS. No. 5. Bureau of the Census. Compiled in co-operation with the Department of Agriculture; Forest Service, Henry S. Graves, Forester. 6 pp.; tables. Washington, December 20, 1911.

POLES PURCHASED, 1910. FOREST PRODUCTS. No. 9. Bureau of the Census. Compiled in co-operation with the Department of Agriculture; Forest Service, Henry S. Graves, Forester. 7 pp.; tables. Washington, January 16, 1912.

WOOD DISTILLATION, 1910. FOREST PRODUCTS. No. 7. Bureau of the Census. Compiled in co-operation with the Department of Agriculture; Forest Service, Henry S. Graves, Forester. 5 pp.; tables. Washington, December 20, 1911.

TIGHT COOPERAGE STOCK, 1910. FOREST PRODUCTS. No. 6. Bureau of the Census. Compiled in co-operation with the Department of Agriculture; Forest Service, Henry S. Graves, Forester. 12 pp.; tables. Washington, January 20, 1912.

MANUFACTURING AND BUSINESS OPPORTUNITIES IN WESTERN CANADA ALONG THE LINES OF THE CANADIAN PACIFIC RAILWAY. Third Edition, 1912. By Industrial Department, Western Lines. 161 pp.; index, map. Winnipeg, Canada, 1912.

GAGING STATIONS MAINTAINED BY THE UNITED STATES GEOLOGICAL SURVEY, 1888-1910, AND SURVEY PUBLICATIONS RELATING TO WATER RESOURCES. By B. D. Wood. Water-Supply Paper 280. U. S. Geol. Surv. Pp. 102. Index. Washington, 1912.

OUR WASTE LANDS. A PRELIMINARY STUDY OF EROSION IN MISSISSIPPI. By E. N. Lowe. WITH AN APPENDED ADDRESS ON MISSISSIPPI'S AGRICULTURAL POTENTIALITIES. By W. J. McGee, Washington, July 12, 1910. Mississippi Geol. Surv. Pp. 23.

SUMMARY OF THE WAGES AND HOURS OF LABOR FROM THE REPORT ON CONDITIONS OF EMPLOYMENT IN THE IRON AND STEEL INDUSTRY IN THE UNITED STATES. By Charles P. Neill. Sixty-second Cong., 2nd Ses., Doc. 301. 57 pp.; index. Washington, 1912.

TESTS OF COLUMNS: AN INVESTIGATION OF THE VALUE OF CONCRETE AS REINFORCEMENT FOR STRUCTURAL STEEL COLUMNS. By Arthur N. Talbot and Arthur R. Lord. University of Illinois Bulletin No. 56. Pp. 47. Ill., map, index. Urbana, March, 1912. Price 25 cents.

PETROLEUM AND NATURAL GAS IN KENTUCKY. By M. J. Munn. Part II.—Mineral Fuels. Advance Chapter from Contribution to Economic Geology (Short Papers and Preliminary Reports), 1910. Bull. 471—A-1. 25 pp.; maps. U. S. Geol. Surv. Washington, 1912.

TECHNOLOGIC PAPERS OF THE BUREAU OF STANDARDS. No. 2. THE STRENGTH OF REINFORCED CONCRETE BEAMS. RESULTS OF TESTS OF 333 BEAMS (First Series). By Richard L. Humphrey and Louis H. Losse. (June 27, 1912.) Pp. 200. Ill., maps, index. Washington, 1912.

PETROLEUM AND NATURAL GAS IN WYOMING. By C. H. Wegemann. Advance Chapter from Contributions to Economic Geology (Short Papers and Preliminary Reports), 1910. Part II.—Mineral Fuels. Bull. 471—A-3. 20 pp.; maps. U. S. Geol. Surv. Washington, 1912.

Commercial Paragraphs

EDGAR ALLEN & CO., LIMITED, manufacturers of tool steel have moved their Chicago office to 718 West Lake street.

BUCYRUS COMPANY announces the opening of an office at No. 1250 Brown-Marx building, Birmingham, Alabama, under the management of E. L. Byron.

THE ROBINS CONVEYING BELT CO. has secured a contract for the installation of its ore-handling system at the plants of the C. & A. Co. and the Arizona Copper Co. at Clifton, Arizona.

The Smuggler-Union Mining Co., of Telluride, Colorado, has lately installed two 6-ft. HARDINGE pebble mills. The Tomboy Gold Mines., Ltd., of Telluride, Colorado, will also install two 6-ft. HARDINGE pebble mills.

J. T. B. BOGARDUS, president of the ABENDROTH & ROOT MANUFACTURING CO., builders of Root water-tube boilers and Root spiral riveted pipe, has returned from an extended trip abroad in the interests of the export business of his company.

J. W. STONEHOUSE, Victor, Colorado, has placed on the market an indestructible enameled-steel mine bell signal, which has considerable merit. These signals consist of white letters on a blue background and are enameled on both sides, so that they will not rust or be affected by mine waters.

THE SAMSON MANUFACTURING CO., of Denver, Colorado, wish to announce that it has sold to P. E. GARRETSON and associates, the Samson Manufacturing Co., together with the good will, all rights, title, interest, and patents in the Samson rock-crusher. The business under the new management will be carried on under the same name. The new owners have for some time been manufacturing the National pulverizer and are now extending their business in the mining field.

WILLIAM L. RICKARD and CLIFFORD A. SLOAN announce the organization of an advertising company which will conduct its business under the corporation name of RICKARD & SLOAN. The offices of the company are in the Evening Post building, 20 Vesey street, New York. Particular attention will be given to the planning and management of advertising campaigns for concerns engaged in the manufacture of mechanical and electrical apparatus and accessories. The service of the company will include the writing and placing of advertising in trade and other periodicals, and the production and distribution of bulletins, catalogues, and circulars.

After a careful study of the possibility of cyaniding the refractory ores of the Republic district, the OLIVER CONTINUOUS FILTER CO. made an initial installation, under a positive guarantee of successful work. The work done has exceeded the expectations both of the engineers of the operating companies and of the Oliver Continuous Filter Co. Recent sales in this district include the following: Rathfon Reduction Works, North Washington Power & Reduction Co., San Poil Mining Co., and the British Columbia Copper Co. It is claimed that all the filters in the states of Washington, Oregon, and California are Olivers and that 90% of the filters in Nevada are of the same make.

The executive offices and New York showrooms of the H. W. JOHNS-MANVILLE CO., manufacturers of asbestos, magnesia, and electrical supplies, were moved on April 20 to the new 12-story H. W. Johns-Manville building, Madison avenue and Forty-first street, New York City, from the old quarters at 100 William street, where the company has been for the past fifteen years. Increased business interests in this and other parts of the country have necessitated the move. The large floor area and spacious rooms in the new building will enable a much larger and more complete stock of goods being carried on hand than heretofore, and will also permit of a better supervision over the company's long chain of branch offices, warehouses, stores, and factories scattered throughout the United States and Canada. This change marks the fifty-fourth anniversary of the company.

What is claimed as the largest order for motor trucks placed with one organization has just been given the INTERNATIONAL MOTOR CO., manufacturers of the Mack, Saurer, and Hewitt trucks, by the Star Motor Delivery Co. and the City Fuel Co. of Chicago. The Star Motor Delivery Co. of Chicago, which is perhaps the largest organization yet formed for general public trucking and transportation service in this country, has just placed an order with the International Motor Co. for 50 Mack trucks of various sizes which are to be put in service within the next few months for handling urban and suburban delivery service of Chicago merchants. This order was placed after months of the most searching investigation and rigid tests of practically every American make of motor truck, and the fact that the Mack was finally selected as the machine best adapted for the severity of the conditions is a distinct triumph for the manufacturers of this oldest of American-made trucks.

The order of the City Fuel Co. for 25 Saurer trucks is the largest single order ever placed by a coal merchant for motor transportation, and comes as a flattering endorsement of the motor truck by an industry which has been, perhaps, one of the most reluctant to be converted to the advantage of motor transportation up to the present time. The first 15 of the Saurer trucks to go into service for the City Fuel Co. will displace 70 double teams, and it is said that before deciding to motorize the delivery department, the City Fuel Co. investigated, tested, and had demonstrated every motor truck of any consequence on the market. In making a test and study of motor trucks for over two years and putting in an investment that means the scrapping of many thousands of dollars worth of existing horse-truck equipment, the City Fuel Co. has pointed the way for hundreds of coal dealers to solve one of their most growing problems—the expeditious, economical, and efficient delivery of coal over a rapidly increasing area which the growth of all large centres has brought about. The City Fuel Co. will use its Saurer trucks in the 'Loop' district of Chicago. The 25 Saurers will displace 100 horses and 25 wagons.

Securing Good Castings for Dodge Products

The Dodge Manufacturing Co., Mishawaka, Indiana, recognizing the fact that the utmost care should be taken in securing the strength of its transmission appliances, maintains a well equipped chemical laboratory. In this laboratory all the various raw materials are analyzed, particularly the pig iron used in the foundry. The composition of the iron is carefully ascertained before it goes into the cupola, and none but the best procurable is used. Although the purchases are made on a guarantee of chemical constituents, each car on being unloaded is sampled for analysis, and the iron remains unused until the report from the company's own chemist shows the exact elements of which it is composed. Some mixtures are high in silicon for soft special castings; some are low in silicon and high in manganese for harder castings. Each mixture, however, is properly proportioned for the work it eventually has to perform.

In charging the cupola, the iron is carefully weighed in the yard, a scale car with a box on it passing from pile to pile of pig iron and getting portions from one pile or another, as the case may demand, to make the proper mixture. These boxes are then hoisted to the charging-floor by an electric crane and are stacked ready for use in the charging-room.

To insure the results in Dodge products, after all care is taken with the composition of raw materials going into the cupola, test bars are taken from the metal coming out, and the final answer to these elaborate preparations is secured. Bars testing 1800 lb. tensile strength to the square inch are considered good by the average foundry, but no metal is considered right for Dodge products unless the test bars show 2200 pounds.

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EDITORIAL

MEXICAN conditions have greatly improved in the last two weeks, and there is now a general feeling that the worst is over. Re-establishment of order throughout the country will necessarily be slow, but defeat of the rebels by the Federal forces in Chihuahua is a long step toward peace.

MANGANESE silver ores have given cyanide experts much trouble and they have but rarely been treated with any degree of satisfaction. We are therefore especially glad to print the full details of a study of these ores, made by Mr. Will H. Coghill in the metallurgical laboratory of Northwestern University. The first of the series of articles appears this week.

PHYSIOGRAPHY is a fascinating science. It was a surprisingly long time before geologists turned their attention from the study of sediments to the question of what was happening on the land while various beds were being laid down in the sea. Just how practical such studies may become is excellently illustrated in Mr. J. B. Tyrrell's study of pay-streaks in placers, noted elsewhere.

CAPITALISTS in search of a large and profitable business have recently been offered the opportunity to join a large international limited liability undertaking for the purpose of working various precious ores. The success of the enterprise, which is Russian in inception, is "guaranteed" by "new methods of extraction without losses." The receiver of the enticing literature circulated by the promoters is informed that such losses "till now amount to 100 per cent or more of the precious metal obtained." We presume this excess loss refers to promotion profits.

DECISION of a case by the United States Supreme Court would seem to settle matters, but does not always do so. In 1908 the Court affirmed a decision of the New York courts in the Old Dominion litigation, and seemed to make it impossible for the company to recover the promotion profits for which suit had been brought against Mr. Albert Bigelow and the estate of Leonard Lewisohn. The case came up again through the Massachusetts courts, and the Supreme Court has just found in favor of the company. The judgment is for $2,100,000 and interest, and is one of the largest ever decreed by the Court against an individual.

MANIPULATION is charged in connection with recent fluctuations in the price of Pittsburg Silver Peak stock. The mine is an excellent one, operated with conspicuous ability. Full details as to methods and costs have been available to readers of the *Mining and Scientific Press* for months, and no one who wished to know had any reason to be deceived as to the value of the shares. The serious phase of the matter is that the decision in the recent litigation was 'tipped off' in San Francisco a day or more in advance of official announcement. However the circumstance occurred, it is such things that make people friendly to the proposal for recall of the judiciary.

NEW DECISIONS are constantly changing the interpretation of the mining law, and readers of our department 'Decisions Relating to Mining' will find themselves amply repaid. The department is edited by an excellent attorney who enjoys unusual facilities for keeping track of changes, and in it will be found announcements of the more important decisions in advance of their general publication.

WE print this week the first part of an elaborate study of the genesis of the lead-silver ores of the Coeur d'Alene district, written by Mr. Oscar H. Hershey. His discrimination of very ancient low-grade lead-zinc deposits that may well have been the parents of the orebodies now being worked, is an especially interesting point. In the continuation of this article Mr. Hershey will describe these mineral bodies more in detail and will discuss the relations of the ores to the faulting in the district.

SHAREHOLDERS in the Han-Yeh-P'ing Iron & Coal Company, which operates blast-furnaces and a steel plant at Hanyang, Hupei province, China, producing 140,000 tons of pig annually, have unanimously refused to sanction an agreement made by the managing director to convert the company into a joint enterprise with Japanese capitalists. The supply of ore for the Japanese Government iron works near Wakamatsu has been largely drawn, under a fifteen-year contract, from mines owned by the Chinese, and the proposed arrangement, which would have been advantageous to the Japanese, who have loaned $4,500,000 to the Chinese company, which is capitalized for $18,000,000, did not meet the approval of either the Chinese shareholders or China's authorities.

WASHINGTON despatches announce the defeat in the Senate of the Cummins substitute for the metal schedule for the tariff bill recently passed by the House of Representatives. There had been some expectation that a combination of Democrats and Progressive Republicans would carry this substitute through the Senate. Mr. F. G. Newlands has now offered an amendment to the House bill proposing a 10 per cent reduction from certain duties the first of next January and a further 5 per cent reduction at the beginning of each succeeding January for four years. A non-partisan tariff commission of five members, appointed by the President, is to be authorized to determine to what products the reductions should apply. In the absence of details it is difficult to say how this would work, but the recognition of the fact that reductions should be made gradually and the effort to lift the matter out of politics is commendable.

DISCUSSION of the need of revision of the American mining and land laws continues actively in the West, but unfortunately little impression is being made upon Congress. Even in so acute a matter as that of the Alaska coal lands, popular interest having been diverted, Congress seems disposed to let matters stand as they are. When an election is impending most congressmen and senators dodge responsibility for any legislation to which there is any opposition; and nothing can be done in regard to Alaska and the coal lands to which someone will not object. This situation is rapidly making converts to the theory that it would be better to pass over to the state and territories, all the remaining public lands as a free gift. There would undoubtedly be much fraud and graft as a result, but the people of the region concerned hold to the right to develop as fundamental. They are willing to make all reasonable concessions, and some which they consider unreasonable, to Eastern sentiment as to the public lands, but some way should be opened through which development can proceed. It is evidently a choice of evils. The Salt Lake Chamber of Commerce has recently adopted strong resolutions urging that some change be made promptly, and the sentiment for similar resolutions elsewhere is strong and growing. It is asked that, pending readjustment, the Secretary of Interior interpret the law and regulations as liberally as is allowable and as much as possible in accordance with established customs. The Mining and Metallurgical Society has a committee at work studying the changes that have been proposed and the San Francisco section has been attempting to formulate the principles that should govern legislation regarding oil lands. Neither report is yet complete and in the meantime discussion of the mining law, especially by those familiar with the codes of other countries, is distinctly helpful. We call especial attention to the article in this issue by Mr. F. J. H. Merrill who brings up the peculiarities of the New York state code, and the workings of the Mexican law. The committee from the American Mining Congress, of which Mr. E. B. Kirby is chairman, has asked Congress to appoint a commission or to authorize one of its own committees, to hold sessions and hear complaints and suggestions regarding the mining law. Nothing has been done with this very sensible and practical suggestion, though a bill for a commission requested by the miners union, to investigate working conditions in mines has been introduced. A little legislation and a few less candidates for the presidency would be sincerely appreciated.

Alaskan Railway Building

Much the most sensible plan yet proposed for meeting the needs of Alaska in the matter of railway building is that embodied in what is known as the '1000-mile bill,' now before Congress. Briefly, this bill proposes: (1) to authorize the President to construct not more than 1000 miles of railroad in Alaska, the line or lines to be such as will, in his judgment, best develop the natural resources of the territory; (2) a commission of five is to be appointed, with an Army engineer as chairman and chief engineer, to have charge of the work; (3) bonds bearing 3 per cent interest and similar to the Panama Canal bonds are to be sold as needed to carry on the work, but money can only be paid out according to annual estimates and as appropriated by Congress; (4) the bonds are to be secured as to principal and sinking fund by a first mortgage on the lines built; (5) until Congress shall provide for operation by leasing or otherwise, the President is to operate the lines as military and postal routes and as common carriers, establishing public rates; (6) the commission may purchase, lease, or contract for haulage rights or transportation over any existing lines, and shall have full power to negotiate such contracts, but is not bound to either purchase or lease; (7) disagreements with existing lines as to rates are to be adjudicated by the Interstate Commerce Commission; (8) an appropriation of $1,000,000 repayable out of bond sales, is to be made to begin the work; (9) in the work the commission may use any of the material belonging to the Government and no longer needed on the Canal Zone.

This bill has been carefully drawn, and embodies the best features of the laws under which the Isthmian Canal Commission and the Reclamation Service are working. Certain features have also been taken from the law under which railroads are being built in the Philippines. Action by the Government, sanctioned by public opinion it is true, has made it entirely impossible for private companies to raise the capital necessary to extend railroad lines through Alaska. It is equally clear that public opinion would not favor a bond grant or other public aid to a private company. Evidently, either the United States Government must

take up the work of railroad construction in the Far North or the country deliberately closed to development. The last is, we believe, far from being the purpose of any considerable part of the American people. Under the circumstances there can be no politics in such a bill as is proposed; in any event progress will be slow, and simple justice to Alaska demands that a start be made. Pass the bill and let the engineers get to work.

Tonopah Mines and Mining

It is just a round dozen years since Jim Butler made the discovery which brought Tonopah into being. While the claims now owned by the Tonopah Mining Company were not staked until August, it was in May that the outcrop of rich silver ore was found and the chain of events that led practically to the rediscovery of Nevada was begun. *The Tonopah Miner*, in an interesting special issue May 25, has summarized the history and present conditions at Tonopah succinctly, and from it the following figures are taken.

The total production of Tonopah can only be estimated, since the records of some of the companies do not include the gross production of some of the early shipments. Taking, however, exact figures so far as they are available, and estimates of company officials to cover the few gaps, the production to the close of April 30, 1912, may be stated as below:

Tonopah Mining	$29,213,153
Tonopah Belmont	10,413,144
Montana-Tonopah	4,600,055
Tonopah Extension	1,022,950
West End Con.	1,247,612
MacNamara	1,404,909
Tonopah Midway	1,273,626
Jim Butler	315,610
North Star	36,224
	$51,527,283

This is a large production for a district to make in twelve years, beginning in a desert and with railways, power lines, water, and all the necessaries of life and work to be supplied. Even more interesting than the fact of the production, is the circumstance that the ore has been mined at a considerable profit. Tonopah is one of the districts in which there has been money made in mining and not alone in company promotion. At the time the Tonopah Mining Company was formed it was so difficult to raise the money needed, that 350,000 shares of preferred stock were sold at $1 per share, two shares of common stock being given as a bonus with each share of preferred. The last of this preferred stock was retired with interest in February 1905. The outstanding stock of the company cost the original owners nothing. Each share has received $8.85 in dividends and is still quoted at about $7 per share. In all, the dividends paid have been as follows:

Tonopah Mining Company	$8,850,000
Preferred stock retired	380,557
Tonopah Belmont	2,843,002
Montana-Tonopah	330,000
Tonopah Extension	300,000
Midway	250,000
MacNamara	50,000
	$13,003,559

Mr. T. A. Rickard has recently written illuminatingly in *The Mining Magazine* about 'phantom profits' and has called attention to the fact that only the money which finds its way into the shareholders' pockets in dividends, is really to be counted in measuring profits. On this basis Tonopah has done well. Over the series of years, roughly 25 per cent of the gross return has gone to the stockholders in dividends. In addition, there has been an accumulation of surplus both as cash and in the form of ore reserves. To an extent, the surplus has been reinvested in plant or in securities of enterprises that would have but small value if the mines ceased to produce, but the Tonopah Mining Company carries a considerable sum in first-class securities and cash, and the other companies have similar, though not so large, resources. The Montana-Tonopah Company has recently purchased the Commonwealth mine in Arizona; the Tonopah Belmont Development Company is reported to have closed a deal for the App mine in California; and the Tonopah Mining Company is well known to be looking for a property in which to reinvest its surplus. It seems likely, therefore, that Tonopah will not only pay its own way, but will directly lead to active development in a number of other districts.

At present there are 260 stamps in operation in the district. The Montana-Tonopah has recently increased the capacity of its mill, the Tonopah Extension and West End Consolidated soon will do so, and the Tonopah Belmont is now building. A little less than a half million tons of ore per year will soon be treated. The practical question is how long this can be kept up.

It has always been difficult to estimate ore reserves at Tonopah. The ore, while rich, occurs in shoots that have been repeatedly faulted, and the rocks have been frequently intruded by later eruptives. The surface is covered by recent volcanics, and only most careful and systematic geologic work with core-drill and drift serves to piece together the mosaic. The district contained originally some of the great ore-shoots of the world; to the miner has fallen the problem of hunting out the scattered fragments, and doing it all at a profit. With the first rich discovery, and in the absence of exact knowledge of the faulting, there was a period of overestimation of the orebodies and underestimation of the difficulties. A good many wild-cat companies sprang up. At that time Mr. J. E. Spurr, then connected with the United States Geological Survey, studied the district and issued a report which, temporarily, made him exceedingly unpopular. Time, however, heals sores, and later Mr. Spurr, having retired from the government service, was invited to re-study the district at the expense of the companies, and they have all come to value his opinion highly. Since the Tonopah Midway Company developed an important orebody 700 feet north of its shaft in virgin ground that Mr. Spurr advised prospecting, the opinion of a geologist has come to have great weight. Many men, however, coöperated in the finding of the ore. The great shoot in the Belmont ground found in December 1909, did as much as any one thing to attract attention anew to the district and to stimulate the present revival of prosperity there. At present the Tonopah Mining Company is understood to have but a small ore reserve in the ground and to be relying mainly on dump ore and the chance of re-investing its surplus. The Belmont undoubtedly has a large reserve and the other companies are credited with ore sufficient to run two to two and one-half years without development. Beyond that it can only be said that a continuation of the present vigorous search may be expected to increase the reserve as needed for many years. Conditions in the district were never more hopeful and several new enterprises have recently been started. Tonopah is a district where the cost of finding ore is high, but where the ore is rich and the profits are large. Not every mine there is paying and not every one will pay when the whole course is run. Mistakes have been made in taking too large chances, but the mines are in good hands, excellent technical work is being done, and the community is prosperous and happy.

Genesis of Lead-Silver Ores in Wardner District, Idaho

By Oscar H. Hershey

Introduction

The town of Wardner is situated in the deep narrow valley of Milo creek, on the south side of the South Fork of the Coeur d'Alene river, in Shoshone county, Idaho. The principal mines in the district are the property of the Bunker Hill & Sullivan Mining & Concentrating Co. Next in importance is the Last Chance mine, operated by the Federal Mining & Smelting Co. The Senator Stewart is at present the third in order of production, and the Caledonia and Ontario the only other producing mines. Formerly the Sierra Nevada and Crown Point mines were of some importance, but have not been operated for years.

My geological field work in the Wardner district was begun on October 10, 1908, and prosecuted continuously (except for several interruptions aggregating less than three months) to August 1910, and has continued at intervals since. Previous to this no detailed geological study of the mines had been made, although the areal geology of most of the district had been mapped in 1903 or 1904 by F. C. Calkins, assisted by W. A. Williams and D. F. MacDonald, and the mines visited by F. L. Ransome. The result of their work is included in 'The Geology and Ore Deposits of the Coeur d'Alene District, Idaho,[1] by Ransome and Calkins, which is now the standard work of reference in the district. Mr. Calkins found that the structure in the Wardner district is too complex and obscure to enable him to do any but very generalized mapping in the time that he could give to the work. The reader is referred to his description of the formations as to their general megascopic and microscopic features. My work has been done for the Bunker Hill & Sullivan company, and its president, F. W. Bradley, and the manager, Stanly A. Easton, have kindly consented to the publication of this paper.

Stratigraphy and Structure

The Burke and Revett formations are thicker and more complex in the vicinity of Wardner than elsewhere in the Coeur d'Alene district, and I have found it practicable, in order to bring out the structure better, to divide the Burke into two members and the Revett into three members. I have also added another formation at the bottom of the series. The following table will sufficiently indicate the character of the sedimentary rocks for the purpose of this paper:

	Approx. thickness, feet.
Wallace Formation.—Thin-bedded, bluish and greenish, calcareous shales, calcareous quartzitic sandstone, and a thin bed of blue-gray limestone....	4,000
St. Regis Formation.—Purple, lavender, and green sericitic quartzite sandstone and indurated shales	1,000
Upper Revett Member.—Rather thin bedded, greenish sericitic quartzites and heavier-bedded white quartzites	900
Middle Revett Member.—Heavy-bedded, white, nearly pure quartzite	100
Lower Revett Member.—Thick-bedded white quartzites, alternating with thinner-bedded greenish sericitic quartzites	1,300
Upper Burke Member.—Thin-bedded greenish sericitic quartzites, alternating with heavy-bedded white quartzites	2,000
Lower Burke Member.—Thin-bedded greenish sericitic quartzites and layers of hard white quartzite; near the top is much purple-gray material undistinguishable from the St. Regis.....	1,500
Prichard Formation.—Gray to black shales in thin regular beds, with slaty cleavage common, and some beds of white quartzite.....	8,000
Cataldo Formation.—Heavy-bedded light lilac quartzites, alternating with dull greenish sericitic quartzites	1,000
	19.800

[1]Professional Paper 62, U. S. Geol. Surv., 1908.

Igneous rocks are not abundant in the district. The Kellogg tunnel cuts a dark-green dike for 75 ft., 4400 ft. from the mouth. R. D. George, of the University of Colorado, from study of a thin section, reports the rock very much altered, the only recognizable primary minerals including a few altered biotite crystals and plagioclase grains. The secondary feldspar shows practically no plagioclase, and is partly interlocked with secondary quartz. Epidote, pennine, and chlorite occur. He thinks it possible that the rock may have been a hornblende-mica syenite. The gouge of the Osburn fault in the same tunnel has been partly produced by the grinding of a small basic dike. In the North Bunker Hill main tunnel a 3 to 4-ft. dark basic dike has been greatly crushed by the Osburn fault. Four fairly thick dikes of dark green basic rock, one of which I have traced continuously for 2250 ft., have been observed in the Wallace area in the Elk Creek basin. A large dike of a medium-grained gray crystalline whose appearance suggests diorite is exposed near the mouth of the Empire tunnel in Government gulch, and 2200 ft. west there is a similar dike in a greatly decomposed condition. A lamprophyre dike in which brown biotite is conspicuous appears in the Coeur d'Alene Central company's upper tunnel. A small dark-brown east-west dike near the south fork of Milo creek was pronounced by Mr. George as probably an altered basalt. Three narrow dikes of fine-grained black to dark greenish gray rock suggesting basalt occur in the Harrison cross-cut from the Silver King main tunnel and several similar dikes were seen in the Wyoming mine near Grouse creek. These are all the dikes that have been seen within the limits of any of my maps. They are never found in apparent genetic connection with any ore deposit and are probably much younger than most of the ore.

The Wardner district is one of the most excessively faulted areas of similar extent in the world. I have found it convenient to name 97 of these faults. They are divided into nine systems, each representing a distinct period and stress. The proper discussion of these faults would constitute a lengthy paper by itself, and cannot be undertaken here; but as some of the faults have preceded, some accompanied, and others succeeded the production of the lead-silver ores of the district, I will make brief references to them in alternation with the discussion of the mineralizations. The accompanying map shows the position of the traces of those faults that reach the surface of the bedrock.

Stages of Mineralization

A notable feature of the mineralization of the Coeur d'Alene district is the presence of much siderite as a gangue mineral in the veins and as a wide dissemination in the country rock. Mr. Calkins describes[2] its occurrence in the latter form in the following words: "Siderite occurs in individuals of varying size; but probably the majority of them are larger than the elastic grains of the rock, the mineral being in places crystallographically continuous for a diameter of several millimetres. The form of the individuals varies much in regularity. The outlines of many of them, especially of the larger grains, appear ragged, but in such cases the boundaries are seen on close examination to be determined in large part by rhombohedral planes. In other individuals the rhombohedral form of the crystal is more marked, in some being perfect. It is an important fact that in any specimen the crystallographic boundaries can be seen cutting sharply across quartz grains, which proves that the siderite has been developed by molecular replacement of the quartz and not by filling in of cavities. The larger grains in the sandstones and quartzites frequently inclose grains of quartz and, much less commonly, scales of sericite. It is thus evident that the siderite re-

[2]*Op. cit.*, p. 97.


GEOLOGICAL MAP
OF THE
WARDNER
DISTRICT
IDAHO
By Oscar H Hershey
January 1912
FORMATIONS
ALLUVIUM
TERRACE GRAVELS
WALLACE
ST. REGIS
UPPER REVETT
MIDDLE REVETT
LOWER REVETT
UPPER BURKE
LOWER BURKE
PRICHARD
DIKES
FAULTS
SCALE

places the sericitic fine-grained cementing material more readily than the larger grains of quartz."

Certain stratigraphic horizons, one of which is near the division between the Revett and St. Regis formations and another includes the lower part of the Lower Burke and upper part of the Prichard formation, are widely characterized by disseminated siderite. In our district, southwest of the mines, it occurs in the thin beds of white quartzite interbedded with the Lower Burke greenish sericitic quartzites and in the upper part of the Prichard formation. The Upper Revett and St. Regis areas abound in it; unusually large siderite aggregates characterize a layer of lavender quartzite that is practically at the base of the St. Regis. In addition to this stratigraphic distribution, the disseminated siderite is also locally abnormally developed, particularly in a small area immediately above the Buckeye fault on the Phil Sheridan claim. The most notable occurrence of the latter form is in the vicinity of Burke, where the entire body of Burke strata at the surface in Custer mountain and on the south side of Canyon creek up to the Revett area is spotted and streaked with limonite from the decomposition of siderite; this is also the area that has produced the largest amount of lead ore in the Coeur d'Alene district. I am far from convinced that the

NEW MILL OF BUNKER HILL & SULLIVAN M. & C. COMPANY.

disseminated siderite is in any way related to the fissuring of the rock, as Ransome assumes. Mr. Ransome refers all the mineral deposits including the disseminated siderite of the Coeur d'Alene district to the action of a monzonitic batholith which he presumes to underlie the district and only to appear at the surface in the form of a few arms, the largest being the monzonite and syenite area near Gem. He explains the absence of siderite from the fairly well developed zone of contact metamorphism on the border of the Gem area on the supposition that the conditions of temperature and pressure were such as to carry the siderite beyond the zone in which the metamorphic silicates were forming. My impression, however, is that the dissemination of siderite antedated the monzonite intrusion and the mineral was, in fact, destroyed by the latter in the zone of contact metamorphism. Spotted rock from a patch of weak contact metamorphism near the Headlight mine was submitted to A. C. Lawson, of the University of California, for microscopic examination, with the suggestion that contact metamorphic minerals of green color had replaced the siderite aggregates of the original rock, and he conceded that metamorphic silicates had replaced a carbonate. The disseminated siderite under discussion, I consider the oldest type of mineralization in the Coeur d'Alene district. The carbonate of iron was probably originally present in the sediments. It may have been most abundant in the carbonaceous shales of the Prichard formation. The regional metamorphism caused more or less migration of the iron carbonate, for in its present form it is younger than the metamorphism properly so-called. The disseminated siderite may have afforded material for all subsequent siderite mineralizations in the district, so that it is not necessary to call on the solutions emanating from the monzonitic batholith to account for the presence of the iron carbonate in the ore deposits of the district.

Contact Metamorphic Mineral Deposits

Ordinary contact metamorphic deposits are not present in the Wardner district, but there are several small deposits that may be the product of waters emanating from a magma at a great depth. In the Upper Blue Bird and Phil Sheridan tunnels, there is pronounced pyrite dissemination in irregular bodies of dark gray rock in a zone 5 ft. wide, parallel to the bedding. The dark greenish gray color of the rock is due to chlorite whose unusual abundance and bunchy distribution indicate a different genesis from that of most of the chlorite of the district. Pyrite is a constituent of the main contact zone near Gem, and chlorite occurs with garnet and a green mica in a small area near the summit of Custer peak, which Calkins says seems to be associated with a fissure which may have been an avenue for mineralizing vapors from the magma. Thus we have precedent for the suggestion that the chlorite-pyrite deposits in the Phil Sheridan claim, near where the Buckeye fault intersects the Middle Revett, are due to waters arising from an intrusive buried at great depth under the district southeast of Kellogg peak, a 2-in. seam in the McGatlin stope of the Sullivan mine, a piece of partly hydrated specularite found in Deadwood gulch, and irregular pockets of limonite, probably originally hematite, in the Lower Revett quartzite on the Matabeleland claim are evidently among the oldest types of mineralization in the district and may point faintly to deeply buried monzonite.

Disseminated Lead-Zinc Mineralization

The earliest deposition of lead and zinc in the Wardner district was in the form of very fine ragged grains of zincblende and galena disseminated through certain bodies of the Revett quartzites in the same block as contains the chlorite-pyrite deposits. Mr. Lawson reported on two samples as follows: "No. 22 is a light gray fine-textured quartzite, mottled with darker areas of a bluish gray mineral of irregular form, with a tendency to disposition in streaks which are rudely parallel. A few crystals of pyrite ranging in size up to one millimetre are scattered through the rock. Under the microscope this rock appears as an aggregate of rather angular and interlocking quartz grains, with interstitial sericite in nests, a few crystals of pyrite, and an occasional crystal of tourmaline. Throughout this aggregate are scattered numerous irregular-shaped grains of zincblende. Associated with the zincblende is a small amount of a dark-colored opaque mineral, which may be galena. This is mostly on the periphery of the zincblende grains and thus appears to have been deposited later than that mineral. Occasionally it occurs alone. The bluish mineral observed in the hand specimen thus appears to be chiefly zincblende, with a much smaller amount of galena associated with it. A portion of this rock was analyzed by Mr. Blasdale, with the following results:

	Per cent.
Constituents insoluble in concentrated hydrochloric acid	96.42
Constituents insoluble in aqua regia	94.87
Lead	0.30
Iron	0.20
Copper	0.01
Zinc	1.52
Al_2O_3	0.75
Sulphur	0.94
Sulphur corresponding to lead (assuming PbS)	0.04
Sulphur corresponding to iron (assuming FeS)	0.23
Sulphur corresponding to zinc (assuming ZnS)	0.75

Stated in other terms, the analysis shows that the rock contains approximately:

	Per cent.
Galena	0.34
Pyrite	0.43
Zincblende	2.27

"The alumina (Al_2O_3) is probably derived from the sericite.

"No. 23 differs from No. 22 chiefly in the fact that it has a rudely schistose structure, which causes it to break

in slabs when struck with the hammer. On the parting surfaces of the rock there is an exceptionally large amount of the gray-blue mineral which occurs as a film or smear on these surfaces, and with this blue mineral there are numerous minute scales of white mica, sericite. The rock presents the appearance of having been sheared, with the development of the bluish mineral and scales of sericite along the shear planes. The rock under the microscope in its more massive parts between the parting planes does not differ essentially from No. 22, except that there is more sericite in the rock and more of the opaque mineral (galena) on the periphery of the zincblende."

These unique lead-zinc deposits are best exposed in the Smith cross-cut and Wormington drift on the Middle Blue Bird level of the Bunker Hill mine. They are in bands from 5 to 30 ft. wide, generally parallel to the bedding and in places limited by bedding planes, though there is much irregularity; also in patches which simply fade out in all directions in the solid Lower Revett quartzite. Samples have assayed, respectively, 2.51, 0.34, 0.125, 0.29, 0.09, 0.08, 0.45, 0.43, and 0.37% lead, the last three with traces of silver. The principal outcrop of these deposits in an oxidized condition is near the centre of the Blue Bird claim, near where the Buckeye fault intersects the Middle Revett band. It is a soft porous material stained by limonite and evidently leached, for the highest lead assay I could get from it was 0.09%. It largely occupies a band 25 to 30 ft. wide, bordered by hard barren quartzite, with, however, scattered bunches of it in the first 50 ft. of rock below. It is streaked, due to being controlled by lamination, and follows the stratification, dipping N.30°W. an average of 50°. Scattered bunches lead up to another band which occupies the Lower Revett immediately under the Middle Revett white quartzite. It seems to be continuous between the Buckeye and Jackass faults, becoming reduced to a regular band 4 to 6 ft. thick. It is exposed in the Hoffman raise. There is another horizon in the Upper Revett in the same locality. The mineral occurs, however, merely as scattered bunches in a zone rich in disseminated siderite which dips northerly with the bedding. The bunches are richer and the minerals are much coarser than is usual to this type; galena and zincblende can easily be distinguished with the unaided eye. Samples taken from the upper Blue Bird tunnel and the dump have assayed, respectively, as follows:

No.	Lead, per cent.	Silver, ounces.	Zinc, per cent.
1	0.97	0.4	...
2	0.13	..	...
3	0.54	0.2	...
4	0.43	..	...
5	0.68	..	...
6	0.12	..	...
7	0.13	0.2	0.60
8	...	..	0.95
9	0.74	..	1.95
10	1.07	..	2.20

In short, these deposits are hard quartzites partly replaced by fine-grained sulphides consisting chiefly of zincblende and galena, the zinc generally several times as abundant as the lead, and the silver ratio very low. The mineralization tends to follow the bedding mainly in an otherwise relatively barren block lying southwest of the disturbed belt containing the mines. There is evidence that on the dip the bands tend to jump from layer to layer, giving the mineralization in general a steeper dip than that of the bedding. It must have been deposited from very hot solutions that rose under great pressure, slowly permeating relatively porous layers of the Revett quartzites and molecularly replacing some of the rock. The character of the deposits suggests that they are another manifestation of contact metamorphic action in the district. Being apparently unconnected with faulting or other evidences of a compressive stress, a magmatic origin for the water seems far the most probable. It was expelled from the presumed monzonitic magma at great depth and forced up through the most permeable strata. But the lead and zinc were not necessarily derived from the magma. The solutions may have dissolved them from the sediments at great depth and deposited them higher.

Certain faults, including the Forest Belle, Monument, Good Luck, Excelsior, South Fork, Stopping, Sold Again, and Pitt, that are evidently very old and fragmentary because of subsequent faulting, I place in the first system and consider them of about the age of the monzonite intrusion of the Coeur d'Alene district. The magma made its way up into the sediments by 'overhand stoping'; instead of being arched over the known batholiths, the strata tend to be depressed. Some of these early faults may be due to unequal sinking over the monzonite. The faults of the second system, including the Milo, Mountain Queen, Summit, Sylvan, Ollie McMillin, Sullivan, Ox Reed, Hough, Kruger, the eastern portion of the New Era fault as mapped, Butte, Cariboo, Rambler, Apex, and Republican faults, with displacements generally varying from 2000 to 10,000 ft., cut the district into a series of long narrow blocks trending in a west-northwest direction. They were probably the result of a strong thrust from the north. After these southward-dipping faults, particularly the Ollie McMillin and the Sullivan, were found, it would seem difficult for mineral deposits parallel to the bedding to form in such a block as that above the Buckeye fault on the Phil Sheridan and Blue Bird claims. This argument places the disseminated siderite, the pyrite-chlorite, and the disseminated lead and zinc deposits in a period preceding the second system faulting. It also constitutes the chief evidence that the presumed underlying monzonite is older than the faults of the second system. It is to be noted that subsequent mineralizations were controlled by fault fissures and present no clear evidence of genetic connection with the monzonite.

Solutions ascending along fractured zones cutting the disseminated lead and zinc deposits would be pretty certain to dissolve some of the minerals and deposit them higher in connection with the fissures and fault seams. In the Middle Blue Bird and Phil Sheridan tunnels, seams representing the oldest type of commercial ore mineralization in the district have been deposited in cracks in the quartzite containing the disseminated lead and zinc in a manner to leave no doubt that they are later. There is so much of this evidence, and it is of so clear a nature that there cannot remain any doubt that the disseminated lead and zinc mineralization is older than any of the types of mineralization that have produced orebodies in the district. There is not enough of the metals in sight in the bands as we see them to account for all of these metals in the mines, but if the disseminated deposits are a product of contact metamorphism they may increase in size and content with depth so that there may be millions of tons that, before leaching, carried 1% lead and 2% zinc. Even near the surface the disseminated deposits may be very much more numerous than we suspect. Recently the Hite drift in the Bunker Hill mine cut a bluish gray stratum near the top of the Lower Burke. It contained fine-grained sulphides and yielded by assay 0.24% lead and 0.12% zinc, though there are no ordinary lead or zinc veins near. The Keating tunnel in Deadwood gulch cut a zone near its mouth in which fine-grained sulphides are disseminated through Prichard strata belonging near the top of the formation; an assay yielded 0.10% lead, although several veins cutting the zone have no lead. Deposits of this class are generally overlooked because the miners do not see the lead and zinc minerals and attribute the dark stain of the rocks to iron minerals. I consider their possibilities adequate as a source of lead and zinc in the later deposits of the district.

(To Be Continued.)

LEAD recovered from secondary sources in 1911 amounted to 54,254 tons, or about 1000 tons less than in 1910, although the lead contained in alloys showed an increase of 856 tons. The total output of secondary lead was equal to 11.1% of the refined lead produced in the United States in 1911, compared with 11.5% in 1910.

Refractory Manganese-Silver Ores—I

By Will H. Coghill

In the month of January 1910 an ore sample was brought to my laboratory for treatment to determine the amount of silver amenable to cyanidation. I noted that it contained a small amount of MnO_2, but gave no thought to this feature and put the ore through the ordinary routine tests, finding that the cyanide process could not be successfully applied on a commercial basis, and a report was made stating the refractory nature of the ore. It then occurred to me that something had been written about refractory manganese-silver ores in Mexico, and that this sample might belong to that class, so at my request the sample was left for further investigation. The client also submitted a report made by a metallurgist in Mexico, who stated that this ore belonged to a class known as refractory manganese-silver ores; that there were a great many orebodies of that nature in Mexico; that the silver seemed to be associated with MnO_2 in a way that had never been identified; that wet concentration processes failed to segregate the silver with the heavy grains; and that contrary to the rule, these ores were refractory at the surface and became more amenable to treatment upon depth. The metallurgist further stated that he knew of several mines which were idle because there was no process known by which the silver could be extracted economically and that it was yet a mystery why some ores contained manganese dioxide and were amenable to cyanidation, the dioxide even aiding by acting as an oxidizer, while others contained dioxide, which seemed to be the cause of the refractoriness. Here, indeed, is an eccentric ore, for, though the silver seems to be in the dioxide, a wet concentration of the dioxide fails to reveal a corresponding concentration of the silver. It is also a rule generally supposed to be without exception that gold and silver orebodies are more amenable at the surface than at depth, but here the conditions are reversed. Again, MnO_2 does not aid cyanidation, as is popularly supposed.[1]

With this information at hand, rather elaborate experiments were made to determine the properties and possibly identify a new mineral, as well as others of a commercial nature. Samples from three localities were investigated. The first is that designated as the Arizona ore, and two samples sent from Mexico at my request are designated as the Durango ore and the Jalisco ore.

Table I.

SIZING TEST—ARIZONA ORE

Mesh.	Grams.	Total sample, per cent.	Ag per ton, ounces.	Total Ag, per cent.
On 80	15.2	25.7	13.80	18.6
80-150	13.2	22.3	15.60	18.4
150-200	6.8	11.5	17.15	10.4
Through 200	23.9	40.5	24.20	52.6
	59.1	100.0		100.0

(1) A sizing test on the Arizona ore (see Table I) resulted in a concentration of silver with the smallest grains, 52.6% passing 200 mesh with 40.5% of the ore, while only 18.6% remained on 80 mesh with 25.7% of the ore. The method of crushing cannot be stated, as the ore was received in a powdered condition. (2) In another sizing test, 56% of the ore remained on 200 mesh and after cyanidation assayed 12.40 oz. silver per ton (calculated from the assay of the classified products shown in Table II), and was treated in Thoulet solution (KI and HgI_2) to separate the mineral grains according to their specific gravity. Three were secured, namely, grains with a specific gravity greater that 3.10, with specific gravity greater than 2.69 and less than 3.10, and grains with specific gravity less than 2.69. (See Table II.)

Table II.

SPECIFIC GRAVITY TEST—ARIZONA CYANIDE TAILING

Specific gravity.	Grams.	Total sample, per cent.	Ag per ton, ounces.	Total Ag, per cent.
+ 3.10	10.30	26.7	29.00	63.2
2.69-3.10	9.90	25.6	7.50	15.7
— 2.69	18.40	47.7	5.40	21.1
	38.60	100.0		100.0

It is quite apparent that the refractory silver is not enclosed in quartz grains, because inspection of the table reveals that the products consisting principally of quartz assay only 5.40 oz. per ton, while the heavy grains are high in silver. Table I shows a concentration of the silver with the smallest grains, and Table II shows a concentration with the heaviest grains. This proves conclusively that at least a great percentage of the refractory silver is in a soft heavy mineral. (3) Persistent grinding and agitating in cyanide extracted only 34% of the silver. (4) Only 32% of the silver yielded to hot strong HNO_3 upon a ten minute treatment of the original sample. (5) A similar treatment with dilute HCl with subsequent ammonia treatment extracted 69%. (6) A like treatment with strong HCl recovered 85% of the silver. Thus far it is indicated by (6) and Tables I and II that the refractory silver is chemically combined with or incorporated in an oxide which is heavy and soft. Now hydrochloric acid is the common solvent for oxidized, and nitric the common solvent for unoxidized minerals. I cannot quote this from an authority, but it is only natural that if nature had made a mineral insoluble by oxidizing it, it can be put into solution with a reducing agent—HCl. If it becomes insoluble through reducing conditions, it should be treated with an oxidizing agent—HNO_3—to put it into solution. It is not known how many oxides were dissolved by the HCl, though it was indicated by the color reaction that MnO_2 was decomposed. So it seems that the silver was exposed to the decomposition of an oxide. Suspicion rested upon the MnO_2. An attack was made upon it with a dilute solution of H_2SO_4 and salt. (7) It dissolved quickly, and tailing from a previous cyanide test yielded 82% of the refractory silver. The action of the sulphuric acid and salt is two-fold: it dissolves the manganese dioxide and in so doing liberates chlorine which chloridizes the silver. The consumption of sulphuric acid proved to be excessive, because it attacked the calcite in the ore. Treatment under pressure in a stoppered bottle prevented the sulphuric acid from attacking the calcite, but the pressure also prevented the evolution of chlorine, which was an essential part of the reaction; therefore the dioxide remained undissolved. (8) Now, H_2SO_3 is a good solvent for chlorine and was added with the H_2SO_4 and salt in the next test in which the charge was agitated under pressure. The reaction was complete in a few seconds, the dioxide color being replaced by the color of the iron oxide. (9) Further tests proved that H_2SO_3 attacks MnO_2 with such avidity that the other reagents had no opportunity to participate. E. M. Hamilton has stated[2] that he used H_2SO_3 as a reducing agent, but I was hunting for a solvent and did not have the results of his investigation in mind at that time. Though very few textbooks mention the fact, it has been known for a long while that MnO_2 is soluble in H_2SO_3, and these reagents have been used to make manganous dithionate (MnS_2O_6), some $MnSO_4$ being formed. There is probably no other case in which a mineral is as soluble in a cold dilute acid; a 1% solution being sufficient to dissolve powdered MnO_2 in a few seconds. (10) It was surprising to find that after dissolving the di-

[1] A private communication from J. B. Empson in reply to an inquiry made nearly two years after this investigation was begun, reads in part: "As you rightly conclude in your letter, there are several properties in Mexico that are unable to treat these ores profitably by cyanide owing to the amount of manganese present. So far as I am aware at the present moment, nobody has been able to shed any light on this matter."

[2] *Mining and Scientific Press*, December 4, 1909, p. 156.

oxide in H_2SO_4 such a large percentage of silver was amenable to amalgamation. A sample which passed 200 mesh and assayed 24.20 oz. gave 63% extraction by amalgamation when treated in the jar mill for twelve hours. (11) A sample of cyanide tailing yielded 45% of the otherwise refractory silver during a two-hour treatment. (12) Also cyanidation of the original sample gave an 85% extraction, but this method is out of the question on account of the soluble salts formed by the acid treatment. The conduct of the dithionate toward the potassium cyanide was not investigated, but the $MnSO_4$ consumes cyanide and must be entirely neutralized by an alkali. This cannot be accomplished economically on account of the great amount of solution required. As the sample was used up, the investigation was reluctantly discontinued. It seemed quite possible to work out an amalgamation process in which amalgamation would proceed under pressure in a closed barrel with fine grinding and acid treatment. A pressure of about 10 lb. per square inch would be necessary to prevent the H_2SO_4 from spending its strength on the calcite, a little salt would quicken the mercury, and copper sulphate in the presence of salt would aid in dissolving the silver. As the ore contained only about 2% manganese, the consumption of sulphur on the basis of manganous dithionate being formed would be 47 lb. per ton of ore. (13) Attention was then directed to a sample from Durango, Mexico, which had been classed with the refractory manganese-silver ores. It contained 10% MnO_2 and assayed 21.85 oz. silver and 0.16 oz. gold per ton. It was stated by the superintendent of the mine from which this sample came that the ore yielded from 40 to 60% of the silver by cyanidation and that the amount of refractory silver varied directly as the amount of MnO_2 in the ore. (14) A sizing test gave a decided concentration of the silver with the smaller grains. (15) The silver displayed the same refractory disposition toward HNO_3 as did the Arizona sample, and (16) a large percentage was dissolved by HCl treatment. (17) Tests by amalgamation, hyposulphite lixiviation, and cyanidation proved the utter futility of attempting to extract the silver without fine grinding. Even MnO_2, though it dissolves in a few seconds in dilute H_2SO_4 when crushed to pass 200 mesh, may resist the acid for an hour when coarser than 40 mesh. (18) After crushing in an Abbé pebble mill, a siding test gave 22% on 200 mesh, 78% through 200 mesh. It was upon this material that the following tests were made. (19) The amount of gold dissolved was not influenced by the presence or absence of MnO_2.

Table III represents a good deal of work and does not indicate a commercial method of treating the ore, but when studied from a scientific standpoint becomes interesting. The tests, which were not made in the order shown, cover a period of several months' investigation, which was carried along with other work. It was a great satisfaction to see that these fit together with so much harmony. For instance, numbers (23) to (26), inclusive, show a steadily increasing percentage of extraction, depending on the time, and that more than 18 hours treatment would probably be useless.[3] Note that the mercury failed to combine with the silver in (21) and collected more than one-half of the silver in (20). In (24) the superiority of potassium and ammonium hyposulphite over the soda salt should be noted. I am not aware that anything has been written on this, but tried them just to satisfy my curiosity, with no idea of using them commercially. Calcium thiosulphate was also tried, but results were low. Sodium thiosulphate is understood to be the hypo salt referred to in these tests unless otherwise specified.

When the strong reducing power of a thiosulphate solution is taken into account and the strong oxidizing power of MnO_2, it would seem to be useless to expect the thiosulphate to last long enough to dissolve any silver, but tests show that neither thiosulphate nor sodium sulphate are decomposed by the MnO_2. In the tests shown in Table III, 1 assay-ton of the sample was treated in a jar-mill. Thiosulphate, when used, was about 1½% of the solution and copper sulphate about ⅕%. The jar-mill was simply pint glass fruit jars with rubber stoppers and lids screwed on to hold the stoppers in place. For abrasive materials marbles and small flint pebbles were used. The jars were fastened with axes parallel to a rotating shaft when grinding in solu-

[3]It was revealed later that all the results in this column are low on account of the ore being a little too coarse for all MnO_2 to dissolve when given the acid treatment.

TABLE III

LIXIVIATION TESTS—DURANGO ORE

Reagents.	No.	Per cent extracted. Without acid treatment.	Per cent extracted. After acid treatment.	Duration of test in hours.....	Remarks.
Mercury	20		51.0	18	
Mercury	21			8	
Sodium thiosulphate	22		25.0	16	
	23		56.0	1	
Thiosulphate and mercury	24		81.0	12	Ammonium thiosulphate, 78.0%.
	25		81.0	12	Ammonium thiosulphate, 78.0%.
	26		81.5	18	
	27	21.0		6	
Thiosulphate and copper sulphate	28		78.0	9	
	29		81.5	48	Solution changed once.
	30	43.0		16	
	31	36.0		20	Salt to make 5% solution.
	32		66.0	7	+ 200 mesh } sizing test.
Thiosulphate, copper sulphate, and mercury	33		83.0	7	— 200 mesh }
	34		69.0	7	Salt to make 5% solution.
	35		73.5	7	
	36		81.0	9	
	37		87.0	12	
Copper sulphate, salt, and mercury	38		71.0	8	
Ammonia and ammonium chloride	39	21.3		8	
Acetic acid	40	0.0		8	
Ammonium persulphate	41	13.5		8	2% solution.
Ammonium persulphate and mercury	42	20.5		8	2% solution.
Potassium cyanide	43		84.0	12	Agitation in cyanide.
	44	44.3		18	Solution changed once.

tion was required and were fastened with axes at right angles to the shaft when merely agitation was desired, in which case they would be turned end-over-end. All the jar-mill tests were made by grinding in solution except number (43). The solution used in (29) did good work. It is the Russell 'extra solution' of cuprous-thiosulphate, and it is claimed by the inventor that it exerts a greater solvent action on the metal, the sulphide and the sulpharsenide and sulphantimonide, that is, all but the chloride, than does the ordinary thiosulphate solution. The late O. Hofmann, in his excellent work on hydrometallurgy of silver, speaks quite disparagingly of the Russell process, stating that it is superior to ordinary thiosulphating only in laboratory tests with very strong (32%) solutions. My solutions were fairly dilute (1½%), and the superiority of the extra solution is again noticed in (36) and (37) when compared with (24), (25), and (26). (31) and (34) contained salt in addition to the other reagents. Comparing them with (30) and (25), respectively, shows that salt was a detriment when used with the extra solution. This closely parallels the condition that the extra solution must contend with in practice, as the ores are generally given a chloridizing roast in which there is an excess of salt. However, much of the salt is leached out by the base-metal leaching which precedes the thiosulphating. It may be that salt simply reduces the activity of the reagents, as does sodium sulphate in ordinary thiosulphating, but it is more likely that salt reacts with the copper sulphate (these reagents were added in the solid state and at the same time), making cupric chloride and sodium sulphate, thus preventing the copper from combining with the hypo to make the double salt and introducing sodium sulphate, which is objectionable.

reader should bear in mind that grinding was continued throughout the lixiviation tests, and it would seem that the grains would all be crushed to an impalpable powder whether or not they were 200 mesh or −200 at the beginning. Subsequent experiments indicated that some of the MnO_2 remained undissolved in the 200-mesh material; this no doubt accounts for the inferior work in (32). The high extraction in (37) as compared with (28) and (29) is probably due to the united forces of the mercury and the solution, where the mercury at once takes up the larger metallics while the solution is dissolving the smaller and more refractory particles. (38) is an imitation of the patio process in which cupric chloride is formed, which is said to be an aid to amalgamation. (41) is just a chance shot taken on account of Thomas Crowe's statement,[5] that "ammonium persulphate is a good solvent for silver," and shows that it is a solvent in this case at any rate.

The amount of sulphur required probably prohibits a preliminary treatment in sulphurous acid. Assuming the formation of manganous dithionate, the theoretical amount required is 151 pounds per ton of ore. (45) In a test on 5 gm., sulphur was consumed at the rate of 150 lb. The absence of calcite is a favorable feature which the Arizona ore did not possess.

Table IV shows results of a series of calcination and chloridizing roasting tests on the same ore. One assay-ton of the ore was taken, and when a chloride was used it was thoroughly mixed with the ore, making 9% of the charge. The temperature is uncertain. Accurate records of the temperature of the muffle were made with a Bristol thermo-electric pyrometer, but it cannot be stated how closely they correspond to the temperature in the scorifier. The jar-mill

TABLE IV

CALCINATION AND LIXIVIATION TESTS, DURANGO ORE

	Calcination			Lixiviation							
						Oz. Ag per Ton					
	Reagents	Temperature, °C.	Duration of Test, hr.	Reagents	Duration of Test, hr.	Recovered	In Tailing	Lost	Recovery, %	Extraction, %	Remarks
46	None	900?	¾	Extra	8	2.12			9.7		Sintered.
47		850?	¾	solution	8		17.70			19.0	Not sintered.
48	Salt	900?	¾	and	6	8.56	3.74	9.55	39.2	83.0	
49	Flour	900?	1¼	mercury	6					58.4	KCN tailing from (44).
50	Salt and manganese	625	2	Thiosulphate	10	15.16	5.60	1.09	69.5	74.4	
			2¼	and mercury							
51	Sulphate	617	2¼	Ammonia	1	5.12	16.00	0.73	23.4	26.8	
52	Salt	617	2¼		1	16.40	5.36	0.09	75.0	75.5	
53		617	2¼		4	17.30	4.40	0.15	79.3	80.0	
54	Salt and manganese sulphate	617	2¼		4	16.60	5.30	none	76.0	76.0	
55		583	1		10	9.74	10.32	1.79	44.6	52.8	
56	Salt	583	3		10	9.60	8.94	3.31	44.0	59.1	
57		583	5	Thiosolphate	10	9.60	9.64	2.61	44.0	60.6	
58	Calcium chloride	620	3	and mercury	10	13.14	7.56	1.15	60.2	65.4	
59	Barium chloride	620	3		10	3.88	17.54	0.43	17.8	19.7	
60	Magnesium chloride	620	3		10	3.80	15.82	2.23	17.4	27.5	

In using mercury in these tests it was not the aim to develop a commercial process in which mercury would be used with these salts, but it was used as a collector to simplify laboratory work. Mercury collects silver completely from the thiosulphate, and can be assayed for silver by the crucible method, giving accurate results when a flux of low fusion temperature is used. If the fluxes are not of the right sort losses will occur. The use of the glass separating funnel[4] makes the separation of the mercury from the tailing a simple matter.

It is a question whether (32) and (33) show the importance of excessively fine grinding or that there was more refractory silver in the harder and larger grains. The was used in the lixiviation as in Table III.

Very little has been written on the chloridizing roasting of non-sulphide ores, and it would therefore make a good field for some energetic investigators. In all ordinary chloridizing roasting the ores contain sulphides, usually of iron and copper, which become oxidized to sulphates. These sulphates react with the salt making sodium sulphate, which is a stable compound under existing conditions, base metal oxides and nascent chloride, which combines with the silver. There being nothing in this ore from which to make a sulphate, $MnSO_4$ was added (the idea being that in commercial work a small part of this ore might be treated in H_2SO_4, making a sulphate, then mixed with the untreated

[4] Will H. Coghill, *Mining and Scientific Press*, July 9, 1910, p. 53.

[5] Researches on Cripple Creek Tellurides. *Mining and Scientific Press*, Sept. 15, 1909, p. 427.

portion and roasted) in (50) and (54), but as (53) and (54) were treated side by side, there is pretty positive evidence that the sulphate was a detriment. In (52) there is positive proof that silver is chloridized by chloridizing roasting this non-sulphide ore, the temperature at which this reaction begins being about 617°. In attempting to account for the chlorination of the silver it may be assumed that there is a reaction between the salt and the nascent oxygen from the MnO_2, resulting in the formation of free chlorine and sodium oxide, the former chloridizing the silver and the latter combining with the silica to make slag. That the ore was not sintered in several tests in which chlorination took place does not disprove this theory, because it is probable that a large portion of the salt was dissipated in the form of a vapor, leaving only a small portion to undergo such a decomposition. Vapor could be seen rising from the charge during some of the tests, but it was not determined whether it was free chlorine or sodium chloride. A. V. Bleininger, in a private communication, is inclined to think that "silver would become chloridized at about 650°C., at which temperature clay dedydrates and is capable of reacting with many chemical substances." In (55), (56), and (57) titration failed to reveal a loss of chlorine, and a low extraction followed, though some of the silver was probably chloridized. Test (58) indicates that calcium chloride is a chloridizing agent. This is extremely interesting, because it is generally supposed that calcium oxide will steal chlorine from silver during chloridizing roasting. Here it should be mentioned in connection with the Arizona ore that the calcite would be a factor to be reckoned with in case chloridizing roasting were to be tried. The great loss of silver as shown by (48) is to be expected when chloridizing at a high temperature. In (49) 1 assay-ton of the cyanide tailing from (44) was mixed with the 40 gm. of flour and calcined in a covered crucible at about 900° for 1¼ hour, then a lixiviation test was made by grinding in extra solution plus mercury, resulting in an extraction of 58.4% of the refractory silver. There is no doubt that the MnO_2 was here reduced to Mn_3O_4, or a lower stage of oxidation, and that a longer period of calcination or lixiviation, or both, would have resulted in a much higher percentage of extraction. Comparing this with (46) and (47), in which there was calcination without flour, shows that the flour is a very active reagent during calcination, either by exerting a reducing effect or preventing sintering. I do not know of any published data on the dissociation temperature of the native oxides of manganese, but wish to note here that the dissociation temperatures of the artificial oxides have been determined,[a] namely,

MnO_2 at 530°C. breaks down in air to Mn_2O_3,

Mn_2O_3 at 940°C. breaks down in air to Mn_3O_4.

I have some data on the dissociation temperature of the native MnO_2 which I will publish later.

The large amount of silver in the tailing in (51) is due to the ammonia being partly neutralized by the manganous sulphate. The mercury (½ assay-ton) in (59) was badly sickened, and in (60) was not as active as it should have been.

Let us now consider an ore from Jalisco, Mexico, which contained 18.70 oz. silver, 0.05 oz. gold, 10% manganese (15.8% MnO_2), and which in the preliminary tests conducted itself in such a way that it seemed justifiable to put it in the class with the Arizona and Durango samples. It is unlike the Arizona ore in that it did not contain calcite, but like the others in that it contained manganese as an MnO_2, quartz, limonite, and refractory silver. Now these ores were all so stained and discolored that it was nearly impossible to distinguish between a piece of quartz and MnO_2, but it was noted that if a sample was screened and that part remaining on 10 mesh given a wash in water, followed by a brief wash in very dilute H_2SO_4 all stains would be removed and hand sorting become a simple matter. Table V shows results of such a test on a grab sample.

TABLE V

CLASSIFICATION BY HAND SORTING, JALISCO ORE

	No.	Gm.	% of Total	Oz. Ag per ton	% of Total Ag
Mainly dioxide..	61	4.90	19.3	25.06	36.6
Mainly quartz...	62	20.50	80.7	10.40	63.4
		25.40	100.0		100.0

Here it is noted that a product assaying 25.06 oz. silver is secured from a sample assaying 13.25 oz. silver. This certainly makes it desirable to repeat the test on a larger scale. (See Table VI.)

TABLE VI

CLASSIFICATION BY HAND SORTING, JALISCO ORE

	Number	Gm. of each	Per cent of total	Oz. Ag per ton	Per cent of total Ag.	Ag, %	Mn, %	MnO_2 (calculated), %	Fe, %	Limonite (calculated), %	Insoluble in aqua regia, %	Total % determined.
Concentrate	63	112.5	11.8	34.00	23.6	0.12	40.6	64.1	1.5	2.5	33.2	99.9
Middling	64	78.0	8.2	33.50	16.2	0.12	18.8	29.7	2.4	4.0	65.0	98.8
Tailing	65	760.0	80.0	12.80	60.2	0.04	2.3	3.6	1.5	2.5	90.9	97.0
		950.5	100.0		100.0							

COPPER equal to 19% of the domestic output for 1911 was derived from secondary sources, according to J. P. Dunlap of the U. S. Geological Survey. The total amount of secondary copper recovered, on the assumption that the brass remelted had an average copper content of 70%, was 107,104 tons, of which 13,948 tons was recovered by regular refining plants and the remainder by plants treating only secondary materials. At least 31,000 tons was recovered from clean scrap made in the course of manufacture of copper and brass ware, so that only 76,104 tons was obtained from ashes, cinders, scrap, and other material that had actually been used and discarded. While many of the railways sell or turn in their brass and copper scrap to dealers in part payment for new material, the reports received show that the railways utilized in their own shops and foundries over 13,200 tons of brass in addition to copper in other alloys.

TIN from ore mined in the United States in 1911 was confined to a small amount of metal smelted in Texas and to the shipment of a small yield of tin concentrate from Alaska, the secondary recoveries of tin form the most important domestic source of supply, according to the U. S. Geological Survey. The secondary tin recovered in 1911 was equal to 32.6% of the tin imported into the United States during the year. The figures for secondary recoveries in 1911 show an increase of 803 tons in quantity and $2,871,240 in value, compared with the recoveries of 1910. The alloys, consisting chiefly of babbit, bronze, and solder, contained 6957 tons. The 7749 tons of recovered tin includes the tin content of products made by several plants from tin scrap. These included some tin oxide, putty powders, etc., but were mainly tin chloride.

[a] *Z. für Anorg. Chem.*, vol. 57, 1908.

Revision of the Mining Laws

By F. J. H. Merrill

The problem now before the country, of formulating appropriate mining laws suited to existing conditions and capable of enforcement, is very important and very complex. The questions to be considered are many, but four of the most important have been raised in a letter issued to the members of the Mining and Metallurgical Society of America, by the Committee on Mining Law of that body, as follows:

1. Classification of lands and segregation by the Government of all minerals from surface rights.

2. Nature of the possessory right. How shall mining rights be initiated? How shall they be perpetuated? and how terminated?

3. Shall mineral lands be permanently alienated or leased? Do you advocate different provisions for the precious metals, or shall coal, iron ore, petroleum, and other minerals be treated alike?

4. If the present system of alienation of title is retained, shall we still keep the extralateral right principle?

In considering these questions it will be of value to cite examples of successful legislation by which they have wholly or in part been solved. For some six years I have conducted mining operations in Mexico and have become familiar with the mining law of that Republic. In my judgment it has so many points of excellence that, in the following answers to the questions submitted, I will make detailed comparison with the Mexican law wherever such comparison is possible.

1. The classification of lands by the Government cannot be perfectly and completely made. This is partly on account of the great labor and expense involved, and partly because, in such a classification, it will be impossible to determine, by examination, at any particular time, the future status of all lands containing mineral not sufficiently rich to be worked with profit or entirely devoid of value. There will arise the question whether or not, at some later date, such land may become of commercial value for its mineral through changes in transportation or other commercial conditions; through new discoveries or inventions in metallurgy; or through the development of new uses for minerals hitherto useless. Further, land classified by the Government as mineral land, on the best obtainable evidence, may, after detailed exploration, prove valueless commercially. Therefore, such a classification must be tentative. Hitherto, under United States statutes, public lands have been regarded as mainly either mineral or agricultural, but under the statutes of Mexico a broader view is taken and the fact is recognized that some land may be valuable for agriculture and still available for certain kinds of mining. The adjustment of questions arising from the effort to carry on the two industries simultaneously is made either by the parties interested or, in case of disagreement, by a duly appointed commission. The law of Mexico, however, differs widely from that of the United States, in that regalian right is asserted, and in all lands, both public and private, deposits of gold and silver, and also of many other metals and minerals, are regarded as property under the direct ownership of the nation and subject to the provisions of the mining code, as stated in the following translation:

"Article I, Chapter I: The following belong directly to the nation and are subject to the provisions of this law. Bodies of all inorganic substances which, occurring either in veins or horizontal beds, or in masses of whatever form, make up deposits whose composition is distinct from that of the rocks of the earth, such as deposits of gold, platinum, silver, copper, iron, cobalt, nickel, manganese, lead, mercury, tin, chromium, antimony, zinc, and bismuth; those of sulphur, arsenic, and tellurium; those of rock salt, and those of precious stones. Also placers of gold and platinum."

The segregation, by our Government, of minerals from surface rights, in lands belonging to the nation, would be a new departure, yet it seems feasible. On mature consideration, however, it becomes evident that some minerals may not easily be separated from surface ownership. In Mexico the following belong exclusively to the owner of the soil:

I. Bodies or deposits of combustible minerals in all their forms and varieties.

II. Bodies or deposits of bituminous materials.

III. Bodies or deposits of salts, which outcrop on the surface.

IV. Springs of surface and subterranean waters, subject to the provisions of the common law and those of special acts in regard to water, without conflict with Article IX [of this code].

V. The rocks of the earth and the minerals of the soil, such as slate, porphyry, basalt, and limestone, and soils, sands, and clays.

While, in the United States, public sentiment might accept legislation separating from surface ownership some mineral deposits in groups I and II, there would be a serious question as to the propriety and practicability of segregating from surface rights all those included under groups III, IV, and V. Under existing federal statutes this question of segregation of surface from mineral rights could arise only in relation to public lands, but in a recent publication of the U. S. Geological Survey, Bulletin 505, A. C. Veatch has expressed the view that the United States is in possession of regalian rights, that is to say, rights of ownership in all deposits of precious metal on lands at any time owned by the nation.

In his very important article on 'The Mining Law' in the *Mining and Scientific Press* of March 9, 1912, H. V. Winchell, in criticizing this view, quotes from 'Snyder on Mines,' Vol. I, p. 15, as follows:

"Neither regalian right nor anything similar has ever existed in or been asserted in the United States."

While our federal government has never asserted regalian right, this statement by Snyder is not wholly accurate, for such a right has been distinctly asserted by the State of New York, as will be seen in the following:

General Laws of New York, Public Lands Law, Section 80.

"The following mines are the property of this state in their right of sovereignty:

1. All mines of gold and silver discovered or hereafter to be discovered within this state.

2. All mines of other metals and of talc, mica, or graphite discovered or hereafter to be discovered, upon any lands owned by persons not being citizens of the United States.

3. All mines of other metals and of talc, mica or graphite discovered or hereafter to be discovered upon lands owned by a citizen of the United States, the ore of which, on an average, shall contain less than two equal parts in value of copper, tin, iron, and lead, or any of those metals.

4. All mines and all minerals and fossils, discovered or hereafter to be discovered, upon any lands belonging to the people of the state."

It is further provided that the discoverer of a mine on state lands, after filing notice of discovery, may work such mine, and his heirs and assigns shall have sole benefit, on payment of a royalty of 2% of the market value of all such products.

The first legislation in New York on this subject was enacted in 1789 and the underlying principle of these provisions seems both to include and to exceed that stated by A. C. Veatch*: "In all states where the federal government has never owned the land, and there are 19 such states, the ownership of the precious metals lies with the state government." In New York, as in Mexico, the Government has claimed not only 'royal mines' but certain deposits of base metals and of non-metallic minerals. Attention is called to this as a detail of history, and not because I regard such legislation as desirable. In fact, gold mines in New York have largely existed in the prospectuses of promoters who claim to have 'secret processes' of extraction.

*U. S. Geol. Surv. Bull. 505, p. 116.

Whether the federal government has hitherto been in possession of an unrecognized regalian right, which it can assert by legislation, is a question which could only be decided by the courts. Thus far it has not been recognized in the federal statutes, and apparently the decisions of the United States Supreme Court have never discussed it. It can hardly be doubted, however, that authority on the part of the federal government to assert this right could have come to it from the same source as the authority which was early assumed by the state of New York. Probably the majority of thoughtful persons, experienced in mining, will agree that, at this late date, it is better that such a right should not be recognized even should it theoretically exist. Certainly it should not be asserted in a retroactive way.

2. In my judgment the general features of the Mexican mining law are essentially satisfactory in the details covered by this question. In Mexico mining titles are regarded and treated as real estate and are subject to the same conditions regarding ownership, contracts, and conveyances. The distinctions are that no surface rights are conveyed, and that the continuance of ownership depends on the payment of a yearly tax or rental of ₱6 per hectare. But the latter distinction is trivial, for improved real estate also is subject to a tax, in default of the payment of which the title may be lost.

The right is initiated by making formal application through the local agent of the Secretaria de Fomento, accompanied by a licensed engineer's survey of the desired property, made under prescribed rules, and depositing with the local agent of the Treasury a sum of money equal to ₱5 per hectare of surface area. This deposit is held until the title has been signed and issued by the President of the Republic, and should the title not be granted, the money is refunded to the locator, but the agent's fee, some ₱35, is not refunded. The title is perpetuated by paying the tax of ₱6 per hectare, and may be terminated by the Government at the end of three months of delinquency in any installment of the tax, which is payable at intervals of four months.

3. As indicated above, a leasing system may be virtually indistinguishable in practical results from one of permanent alienation; but in Mexico, as already stated, surface rights are not leased with the minerals. In California, when the suggestion was first made that public oil land should be leased by the Government, there was a strong expression of feeling on the part of many of the oil men. Their view was that if, in future, oil lands must be leased, the persons who secured their lands under the present law would have an advantage in obtaining their ground at less cost than those who came later. The justice of this objection would depend largely on the detail of the proposed legislation. Under the Mexican law no one regards the mining tax as a hardship. And here it must be made clear that there is a material difference between leasing on a rental per acre, as in Mexico, and leasing on a royalty involving supervision of business detail by a Government bureau. The latter might be open to serious objections. In addition to the mining tax, Mexico imposes an internal revenue tax on bullion and also a coinage tax.

In answer to the question whether coal, iron ore, petroleum, and other minerals shall be treated alike, it must be emphasized that, in one particular, petroleum should be differently treated, because a petroleum property cannot be protected from lateral encroachment. In other words, a tract of oil land lying idle and surrounded by producing wells may lose the larger part of its oil without one well being drilled upon it. This is evidenced in the Santa Maria field in California, where, on account of special local conditions, it has been found possible to operate with one well to each forty acres. Loss due to this condition can be prevented only by drilling and operating wells along the boundaries. In simultaneously operating adjoining properties, it is customary to sink wells at equal distances on either side of the intervening boundary line, so that the encroachment is mutual and equalized. Possibly legislation could be enacted which would provide adequate compensation for lateral encroachment on public oil lands or on private oil properties lying idle, but this would not be an easy matter.

Whether coal and iron ore should be treated differently from gold, silver, copper, lead, and zinc is a question properly left to those specially experienced in the mining of coal and iron. Special provision will be needed for some of the minor minerals.

4. The principle of extralateral right is undesirable, but cannot immediately be taken from those who already possess it. The regulation of this matter may be difficult. Probably the only solution is by legislation providing for vertical plane boundaries in future locations and permitting those who now possess extralateral rights to use them only until the orebodies affected have been exhausted. This could be accomplished by providing that at the end of some reasonably long period, say 10 to 20 years, all such rights should terminate.

Zinc-Aluminum Alloys

Twenty years ago the Institution of Mechanical Engineers formed a committee to undertake researches into alloys. In those days Roberts-Austen was always to the fore in such work, and he was appointed to the chairmanship of the committee. His strong point was not steel or copper, but gold, and he caused dismay among the engineers and steel men by switching the inquiry along the lines of his favorite metal. When the first report was presented, J. O. Arnold, of Sheffield, indulged in unparliamentary language, publicly stating that the report was "not worth a rush." However, those times are now gone by, and nine other reports have since been issued. Nowadays the subject matter of the research is more in the line of the Institute of Metals, a society founded four years ago and showing wonderful vitality. The tenth report, recently issued, covers the alloys of aluminum and zinc. To the average reader the description of a new alloy of aluminum, zinc, and copper is probably the most interesting part. This alloy has given the most important results of all the light ternary alloys so far tried. The composition is 72% aluminum, 25% zinc, and 3% copper. In the cast state it exhibits little or no ductility, but with sand castings and chill castings the tensile strength is 18.25 and 20.22 tons per square inch, respectively. With the usual plant and methods employed with aluminum, the hot-rolling of this alloy is difficult, but as perfectly sound bars have been obtained, it is believed that with modifications it should be possible to roll it commercially. Great care is required as regards temperature regulation; if the alloy is too hot it breaks into powder, and if too cold it becomes excessively hard. The rolled alloy exhibits considerable ductility, but cannot be drawn into wire; the thinnest section obtained had a diameter of ⅜ in. Remarkable results were obtained in the tensile test on ½-in. rolled bar. This showed a yield-stress of 27 tons per square inch, an ultimate stress of 31.7 tons per square inch, and an elongation of 21%. By cold-drawing down to ⅜-in. diameter, the yield-stress is further raised to 31.5 tons per square inch and the ultimate stress to 33.3 tons, while the elongation is reduced to 13%. The specific gravity in this condition is 3.29. A compression test gave 24.21 tons per square inch as the yield-point, and 29.02 tons as the collapsing stress. The general conclusion of these and other tests is that this alloy has the greatest strength in proportion to its weight of any yet discovered.

JUNK collectors and dealers pay low prices for small quantities of scrap metals, but the competition for the scrap, drosses, skimmings, and other waste products of large users of metals is very active. It is necessary for some uses to employ primary or virgin pig metal, but as a general rule secondary metals, in whole or in part, can be used by manufacturers. They are in active demand and displace an equivalent quantity of primary metal.

Law of the Pay-Streak in Placer Deposits

By J. B. Tyrrell

*The pay-streak is a feature in the structure and growth of the valley in which it occurs, its formation is governed by certain geological laws, and those laws should be recognizable without great difficulty if the growth of the valley can be traced with reasonable accuracy. In what is now known as the Klondike district, marine sediments were laid down at various periods up to the beginning of Tertiary times, and after their deposition they were raised, crushed, and bent into their present form and position. The country was then worn down to base level, and a peneplain, the remains of which can now be seen at an elevation of about 3300 ft. above the sea, was formed. This peneplain may be called the 'Dome peneplain,' as portions of it are distinctly recognizable in the vicinity of the mountain known as the Dome. The period of its formation may be designated as the first cycle of erosion, since the history of the gold-bearing gravels would appear to begin with it, and no gravel deposits have yet been recognized on it.

After the Dome peneplain was formed the first period of elevation began, and the country was raised to a considerable height above the sea. The Yukon river, which had probably been outlined at an earlier period, immediately began to erode its channel, while the water, which fell as rain on the elevated Klondike land, carved out smaller valleys to carry the drainage from it to the larger river. As the Yukon river was a powerful eroding agent, it deepened its valley rapidly, and at the same time the smaller streams radiating from the Dome, such as the Bonanza, Hunker, Dominion, and Sulphur creeks, kept excavating their channels to keep pace with the lowering of the bottom of the valley of the Yukon river, which was the master-stream into which they flowed.

During all this time the valleys of these smaller streams maintained the general character of gulches or young valleys, with V-shaped cross-sections. But little gravel or loose material remained on the rock which formed the bottoms of their channels, for it was being constantly moved downward by the current toward the Yukon river, and, on the way, was helping to cut deeper and deeper into the rock over which it traveled. While this process of deepening the valleys was in progress, detrital material was being constantly brought into them by wash from their sides and by smaller streams from the ridges between them, and, as the rocks from which this material was derived was gold bearing, the detritus contained a small quantity of gold. Thus gold and particles or masses of rock were fed gently into the main streams.

Now a stream with a given velocity is able to carry pebbles of a definite size and specific gravity. If the specific gravity is constant, the diameter of the pebbles which it can carry will vary according to the square of the velocity, and if the velocity remains constant, the size of the pebbles will vary according to the specific weight of the substance composing them weighed in water. For instance, if the velocity of a stream is doubled, it is able to carry pebbles of quartz four times the diameter, or 64 times the weight, of those which it could carry before. If, on the other hand, one pebble is of quartz and the other is of gold, which is 11 times as heavy as quartz weighed in water, the volume of a pebble of quartz which can be carried by the current will be 121 times (11.2) as great as that of a pebble of gold, or, in other words, the diameter of the pebble of quartz will be about five times the diameter of the pebble of gold. Again, if particles of quartz and gold of equal size are dropped into water the gold will sink to the bottom with more than three times the velocity of the quartz.

Where the fragments of rock, consisting of quartz, schist, granite, and gold, are fed into the stream, they are caught by it and carried along the bottom until they lodge in some crevice or opening, from which they cannot be dislodged except by upward currents, and these upward currents will lift any pebbles of quartz or similar rock which are less than five times the diameter of nuggets, or grains of gold occurring with them, before they will lift the gold, even if the quartz and gold are equally accessible. This makes the removal of the gold exceedingly difficult as long as the crevice remains, for the upward currents will constantly carry away the finer and lighter rock, and undermine the grains of gold and allow them to sink. When the finer and lighter material is carried away, the coarser and lighter pebbles are exposed to the force of the current, and the smaller and heavier grains of gold are able to obtain lodgment beneath and between them so as to be almost inaccessible. In fact, under normal conditions, the spaces between the lighter pebbles are large enough to hold any grains of gold which could be carried by the current flowing over them. It is thus shown that gold will remain permanently in a fissure of the rock at the bottom of a stream as long as that fissure remains in existence, and also that it will remain between or beneath larger pebbles and boulders as long as these remain unmoved.

Now, the small streams of the first period of elevation, which developed into, or was succeeded by, the second cycle of erosion, continued to cut down their channels as long as the Yukon river continued to deepen its valley. During all this the bottoms of their valleys continued to act as sluices, which were more or less efficient agents in collecting and retaining gold according to the character of the rock of which they were formed. If the rock where the gold was discharged into the stream was a fissile schist standing on edge, the gold would be caught at once, while if it was a massive granite or other similar rock, without joints or fissures, or a smooth horizontal schist, the gold would be carried down-stream over it until it would be caught by some more favorable rock. In this way there would be rich places, poor places, and blanks in the streak of gold deposited in the bottom of the valley.

As the stream would continue to deepen its valley very gradually, almost imperceptibly, by downward erosion, those places which were underlain by schists standing in a vertical or highly inclined attitude would continue to hold the gold which they had already caught, and to accumulate more, for fissures would open as fast as the surface was worn away, and the gold would sink into them as they opened. On the other hand, those places which were underlain by a harder bedrock, and which had probably also a steeper grade, would remain barren. If, again, the character of the bedrock should change from 'open' to 'tight', the gold which it had held might be undermined by the continual downward erosion, and so be brought again within the influence of the transporting power of the running water, by which it would be carried along to find some new resting place farther down the stream.

When the Yukon river had eroded its valley down to base-level, the smaller inflowing streams were no longer obliged to continue to deepen their respective valleys to keep pace with it, but were able to cut them down to grade and then to widen and form flood-plains in them, thus changing the V-shaped valleys into U-shaped ones, floored by alluvial plains through which the rivers and brooks meandered from side to side. A normal stream decreases in velocity and gradient as it descends its valley and reaches grade near its mouth before it has cut down the rest of its valley to grade. So, when each of these streams had cut down the lower portion of its valley to correspond with the base-level established by the Yukon river, it would begin to meander and extend the width of its floor. At the same time, with the decrease

*A paper presented before the Institution of Mining and Metallurgy, May 16, 1912.

in gradient, the velocity of the current would decrease, and its transporting power would be diminished. Consequently, part of the detrital material which would be brought down by the upper and swifter portion of the stream would be dropped where the current was retarded by the decreased gradient, and would lodge in the bottom of the valley and form a flood-plain or alluvial plain. This alluvial plain would be first formed where the V-shaped valley changed into a U-shaped one.

Most of the gold which had previously been discharged into the stream with the detritus from the adjoining hills and ridges would have already lodged in the bottom of the V-shaped valley, and would have settled down almost vertically as the bottom was lowered by the downward erosion of the stream. If any gold was carried down to the mouth of the V it would have a strong tendency to settle just where the velocity of the current was diminished, or at the head of the flood-plain, and the weaker current would have no power to pick it up again, or to release that gold which was already present beneath it on account of having been previously caught in the bottom of the V-shaped valley. Thus the pay-streak would be formed. Afterward the gravel, sand, and alluvium of the flood-plain would be deposited over and beyond it, but it would continue to mark the position of the bottom of the old V-shaped valley, no matter how wide the bottom of the mature valley might be afterward extended. After a flood-plain had been formed at the mouth of a valley, the river farther up-stream would still continue the downward erosion of its channel until it reached the grade of that below it, when lateral planation and the formation of the flood-plain would begin. Thus the flood-plain was formed gradually up the valley from its mouth, and always, where the old V-shaped valley changed into a U-shaped valley, there was left a trail of gold beneath it.

The gold which was collected and stored in the bottom of the V-shaped valley had been derived from the rocks of the adjoining country. At the same time the lighter material derived from the disintegration of these rocks had been carried through the valley and out beyond its limits, for the stream was then cutting down and enlarging it, and not filling it up, and there was very little room beside the stream for the accommodation of loose rock material. At the head of the flood-plain this gold, which had been concentrated from the rocks of the surrounding country through previous ages, was gradually covered, and hemmed in on both sides, by gravel and alluvial material brought down by the stream at a later date. Therefore the gold in the pay-streak was derived from its home in rocks at a date which preceded that of the formation and deposition of the gravel which overlies and surrounds it.

The gravel of the flood-plain may itself contain some gold which had been washed down the stream with it, or which had been washed into the valley from the sides, but this gold is usually very fine, such as might readily be carried by the stream for long distances. If, after the flood-plain was once formed, the stream should continue to deposit gravel to considerable thickness in the bottom of the valley through which it meanders, the source of supply for the gold would, on account of the general wearing down of the country, become more and more remote, and the average gold content of the gravel would gradually decrease from below upward.

The laws governing the formation and position of the pay-streak in an alluvial plain in the bottom of a valley may therefore be stated as follows:

1. It was formed in the bottom and at the mouth of the V-shaped valley, which was the young representative of the present valley.

2. It marks the position formerly occupied by the bottom of that V-shaped valley.

3. The gold contained in it was washed out of the surrounding country and collected into approximately its present position before the gravel of the flood-plain (or terrace) was deposited over and arround it.

It has been assumed for purposes of illustration, that the growth of the valleys in the Klondike district, which empty into the Yukon river, was continuous and regular throughout the second cycle of erosion, and in view of their symmetrical character and the regularity of the pay streak, which has been shown to have existed in them, it is probable that this assumption is not very far from correct; but nevertheless there were doubtless interruptions and cessations, both in the regular course of erosion and sedimentation. After the Yukon river had cut its valley down to base-level in this White channel period, or second cycle of erosion, the tributary streams flowing from the Klondike district also widened their valleys and formed flood-plains, as has just been described.

Then there was a long period of quiescence, during which the base-level of the country was raised, permitting heavy accumulation of gravel in the valleys, while at the same time the hills and ridges were worn down to mature forms. At the mouth of the valley of Bonanza creek the local gravels, derived from the watershed of the creek itself, accumulated to a thickness of more than 200 ft. These gravels can still be recognized forming terraces at many places on the hills several hundred feet above the bottom of the valley, and R. G. McConnell,† who has carefully measured them, has shown on a map accompanying his report a pay-streak running in a straight line through and beneath them. According to the laws here formulated, this pay-streak was formed in the bottom of the old V-shaped valley, which represented the valley of Bonanza creek at the White channel period in its youthful stages, and it now tells us the original position of the bottom of the V-shaped valley.

Just before, or at the termination of, the second cycle of erosion, the Klondike river brought a heavy load of sediment down from the mountains to the east, and covered the bottom of its own valley, and the mouths of its tributary valleys, with a bed of gravel, which, opposite the mouth of Bonanza creek, has a thickness of 150 ft. The influx of this gravel caused the lower portion of the latter stream to move westward, almost to the limit of its own flood-plain, and to be ready to begin a new rock valley with the advent of the next erosion cycle.

After the deposition of this upper gravel in the valley of the Klondike river, a period of elevation‡ set in, and the third cycle of erosion was inaugurated which has continued down to the present time.

With the advent of this cycle of erosion the Yukon river was rejuvenated and again began to actively deepen its channel, and at the same time the tributary streams also began to deepen their old channels, or to cut out new ones, in order to keep pace with the master-stream. The Klondike river, the largest affluent of the Yukon in this district, probably did not lag very far behind it in the work of downward erosion, but its tributaries, such as Bonanza and Hunker creeks, undoubtedly continued to flow in narrow V-shaped valleys as long as the main stream was actively engaged in deepening its channel.

Opposite the mouth of Indian river the Yukon river has not deepened its channel as far below the level of the channel of the second cycle of erosion as it has at the mouth of the Klondike river, and the Indian river itself, being a smaller stream, has not cut back its valley as fast as the Klondike river, so that Dominion, Gold Run, Sulphur, and the other tributaries of Indian river have not had the same opportunity to deepen their channels as the tributaries of the Klondike river.

During the third cycle of erosion the smaller streams, and especially those flowing into the Klondike river, have cut down their channels to grade in narrow valleys, and

†Report on 'The Gold Values in the Klondike High Level Gravels,' by R. G. McConnell, Ottawa Government, 1907.

‡In a paper published in the *Scottish Geographical Magazine* for June 1900, entitled 'The Basin of the Yukon River in Canada,' I stated that this elevation was probably in the nature of a tilting from the southwest toward the northeast, but in view of the fact pointed out by Mr. McConnell that the rock terrace of the White channel period on the sides of the valley of the Yukon river, now rises steadily northward from the mouth of Stewart river to the mouth of Fortymile river, this opinion is no longer tenable.

have widened the bottom of those valleys by lateral planation and the formation of flood-plains, giving them a U-shaped profile. Terraces have been formed on the sides of the valleys, indicating halts in the progress of downward erosion, and narrow V-shaped gulches still carry

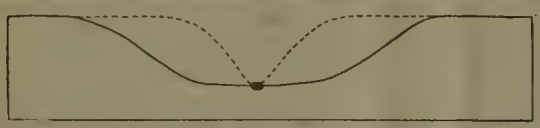


FIG. 1. DIAGRAMMATIC REPRESENTATION OF PAY-STREAK IN THE BOTTOM OF A SIMPLE VALLEY.

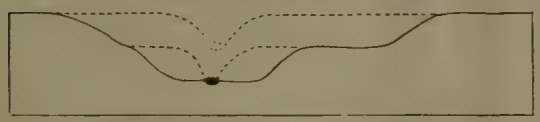


FIG. 2. DIAGRAMMATIC REPRESENTATION OF SECOND PAY-STREAK DIRECTLY BELOW THE FIRST.

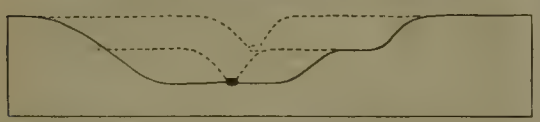


FIG. 3. DIAGRAMMATIC REPRESENTATION OF SECOND PAY-STREAK OBLIQUELY BELOW THE FIRST.

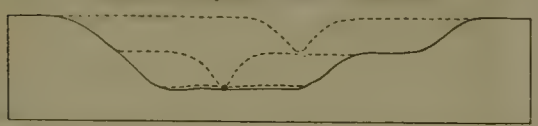


FIG. 4. DIAGRAM SHOWING HOW FIRST PAY-STREAK MAY BE DISTRIBUTED IN SECOND VALLEY.

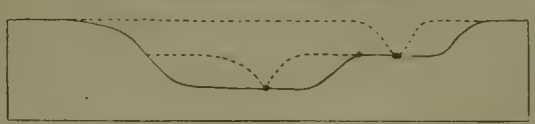


FIG. 5. DIAGRAM SHOWING FIRST PAY-STREAK AS TERRACE AND SECOND LIGHTER PAY-STREAK IN SECOND VALLEY.

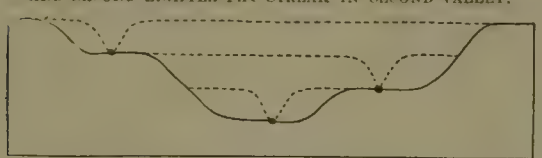


FIG. 6. DIAGRAM SHOWING THREE PAY-STREAKS AT DIFFERENT ELEVATIONS.

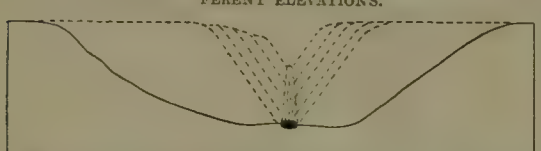


FIG. 7. DIAGRAM SHOWING FORMATION AND DOWNWARD GROWTH OF PAY-STREAK IN A WIDE VALLEY.

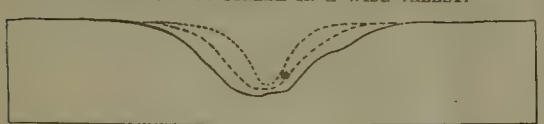


FIG. 8. DIAGRAM ILLUSTRATING THE TRANSFORMATION OF A V-SHAPED VALLEY INTO A U-SHAPED VALLEY.
(After Chamberlin and Salisbury.)

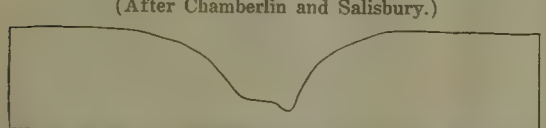


FIG. 9. DIAGRAM TO ILLUSTRATE THE WIDENING OF A VALLEY FLAT BY EROSION.
(After Chamberlin and Salisbury.)

small, or intermittent, streams into the sides of the main valleys. Pay-streaks, which have now been almost entirely mined out, ran beneath the flood-plains down the bottoms of these valleys, or crossed the terraces on their sides, and other pay-streaks were in process of formation in the gulches until that process was arrested by the work of the miner.

It is not necessary for the present purpose to follow the growth of these younger valleys in detail, or to trace the formation of the pay-streak in them, for that was clearly governed by the laws which have been already enunciated, but it will be interesting to indicate a few of the eccentricities which may have been introduced in the pay-streak by irregularities in the growth of the valleys in which they were formed. Difference in the character of the bedrock will produce a marked difference in the quantity of the gold in the pay-streak. A variation in the supply will also influence the richness of the deposit, as may be clearly seen in many of the small lateral streams, which flow into the main creeks. Some of these cut across the old pay-streak of the second cycle of erosion, and where this occurs the gravel in the bottom of these streams is enormously enriched. Temporary cessation of downward erosion, with the corresponding formation of flood-plains at successive levels, would appear, however, to exert the most powerful influence in affecting the nature of the pay-streak and introducing irregularities into it. Suppose that a valley has been eroded down to the first level, and that a flood-plain has been formed at that level. The pay-streak will occupy its normal position in this flood-plain on the line of the bottom of the old V-shaped valley, as shown in Fig. 1. If the stream is rejuvenated and again begins to deepen its valley, a number of other conditions may occur.

1. It may cut down its channel directly beneath pay-streak No. 1, in which case the pay-streak will simply be lowered, and will contain practically all the gold from the older pay-streak, as well as any gold that may have collected into the channel since the time of its formation, as shown in Fig. 2.

2. It may cut down its channel to one side of pay-streak No. 1, and while still actively engaged in downward erosion may undercut the pay-streak and allow the gold to slide down the side of the valley into the stream, where it will be carried downward until it finds a new resting place. In this case, too, the second pay-streak will contain most of the gold that was in the first, but it will have undergone a decided movement down the stream. (See Fig. 3.)

3. The stream may cut out its second V-shaped valley entirely to one side of the first pay-streak, but when it again begins the process of lateral planation, and forms its second flood-plain, it may undercut the pay-streak and allow it to fall into the meandering stream, where part of it may quickly sink and form a pocket off the line of the true second pay-streak altogether (though it will give an indication of the former position of the first pay-streak), while part of it may be carried down by the stream and distributed in its winding channel. The true second pay-streak itself will, in this case, probably be very weak. (See Fig. 4.)

4. The second channel may be formed altogether to one side of the first pay-streak, in which case the first pay-streak will be on a terrace, and the second pay-streak will probably be weak. (See Fig. 5.)

Any of these conditions may occur in different parts of the same valley, and their relative intensity, or rapid changes from one to another, may cause great variations in the character of the pay-streak. A great number of stages in the deepening of a valley would allow for a still greater complexity in the character of the one or more pay-streaks which might be found in it, and these might be still further added to by a filling of the valley with detritus and part re-excavation at one or more different times. But, for the period in which it was formed, the pay-streak represents the bottom of the young V-shaped valley, which formerly occupied part of the present valley.

Vipond Porcupine Gold Mines Co., Ltd.

By W. S. Dobbs

The property of this company consists of four claims situated about one-half mile south of Pearl lake, in Tisdale township, and southeast of the Hollinger mine. Work has been carried on continuously since April 1910. A test-mill consisting of one Nissen stamp was erected the last week in February 1911, and was in operation continuously till the fire on July 11 destroyed the entire plant. The mill clean-ups amounted to more than $6000. The plant consists of a 12-drill Sullivan compressor and a Jenckes hoist in one building, a shaft-house, two bunkhouses, cook camp, office, and assay office. A mill is being built. The assay office is furnished with a complete series of appliances, rotary and jaw crushers, a Braun combination muffle and crucible furnace, scales for weighing crucible charges, and a button balance, anchored and free from all vibrations of the building.

On the northern claim, some 27 veins have been discovered, but the principal development has been on the veins known as No. 2 and No. 3. Besides two test-pits or prospecting shafts and an open-cut on No. 3 vein, the principal work has been carried on from the main shaft, which has been sunk to a depth of 300 ft. As soon as a station has been cut and a sump sunk, cross-cutting will be done to intersect veins No. 2 and 3. The principal work has been done on the 100 and 200-ft. levels. On the 200-ft. level 500 ft. of driving has been done on No. 2 vein, and 140 ft. on No. 3. This showed good ore at the southwest end. On the 100-ft. level 600 ft. of driving has been done on No. 2 vein, the westerly end of the drift being stopped because of the proximity of the swamp. At the east end the latest assay across the face of the drift showed ore worth $98 per ton. No. 3 vein has simply been crosscut and is 25 ft. wide. It assays $12 across this width. On the 100-ft. level an irregular mass of quartz lenses interspersed with hornblende schist, and assaying from $3.50 to $6 per ton, has been cut. This zone is 50 ft. wide.

The principal veins occur in a shear-zone of amygdaloidal basalt altered to a hornblende, and in some places to a sericite schist. The crushing and shearing has also opened a series of channels, along which the depositing solutions operated, so that this shear-zone is a mass of fine stringers, and along certain well defined lines much larger orebodies have been formed. One other result of this action has been to dissolve the calcite and carbonates of iron and magnesium which fill the amygdules, and redeposit the material as stringers through the fracture planes.

The framework of the mill is practically all in place, the roof is rapidly being completed, and the erection of machinery was commenced April 22. The flow-sheet and milling practice is to be as follows: The ore will be delivered at the mill by a tram from the main shaft and passed through a Buchanan jaw-crusher, then after passing through Sturtevant rolls which will reduce it to ¾-in. size, by elevator and conveyor to ore-bins. From the bin the ore will pass through James automatic feeders, to Hardinge 4½-ft. ball-mills, then through Colbath classifiers, the slime passing directly to the amalgamating plates, while the sand is to be passed through a 6½ by 6-ft. Hardinge tube-mill. The product of the tube-mill will be passed over a second Colbath classifier, the slime from this passing over the amalgamation plates and the sand being returned to the tube-mill for recrushing; the whole in time being slimed and passed over the amalgamation plates.

The mill is designed so that two units of 75 tons capacity each can be operated in parallel; each unit being entirely independent. The construction of a cyanide plant was in contemplation, but in view of the excellent results obtained in the Dome mill, the management of the Vipond has decided to test the present plan of sliming and amalgamating before proceeding with any further ore-treatment. The manager, C. H. Poirier, estimates that one unit at least will be in operation by May 20, 1912.

A Chart of Ore Deposition

By Charles R. Keyes

In so far as workable orebodies are concerned, descending currents of water are probably more important than the ascending. In the diagram shown herewith, the courses of the various circulations are represented as merging at a single point or along a given line. The latter may be an old mineral vein or it may be a recent fault plane. In either case the currents reach ground-water level, where their burdens of oxidized ores are mainly reduced to sulphide form, and dropped to form the bonanza zone, or layer of secondary sulphide enrichment. A minor part goes on downward into the profound zone. The proportion

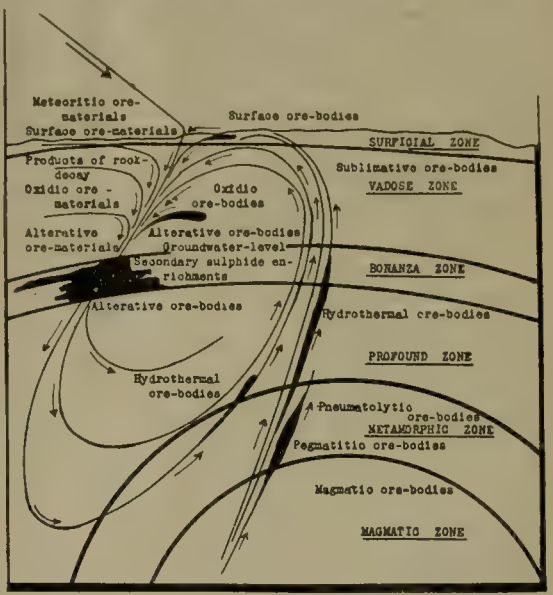


DIAGRAM SHOWING UNDERGROUND CIRCULATION OF WATER.

of metallic substances derived from each source is difficult to determine. Meteoric sources supply much larger amounts than has been commonly supposed. The part liberated by the secular decay of rocks is probably the largest. By the oxidation of small masses of sulphidic ores in rocks appreciable contributions are made. Through the constant working over of the bonanza layer, the ores are kept localized. At any rate, deposition of ores direct from the vadose zone is much more important than is usually assumed. The conclusions may appear, at first sight, somewhat theoretical; but accord with the observed facts. Of the worked ore deposits of the world, a majority probably have their immediate origin from vadose rather than seated igneous sources.

Time in Drilling

The following tabular recapitulation of the drilling operations in the Laramie tunnel, according to D. W. Brunton, shows that the men could not only complete a round in an 8-hour shift, but had sufficient extra time to provide for shooting missed holes or taking care of any of the minor difficulties which often arise in tunnel work.

Exhausting smoke from face	10 to 12 m.
Picking down roof and sides	5 to 10 m.
Jacking cross-bar in place	6 to 8 m.
Attaching drills, making hose and water connections	5 to 15 m.
Drilling from top set-up	3 h. to 4 h. 15 m.
Dropping horizontal bar to lower position	15 to 20 m.
Drilling on lower set-up	1 h. to 1 h. 15 m.
Removing drills, cross-bar, hose, etc	15 to 20 m.
Blowing out holes, loading and firing	20 to 25 m.
Ignition to explosion of last hole	8 to 8 m.
Total time required to complete cycle of operations	5 h. 24 min. to 7 h. 28 m.

British Columbia Living Conditions

By S. S. Fowler

[In the course of an interesting and instructive paper on costs and cost conditions at the Bluebell mine, read before the Canadian Mining Institute, Mr. Fowler gave the following details as to quarters and wages.]

The Bluebell mine is situated on a peninsula which projects from the east side of Kootenay lake, British Columbia. The orebodies, outcropping at 100 ft. or less above the water-level, are attacked through an adit whose portal is within 100 yd. of a wharf at which all supplies are received and from which all product is shipped. Adjacent to the portal are the concentration plant and shops; and the office, laboratory, and living quarters, save certain cottages, are within 200 yd. thereof, while the greatest distance from which the ore so far developed requires to be hauled does not exceed 300 yd. It will be observed, therefore, that accessibility is practically perfect. Nelson, the chief source of ordinary supplies, is distant about 32 miles by boat.

The living quarters comprise: (*a*) Several four-room cottages, all plastered and painted, situated about 500 yd. from the work, provided with water and electric light and each surrounded by a fenced plot of ground 60 by 120 ft. These cottages are rented to employees with families at $12 per month each. (*b*) A bunk-house containing 27 rooms and two recreation rooms. All of these are plastered and painted and open on to covered verandas, there being no internal passages. No more than three men may occupy any one bedroom. (*c*) A 'dry'-house adjoins the bunk-house and contains in one room 6 shower-baths with cement floors and ample sinks, laundry tubs, and hot and cold water. In a connecting room are lockers properly ventilated and provided with steam-pipe below. Toilets are in a small separate but conveniently placed building and are fitted with flush closets on a cement floor. All buildings are steam heated when necessary. (*d*) Within 50 yd. of the bunk-house is a boarding-house with seating capacity for 100. In a basement of this building is a post-office (Riondel) and a store supplied with the commoner necessaries of the employees; but no employee is either compelled or influenced in any way to trade there. The dining-room is ceiled, painted white, and amply lighted on north and south sides, thus being a cheerful place whose influence on the dispositions of those who use it—to say nothing of their appetites—is notably favorable. An easily accessible field situated some 300 yd. from the living quarters is much used for sports, and several of the men have maintained their own canoes and small motor-boats in the nearby bays.

Without reference to the natural and quite exceptional beauties of the surroundings, such are the conditions which affect the lives and work of those who labor at Bluebell. It need hardly be said that they attract the best class of men, who, when once they have secured employment, usually are not desirous of change. On the part of the management there has been no attempt at paternalism. The sole prohibitions are canvassing, gambling, and overmuch drink. It does nothing and provides nothing which may be regarded as charity. The result has been that while doubtless all hands realize that low costs are essential to a continuance of operation, the men as a staff also possess what may be termed a 'collective conscience,' the existence of which has contributed in large, no doubt, to low costs in a country of high wages and expensive materials.

Practically all work has been done by day labor rather than by contract, and the wages paid (regarded as 'standard' for the district) are as follows, 8 hours being the basis except for mill hands, who work 9 hours:

Foremen, $5 to $6; shift bosses, $4 to $4.50; machine miners and helpers, $3.50; hand miners, $3.25; mill hands, $3 to $4; blacksmiths and helpers, $3.50 to $4; compressor runners, $4; muckers, $3; carpenters and machinists, 50c. per hour; outside laborers, $3. The approximate average wage for all classes is $0.433 per hour.

Western Australian Gold Production

The gold yield from Western Australia in March was valued at $1,975,000. The mint dealt with 114,405 oz. of bullion and issued $590,000 in gold coin. Returns from the chief producers were as follows:

Name.	Tonnage.	Value.	Profit.
Associated	10,858	$ 70,500	$ 5,600
Associated Northern Blocks.	1,988	28,000	5,000
Burbanks Main Lode	1,770	21,500	10,000
Golden Horse-Shoe	25,201	162,000	6,500
Golden Ridge	2,982	26,500	8,700
Great Boulder Perseverance.	19,715	105,000	5,800
Great Boulder Proprietary..	18,057	238,000	131,000
Great Fingall	5,929	58,500	6,500
Hainault	5,700	35,000	2,500
Ivanhoe	20,010	208,000	90,000
Kalgurli	10,720	107,500	45,500
Lake View & Star	18,202	106,500	18,000
Oroya Black Range	4,750	40,200	10,000
Oroyo Links	11,030	67,500	15,000
Sons of Gwalia	12,740	98,500	20,000
Sons of Gwalia South	2,435	11,500	.....
South Kalgurli	9,668	61,500	10,500

Calumet & Hecla Report

The report of the Calumet & Hecla Mining Co. just issued covers the period from April 30 to December 31, 1911. A comparison is made of mining costs, yield of the ore in pounds of copper for a period of four years. This report is interesting in connection with similar reports just issued by copper companies operating on low-grade deposits in Utah and Arizona.

Calumet & Hecla Lode

	1908.	1909.	1910.	1911.
Tons mined	2,643,938	2,842,880	2,795,514	2,909,972
Mine cost per ton	$2.15	$1.93	$1.92	$1.84
Pounds of copper per ton of rock	31.22	28.18	25.77	25.47
Total cost of copper per pound, cents.	9.00	8.28	8.96	8.52

This tonnage is produced from the so-called Conglomerate lode, and the Osceola lode, two-thirds of the output coming from shafts on the former lode.

The results of the operations of the re-crushing plant started in February 1909 for the re-treatment of tailing from the old Calumet mill are also given.

	1909.	1910.	1911.
Tons coarse tailing crushed	278,175	441,920	447,794
Pounds copper in material	12.96	12.60	12.66
Pounds copper saved	4.50	4.42	4.50
Cost per pound, exclusive of smelting and selling, cents	4.81	5.08	5.01

Dividends

Alaska United G. M. Co., dividend No. 19, 50c. per share, payable May 28.

Alaska Mexican G. M. Co., dividend No. 66, 40c. per share, payable May 28.

Alaska Treadwell G. M. Co., dividend No. 97, 75c. per share, payable May 28.

The Pittsburg-Idaho Mining Co., of Gilmore, Idaho, has declared a dividend of 4c. per share.

The Parrot Silver & Copper Mining Co. has declared a regular quarterly dividend of 15c. per share, payable May 27.

The National Lead Co. will pay a regular quarterly dividend of 1¾% on preferred stock, payable June 15.

The National Lead Co. will pay a regular quarterly dividend of ¾% on the common stock June 29.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Mining on the West Coast of Mexico

The Editor:

Sir: My attention is called to your issue of May 18, in which you make the statement that only the Mina Mexico and the La Dura mines are working in the Yaqui River district. This is an error. The following mines are working at the present time and there has been no thought of their shutting down and no diminution of their output:

The Goteras, Thomas C. Hardy, consulting engineer and manager; the Las Animas, Wyman Mining Co., W. C. Laughlin, lessee and manager; the San Antonio Copper Co., J. E. McIntyre, superintendent; Mina Mexico, W. E. Pomeroy, manager. In addition to these four, there is another mine in the San Xavier district under the management of J. A. King. I do not recall the name either of the property or the company.

You are also in error in stating that the Southern Pacific railroad has suspended service on account of the depredations of the Yaqui Indians. There were a few bridges burned more than a month ago between Guaymas and the Yaqui river, and service was suspended only until these could be repaired. On account of the depredations of the *Revoltosos* in Sinaloa, service was temporarily suspended south of San Blas. It has not yet been resumed fully, but the company is operating some trains now on the south end.

For your further information regarding industrial conditions on the West Coast, I may add that the exports of citrus fruit from Sonora this season show an increase of more than 30% over last year. The exports of tomatoes and cantaloupes show an increase of 50% over last year.

G. C. WHITE.

Guaymas, May 23.

[It is always a pleasure to correct bad news, and we are sincerely glad that conditions in Mexico were never as bad as reported and are now much better. Steady improvement is, in the opinion of competent observers, to be expected from now on. A country that increases its agricultural exports in the midst of revolution, is evidently sound at heart, and the 'West Coast' may well anticipate generous prosperity when the present troubles are finally ended.—EDITOR.]

Low Mining Costs

The Editor:

Sir—I am sure the readers of your journal would be interested in the record made for April at Prietas, Sonora, Mexico, at the mines of the Mines Company of America. The ore was taken from the Creston and Colorada mines. A total of 18,000 tons was treated in two mills; 9900 tons in the Creston mill and 8100 tons in the Grand Central mill of Charles Butters & Co., Ltd. This was done at a total mining and milling cost of $2.60 gold. The divided costs were as follows:

Mining and development	$0.65
Tramway	0.07
Milling	0.45
Cyaniding	0.97
General expenses	0.23
Bullion	0.20
Taxes	0.03
Total cost	$2.60

I think this is a record for low costs in Mexico, remembering that it was done during the disturbed period of last month. These low costs were obtained notwithstanding the fact that power costs in the neighborhood of $12 per horse-power.

M. F. Perry, joint manager for the Mines Company of America and Charles Butters & Co., Ltd., is in charge of the property, and I think that a great deal of credit is due him and his staff for such a low record of working costs.

CHAS. BUTTERS.

Oakland, California, May 24.

American and Foreign Technical Journals

The Editor:

Sir—In your issue of December 9, 1911, in a book review by T. T. R., appeared the following:

"That American text-books and technical journals are ample to meet the needs of the well-read metallurgist is far from the truth, is exhibited by the fact that there does not exist in America a metallurgical journal to be compared with *Metallurgie*."

Supposing that T. T. R. is right (which he ought to be, having had such experience as would make him a judge), then there is only one inevitable conclusion, which is, that something is wrong with American technical journals. The purpose of a technical journal, as generally understood, is to keep its readers well informed on the best technical practice and at the same time make money for its owners. The latter usually follows if the first is accomplished. Does T. T. R. mean to tell us that the metallurgist who doesn't read *Metallurgie* because he can't read French cannot be well informed? If so, then why doesn't he or the journal with which he is connected endeavor to remedy the matter? I have often wondered how much American engineers were missing and how often they duplicated the improvements and progress of foreign engineers on account of their inability to read French or German. According to T. T. R., it must be considerable.

What is to prevent American periodicals from translating and publishing these articles for us in English? True, *The Mining Magazine* abstracts some of the better articles, but there are others that must have unquestionable value. The *Mining and Scientific Press* and other technical periodicals print pages from the U. S. G. S. bulletins and other publications in English which, I feel sure, the majority of readers would appreciate more if they were filled with translations of the better foreign articles.

In this day of indexes, digests, etc., we can easily find all the information published in English, but the technical information in a foreign language, even when found, is a sealed book to 95% of our engineers. A reader cares little whether an article is original with the publication printing it as long as he is unable to read it elsewhere. Why can not or will not a technical journal adopt the policy of translating and reprinting such articles in foreign publications that possess as much merit as the average run of their own articles? Are there too many of them? If so, then give us a special department of several pages filled with the best. Are we already getting in English those worth while? If so, then T. T. R. is wrong, and he put it rather strongly.

NOAH'S ARK.

Guazapares, Chihuahua, May 3.

[Our correspondent, like any other person who amplifies a specific statement into a generalization, produces some confusion of ideas. The statement which he quotes was used to refute an assertion that the author of a text-book may properly confine his references to a few of the American technical journals and the standard American treatises on metallurgy. The patriotism of this is more admirable than its accuracy, for the best work upon the mechanical treatment of steel, for example, is an English book, and, as quoted, *Metallurgie* (a German journal, by the way) is in a class by itself in many respects. It does not follow, however, that those who do not subscribe to foreign technical journals are missing much that would

be of value to them. All the more important volumes in French and German are promptly translated into English with a view to reaching the large group of readers in America who buy technical books much more freely than do English engineers. The American Chemical Society maintains a staff of over 200 editors and abstractors whose duty it is to read and abstract all the important papers bearing on chemistry as they appear, and over 6000 such abstracts were published in *Chemical Abstracts* during the first four months of the current year. All phases of engineering work are based upon either physics or chemistry, and as the chemical side is the one that lends itself easiest to investigation, it is safe to say more than half of the important papers published abroad are thus abstracted. The labor and cost of this work is enormous, and it would be idle for any other American journal to duplicate it. Important papers without bearing on chemistry appear abroad, but they are usually on topics such as coal or iron mining, or descriptive and areal geology, which either are outside the field which the *Mining and Scientific Press* attempts to cover or would not interest Americans. Abstracts of the few papers which are not included in any of these groups appear in our columns from time to time. The few men who are engaged in advanced research work must necessarily consult all the literature on the topic under investigation, but those engaged in such work can usually read foreign languages, though perhaps with difficulty. It must not be overlooked that technical journals confine themselves to some special field; the *Mining and Scientific Press*, for example, is not a bibliotheca, but a journal devoted to the mining and metallurgy of the nonferrous metals, and many important articles which would be of interest to a few readers have to be excluded to make room for what interests the majority. We would be glad to receive expressions of opinion and suggestions from all our readers as to how we can best serve their needs.—THOMAS T. READ.]

Conservation v. Encouragement

The Editor:

Sir—Just before the assassination of that great and good man, Abraham Lincoln, Schuyler Colfax left Washington to cross the continent. As Mr. Lincoln bade him farewell, he said:

"I want you to make a speech for me to the miners you may find on your journey. I have very large ideas of the mineral wealth of our Nation. I believe it is practically inexhaustible. It abounds all over the Western country, from the Rocky Mountains to the Pacific, and its development has scarcely commenced. Now the Rebellion is over and we know pretty nearly the amount of our national debt; the more gold and silver we mine makes the payment of that debt much easier. I am going to encourage that in every way. We shall have hundreds of thousands of disbanded soldiers, and many have feared that their return home in such great numbers might paralyze industry by suddenly furnishing a greater supply of laborers than there will be demand for. I am going to try to attract them to the hidden wealth of our mountain ranges, where there is room for all. Immigration, which even the war has not stopped, will land upon our shores hundreds of thousands more every year from overcrowded Europe. I intend to point them to the gold and silver that waits for them in the West. Tell the miners for me that I shall promote their interest to the utmost of my ability, because their prosperity is the prosperity of the Nation. We shall prove in a very few years that we are indeed the treasury of the world." This was the last message, almost the last public utterance, that came from the lips of Mr. Lincoln. Those prophetic words, uttered nearly half a century ago, still make the heart of a miner glow. How different from the 'encouragement' the miner and prospector receives from a paternal and beneficial government at the present time.

The purchase of Alaska is generally accredited to the far-seeing enterprise of W. H. Seward, Secretary of State under Lincoln, and afterward under Andrew Johnson, but is it not possible that this purchase was inspired by the wisdom of Lincoln? At any rate, on March 30, 1867, the transfer of 581,107 sq. mi. was made to the United States for the sum of $7,200,000, known as Russia-America-Alaska; on June 20, 1867, ratifications were exchanged, and the formal transfer made to General Rousseau at Sitka, October 9, 1867. At that time there was much dissatisfaction expressed all over the country at this high expenditure of public money "for this miserable barren waste of ice and snow."

Forty-four years have come and gone since that time, and it is now evident that Mr. Seward made no mistake; that before even one-fourth of this vast region has been even partly explored, and only a few thousand acres surveyed, Alaska has returned her purchase price many times over. This "miserable barren waste of ice and snow" has since 1880 yielded a mineral production of $186,000,000, out of which $179,000,000 is represented by the value of the gold output. Since the year 1800, about 3,000,000 sq. mi. have been added to American territory at a cost of approximately $90,000,000, all of which the output of American gold for almost any one year since 1900 more than paid for. Mr. Lincoln's prophecy has been well sustained.

Not so long ago some wise 'wags' even attempted to create an overproduction-of-gold scare, but the rapid increase in the production of gold and silver of a few years ago has ceased. It is a safe prediction that, under the present system, in a few years the pendulum will swing in the opposite direction; at least so far as the United States is concerned. The present standard of the gold and silver production in America is maintained by application of improved metallurgical methods to low-grade ores and dumps at old mines, material which was previously considered unprofitable, and not by virtue of new discoveries. It is not hard to see the 'beginning of the end' of the large gold and silver output in this country, if the Government persists in 'conserving' the unexplored mineral districts for some distant future generation.

It is said that it is far from being the intention of prohibiting "legitimate settling and prospecting"; contrariwise, the Government's desire is to encourage it; but the fact remains that all prospecting and exploring has practically ceased throughout the entire mountain regions of the West; the old-time hardy, intrepid, and intelligent prospector has been driven out of the field. If you ask him why, he will likely tell you that he does not propose to be bulldozed by some impertinent Forest Ranger, who knows less about minerals than the horse he rides, nor to take dictation from him as to where he may or may not prospect.

The prospector does not object to inclusion of mineral areas in the National Forests. The average prospector has more regard for the timber on his claim than has the Government itself; he is a conservationist by instinct; but he does object to the intolerable restrictions to which he is subjected, and he has quit the field in disgust. There is something radically wrong with the system as now in practice, especially with reference to the unexplored mineral areas in the western states. Would it not be far better to leave each state to work out its own "conservation" to suit its own peculiar needs? Anyway, encourage and protect the pioneer settler and prospector.

MARTIN FISHBACK.

El Paso, Texas, May 1.

ZINC to the amount of 71,937 tons, equal to 25.1% of the total production of primary spelter, was derived from secondary sources in the United States in 1911, according to J. P. Dunlap of the U. S. Geological Survey. The zinc recovered in alloys other than brass amounted to 3223 tons. Of the 44,714 tons of secondary zinc recovered as spelter, 18,244 tons was obtained by re-distillation from drosses and skimmings. In addition to the large quantity of spelter recovered, several thousand tons of zinc chloride was made from drosses, skimmings, and similar material.

Special Correspondence

BOSTON

Copper Metal Strong.—Dividends Increase. New Life for Shannon.—Amster Plans New Company.

The copper metal has advanced in price faster than the stock market for the shares. Some of the producing companies have increased their dividend rates, and the public is expected to bid up good copper stocks in anticipation of the increased earnings inducing other companies to distribute larger profits to shareholders. Calumet & Hecla and Quincy have both added to their fame as dividend payers by increasing their rates. These two Lake coppers have probably done more than any other companies to inspire public confidence in the stability of the mining industry as a source of dividends, and it is regarded as particularly fitting that at this crisis they should help set the pace for the other dividend-paying copper companies. Quincy is an older dividend-payer than Calumet & Hecla, and has maintained payments since 1862, except for the two years 1866 and 1867. The company was incorporated in 1848. Under the Michigan laws, a charter could be obtained for only 30 years. So Quincy has had to reincorporate twice. Its first capitalization was $500,000 in 1848; its second was $1,000,000 in 1878, which was increased to $1,250,000 in 1889, $2,500,000 in 1896, and $3,750,000 in 1906. In 1908 its third term of life was entered without further increase in capitalization. Calumet & Hecla was organized in 1871 with a capital of $2,500,000 and reincorporated in 1900, but has retained its original capitalization since the formation of the company. Under the new laws of Michigan, in 1905 its charter was amended so as to make it a holding as well as a mining and smelting company. Last year the company sought to have its capitalization increased to $10,000,000 for the purpose of effecting a merger among a number of companies in the Lake country, but after a close and acrid contest the proposal was dropped. Calumet & Hecla leads Quincy in the total amount of dividends paid, and is now on a basis of $40 per year, with Quincy paying $5 per year. In addition to these two well established companies, Ahmeek, Amalgamated, North Butte, and Old Dominion have increased their rates. Last year there was but one increase, a really unexpected and remarkable one, by Old Dominion, while four companies, Calumet & Hecla, Copper Range, Mohawk, and Osceola reduced their rate, and two other small but formerly rich copper properties, Butte-Ballaklava and Shattuck-Arizona, discontinued payment. There are now 15 regular dividend-paying coppers on the Boston Exchange, as compared with 17 a year ago, 20 in 1910, 15 in 1909 and 1908. Other companies are expected to follow the lead of the stronger stocks and by declaring dividends attract the public back into the copper market, with as lively an interest as in 1906.

Nathan L. Amster, one of Boston's copper speculators, is still looking for his money where he lost it. Instead of withdrawing his losses, Mr. Amster declares that his hat is still in the ring. He has lost the control of the Arizona Commercial, but has held on to Shannon and to Boston & Corbin. Shannon is now producing at the rate of 18,000,000 lb. of copper per year, a material increase over last year. As a commentary on the changing methods of mining since churn-drills and steam-shovels were introduced from the iron districts, Mr. Amster claims Shannon to have been the first porphyry mine ever opened, and that the management would consider the advisability of changing the method of mining to open-cut but for the expense involved in the purchase of steam-shovels and in other necessary changes in machinery. Shannon has produced over 100,000,000 lb. of copper since the mine was declared exhausted a few years ago, and is now said to be in better shape than ever. Mr. Amster points to this fact as the best possible evidence of the great value of churn-drilling. Its application to Shannon earlier in the history of the company would have kept hundreds of investors from sacrificing their holdings a few years ago, under the belief that the mine had played out. The Shannon ore deposit is spread out laterally, and when the lower limit of the blanket was reached the mine was considered exhausted. The time may come when drilling will be applied to all properties in the neighborhood of rich producers which have been abandoned, and in the future no mining property will be given up for lost until every modern method of finding extension of orebodies is exhausted. It is of interest to note that Amster has taken over a new copper in the Patagonia district of Arizona, 62 miles south of Tucson, but only three miles from the Southern Pacific railroad. He claims to have in this property an orebody similar to Miami and Chino, 800 to 1000 ft. wide and 5000 to 6000 ft. long. The property will be developed by the open-cut method, and rich ore which it is claimed exists in shoots will be shipped to the Copper Queen smelter at Douglas and to El Paso. This mine has not been incorporated as yet, but Amster is known as a skilful mining operator and a daring market manipulator, and should he decide to organize a company to operate his new property he should have little difficulty in commanding the support of a large following among both Jews and Gentiles in Boston and New England.

WESTERN AUSTRALIA

Production.—The Strike.—Railway Construction.

In March two new producers, the Ywanni and Mountain Queen, returned 5050 tons worth $49,000, and 3516 tons worth $15,300, respectively. The former has a 20-stamp mill, tube-mills, and vacuum plant, while the latter is so far equipped with two Holman pneumatic stamps. On running time the Holman stamps crushed 67 tons each per day. About the most important development during the month was at the 200-ft. level of the Kalgurli, where, in the V drift off W cross-cut the ore is 24 ft. wide and worth $27 per ton. In the S drift off this cross-cut the first 9 ft. assays $30, the next 5 ft. $12, and the next 10 ft. $5 per ton. The Lancefield, at No. 8 level, cut the lode, and so far it is 96 in. wide and worth $11.30 per ton. The Sons of Gwalia progress reports are fairly good; diamond-drilling is still in progress on three levels. The Fingall winzes below 17 and 18 levels show profitable ore. Reports from the Bullfinch, Ywanni, Lake View & Star, and numerous other properties are on the whole rather satisfactory.

Ore of low grade shows at the north end of the Kalgoorlie field. The Golden Dream treated during the past half-year 7204 tons of oxidized ore with a yield of $18,000, or $2.48 per ton. The reserves are stated at 7000 tons, worth $2.62, in lodes 15 to 30 ft. wide, assaying $1.80 to $2.64. Dividends are paid on this grade. The treatment plant includes a jaw-breaker, a 5-ft. Huntington mill, sundry pumps driven by a Crossley gas-engine, spitzkasten, and leaching vats for the sand. The summer is over, and we have had splendid rain, so that many ponds are full, rock holes filled, and grass is shooting up fast.

The Iron and Brass Molders' strike is still on, with no apparent settlement in view, yet the mines are working full time on spares and makeshifts. The men have no chance of getting $26 weekly and extra overtime.

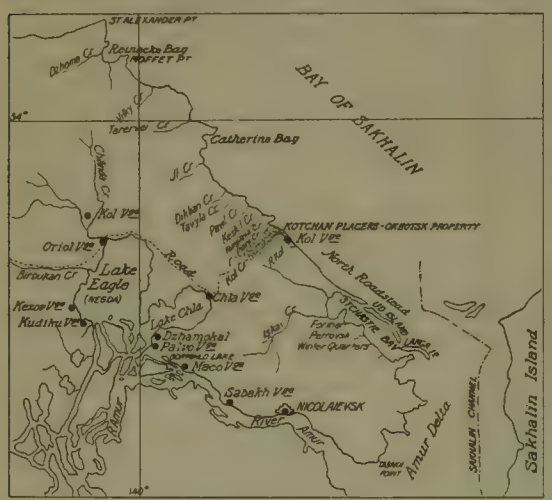
Preparations are in progress for the starting of work on the trans-Australian railroad. In all probability the workshops will be erected in Kalgoorlie near our own central station. It is the intention of the federal government to supply the men with stores, look after sanitary condition of camps, and work everything on a proper system. The work will be done by day labor. The Western Australian Government has decided to sell water at 48c. per 1000 gal. to mines not yielding over $2.40 per ton; and the old price of 84c. to those returning up to $3.26. This is a big concession, and may stimulate work. On March 21 there was a fearful cyclone or 'cock-eye' on the northwest coast, in which a 4000-ton steamer and 140 passengers and crew disappeared, besides which smaller craft were wrecked, many lives lost, and great damage done generally.

Every year these disturbances occur in that region. We have modified 'blows' on the goldfields, but nothing approaching those in the tropics. There have been a few mining accidents of late, also several 'high-grading' cases. Metallurgically there is little to report. A party is about to re-treat the residue from the old Boulder Main Reef dry-crushing and roasting plant, by a system of leaching. A few years ago another syndicate sought to re-treat this dump by agitation and filter-pressing, but failed badly, the expected gold content not being recovered. The Boulder has its second Ridgway, No. 3 type filter, at work, the first type being discarded. One man can watch several of these working, with a minimum of repair. Extraction and cost are said to be good.

ST. PETERSBURG, RUSSIA

Osmiridium in the Urals.—Silver in the Urals.—Gold Along the Amur.—Mineral Deposits of Kuznetzky.

The production of osmiridium in the Urals has fallen almost to the vanishing point, according to the returns issued for 1911. In 1902 the production amounted to 11 funts, but it has declined since 1904 with fair regularity to only 34 zolotniks last year, after having been 3 funts 93 zolotniks in the year 1910. It is a remarkable decline, particularly at a period when the Russian Government is arranging to monopolize the platinum production with, among other objects in view, the retention in the country of the



LOWER AMUR GOLD REGION.

associated osmiridium; it being a matter of perennial complaint in Russia that this precious metal leaves the country practically in the form of a free gift to the buyers of the platinum ore. It is not to be supposed that though the production has practically ceased in the Urals the metal has ceased to be associated with the platinum which is still found in fairly large quantities in that area. The presumption is that the St. Petersburg or local refiners have not found it to pay to separate the osmiridium, and that now produced is obtained at the refineries of western Europe and America.

The record of last year's silver production in the Urals shows that progress is being made in its production. It is estimated that the production for 1911 in the Urals amounted to about 500 poods, as compared to 452 poods produced in 1909. The works engaged in separating this metal are those of the Kyshtim company and of A. Ph. Poklieffsky-Kozel, in the Northern Ekaterinburg mining district, which produced the small quantity of 9 poods 14 funts. But in the Western Ekaterinburg district at the Nizhni Kyshtim electrolytic works 117p. 8f. of pure silver was separated. It is stated that besides the silver produced at the Blagodat mines of Poklieffsky-Kozel in the process of smelting copper and lead ores, both gold and silver are extracted from ores and smelter products abroad, and it is on the assumption that the results from these equaled those of 1910 that the 500 poods total for 1911 is arrived at. This would make a record silver production for the Urals.

Reports have been received from Nikolaievsk as to the prospects for gold working on the Amur during the coming open season, and it is stated the gold deposits there will be vigorously worked with electric dredges; particularly on the ground of the Ochotsk company, which has been leased to the English Orsk concern, a station having been built about 12 versts (8 miles) from the mines on the bank of Lake Chlya. Considerable activity is observable also on the gold-bearing Lakes Udyl and Orel, and negotiations are said to be proceeding between the present holders and English houses for the transfer or sale of the properties. With the institution of such work and thereafter of exploitation, Nikolaievsk, which is now of considerable significance as a port and centre of the fishing industry, will acquire importance also as the centre of the gold industry on the Lower Amur. A group of gentlemen have asked for permission of the Irkutsk mining government to explore and exploit the rock-salt deposits within the limits of its administration. The personnel of this group, it is added, is exclusively Russian.

In the foothills of the Altai mineral deposits occur, particularly in the Kuznetzky district, which contain gold, silver, copper, iron, and coal. The most important of these are gold and silver, though the Kuznetzky is rich in coal measures and beds of iron ore. Between the Salairsky and Kuznetzky chain of hills there are frequent outcrops of coal covering an area of about 60,000 square versts, in some cases to 20 sagenes or 140 ft. thick. Some of the deposits yield good coking coal. Altogether the district is considered to be very valuable. Along with the coal there is iron ore. To the north along the Salairsky chain there is both red and brown iron ore, and to the south along the river Telbess and near the tent of Sucharinki magnetic iron ore occurs in large amounts.

LONDON

Tin Companies.—Methods of Financing.

I have repeatedly referred in this column to the unsuccessful work done by the Schiff-Dietzsch group in Cornwall. One flamboyant scheme has succeeded another, and large sums of money are extracted from the public, but no tangible results are ever obtained. The latest of the scheme was the St. Agnes Consolidated. To avoid newspaper criticism, the shareholders' meetings are kept quiet, but nevertheless the reports come to my notice. For instance, one was issued early in May and it affords as good an example of exaggerated optimism as I have seen for a long time. It refers to the fact that the company's operations have been almost entirely confined to the development of its extensive mining area at St. Agnes, and says that "these operations have been effected with highly satisfactory results." No one acquainted with the results actually attained would endorse this statement. It is common knowledge that the West Kitty Mines, in which the company holds a controlling interest, is in a tight corner, and, without a good deal more capital, cannot possibly be made a profitable proposition; the valuable lode found some months ago in the 80-ft. cross-cut south from Wheal Friendly cannot be properly developed until the shaft has been sunk another 25 fathoms. At East Blue Hills, the only other property to which much attention has been given, a fair amount of low-grade ore has been exposed and most of it already milled. But it is hardly correct to call this ore "an excellent tin deposit", or to assert that, because the lode presumably enters the adjoining Blue Hills mine, "a large block of ground for extensive mining operations" is available. The St. Agnes district is notorious for the bunchiness of its ore, and any forecasts of the contents of undeveloped ground are the merest guesswork. No doubt the company owns properties of great possibilities, and the limited exploration so far undertaken has

given encouraging results. This is really all that can be said. The capital of the company is £175,000, and of this £137,900 has been issued; with the exception of about £400, this has been allotted for the purchase of properties which at the time consisted solely of leases, and none of the properties had any equipment. Cash capital to the extent of £43,700 was obtained by the issue of 6% participating debentures. The expenditure from the commencement of operations to December 31 last has been:

On plant, shafts, and buildings		£ 9,373
On development and establishment expenses	£10,690	
Less tin sales, interest, etc	2,078	
		8,612
On investments in and loans to West Kitty Mines		23,502
On preliminary expenses and commission on placing bonds		2,364
		£43,851

"Sundry debtors" and cash in hand amount to £1728, while the "sundry creditors" are £11,543; so it is evident that the company is in debt and will require additional capital to keep it going. Of the £10,690 placed to development account, apparently only £3174 was actually spent on the mines.

After writing the above paragraph, it is pleasant to be able to turn to the doings of another tin company that is managed economically and wisely. I refer to the Tekka, which belongs to the Wickett group, operating alluvial tin mines in the Federated Malay States. The offices are in Redruth, and the directors and shareholders are mostly Cornishmen. Osborne & Chappel are the managers. During the year ended January 31 last, 625,844 cu. yd. of gravel was treated, yielding 419 tons of black tin, a recovery of approximately 2 lb. per cubic yard. The quantity of gravel treated was 197,028 cu. yd. less than in the previous year, and the yield 14.7 tons less. Owing, however, to the advance in the pride of tin, the income was £6453 greater, the figure being £46,599. The mining cost was £13,620, and income tax absorbed £1057. The expenses in England were £560. The divisible profit was £32,276, out of which £26,741 has been distributed as dividend, being at the rate of 35%. The smaller amount of gravel treated is explained by the fact that more water is now required for elevating purposes. During the year the Taiping property has been acquired, and work was started in December.

A great deal has been heard of Nigerian tin recently, and the speculation has been ridiculous and wild. Not only so, but we have been treated to wide differences of opinion on the part of the mining engineers. The spectacle is unedifying and I pass it by. Instead I will give an account of actual work at the Bisichi, which is a small alluvial property near Naraguta, in the Bauchi province. The company was formed in October 1910, and H. W. Laws is consulting engineer. The property is favorably situated as regards water-supply and fall, and hydraulicking has been adopted for most of the ground. Until the end of March the work had been confined to ground-sluicing and calabashing. The report from the foundation of the company to December 31 last shows that 171½ tons of concentrate had been won. Of this, 106 tons has been sold for £138 per ton, the assay being 73.3% metal. The remaining 65 tons in transit when the accounts were prepared has since been received and sold. The cost of production and freight to Liverpool, but not including cost of treatment, was £49 per ton of concentrate. The accounts show £17,315 as the receipts, actual and estimated, from the sale of the 171½ tons, after all charges for freight had been paid. The cost of mining was £8846, and London expenditure accounted for £2768. The net profit was £6490, which was carried forward. Since the beginning of the year, the production at the mine has been 60 tons, which is lower than the average. The reason is that the labor force is scarce and men have been taken from the ground-sluicing operations to help in the erection of the hydraulic plant.

JOHANNESBURG, TRANSVAAL

Record Output in March. Possibility of Exceeding It. Work of the Three Leading Plants.

A record gold output was declared by the Chamber of Mines for March, amounting for the whole of the Transvaal to 830,723 oz., of a value of £3,528,688. This is easily a record, the previous highest month, being January, with a declared output of the value of £3,130,830. Unfortunately, neither of these declared outputs was actually produced during the month to which it is credited, the output for March as declared including £297,946 worth of gold accumulated in previous months to make the monthly output uniform and amounting to 70,143 oz., while January also included accumulated gold reserves to the extent of £82,564. Nevertheless, if gold reserves are excluded and only actual production considered, the output for March is still a record one, as it amounts to no less than £3,100,361, being 163,220 in excess of that for November, the previous highest month for gold actually produced. The abolition of gold reserves by most of the companies and their inclusion in the March output places the record at a figure which some doubt will ever be exceeded. This doubt is based largely on the chronic scarcity of labor on the Rand and to the fact that several large producers are practically worked out, such as the Geldenhuis Estate, May Consolidated, and Crown Reef, while the New Primrose, Ferreira, Village Main, and other prominent producers may also soon follow in their wake. It is quite true, however, that such new producers as Brakpan, Bantjes, City Deep, and Roodepoort United can materially increase their output under more favorable labor conditions, and so can the Robinson Deep, Crown Mines, and Randfontein, as well as some of the low-grade deeps near Germiston. But so much of the Rand has been put under tribute and so much of the richer ores worked out, that even if full credit be taken for the half-dozen developing properties not yet producers in the Far East Rand, a monthly output of over three and a half million sterling as declared for March will not be easily surpassed. With favorable labor conditions the output of the Rand will exceed three million sterling monthly. For some time to come increases in production may be expected, but the abolition of the gold reserves may cause the records of individual companies to fluctuate more than has been the case.

Only three producers on the Rand working under normal conditions declared a reduced output for the month of March, the most interesting feature perhaps being the return of the East Rand Proprietary Mines to the top of the list of producers after a somewhat prolonged absence under the influence of peculiar conditions. The East Rand Proprietary Mines, with its equipment of 820 stamps and 25 tube-mills, crushed 163,000 tons, with a recovery of 66,147 oz., valued at £280,975, indicating a recovery of over 8 dwt., where, according to the annual report of the superintending engineer, the average value of the ore reserves is only 6.9 dwt. No official explanation has, up to the time of writing, been given of this unexpectedly high yield, but the local mining press, usually well informed on these questions, attributes it to increased sorting, cleaner mining widths, and sending less development rock to the mill. Last year little development was accomplished, and last month the percentage of waste rock sorted out was under 10%, so that some other explanation will have to be found for the abnormally high yield. At the Randfontein property, which came next on the list, some 229,642 tons was crushed, yielding £260,615, being at the rate of 22s. 9d., or practically 5½ dwt. per ton, as against over 8 dwt. at the East Rand Proprietary Mines, where the ore reserves are supposed to be the same grade. No one would expect the East Rand Proprietary Mines to approach the yield of the Crown Mines, which come next on the list. During March 161,500 tons was crushed, yielding £257,884, or 31s. per ton; while in March the recovery at the East Rand Proprietary Mines averaged 34s. per ton milled.

NEW YORK

Copper Market Quiet.—Michigan Coppers Increase Dividends.—Anaconda Has Large Cash Surplus.—Tennessee Copper.

There is still to be heard some little argument in regard to the copper surplus, and there remains a little skepticism as to the manner in which the world's supply—which at one time seemed to threaten the future of the industry—disappeared so rapidly under skillful handling. It is pointed out that the semi-official figures that are given out treat only of refining outputs, and that this may not by any means represent all of the mine output. Inasmuch, however, as the mine output is not commercial copper until it has gone through the refinery, it is not unfair to say that it is the amount of refined copper that is ready for sale in which the consumer is interested. It is refined copper that goes to the consumer, and he is justified in studying mine outputs in something the same light as he would ore reserves, since both are convertible into commercial copper.

The Calumet & Hecla is admitting its stockholders to their share of the prosperity resulting from higher priced copper. The dividend declared last week was for $10, as compared with $8 three months ago, and $6 six months ago. The Calumet & Hecla directors are calling in $1,000,000 of the ten-year 5% notes which the company put out in 1909. There is one feature in connection with the Lake coppers that is worthy of mention. These companies do not suffer from an overload of capitalization. The result is plainly to be seen from the following that the Lake coppers have in Boston, where conservatism is one of the prized traditions. The report of the Calumet & Hecla Co. sent out last week covers the period from April 30 to December 31, 1911, the company's fiscal year having been changed to agree with the calendar year. During eight months there was produced 74,130,977 lb. of copper, as compared with 72,059,545 in 1910. The average price received for copper was 12.82, against 13.20 in 1910; copper cost of 8.52c., against 8.96c. in the previous year. The Quincy Mining Co. is another of the Lake coppers that has increased its regular disbursement. The current dividend just declared is for $1.25 per share, this being an increase of 25c. over the regular dividend rate, which has been $1, maintained since December 1910.

The financial situation of the Anaconda, Amalgamated, United Metals Selling Co. combination is worthy of some comment. The Anaconda company is now producing copper at the rate of something above 300,000,000 lb. per year, with some 1,000,000 oz. silver per month as a by-product, which, credited to copper costs, makes a material reduction. Anaconda's copper is now estimated to cost just about 9c. The Amalgamated Copper Co. owns approximately two shares of Anaconda for each share of stock outstanding. If the Amalgamated Copper Co. held no other interests, the ratio of price as between the two would be 2 to 1. The Amalgamated has, however, some other important holdings, chief among which is the capital stock of the United Metals Selling Co., long known as the largest copper brokerage concern in the world. The United Metals Selling Co. has paid 20% annually for several years, and not long ago paid an extra dividend of 50%. Its earnings are said now to be as large as at any time in its previous history. All three of these concerns now have cash surpluses that are important elements in the copper market. Amalgamated has about eighteen and one-half millions, Anaconda about three millions, United Metals Selling Co. about six millions. According to most recent reports this total of between twenty-seven and twenty-eight millions has been materially augmented during the six months last past, and it is safe to say that directors of these companies, from these sources alone, can direct the weight of at least thirty-five millions when they desire to do so, a factor of no little importance in market operations.

It is expected that the Tennessee Copper Co. will increase its dividend when the meeting of the board of directors occurs next week. Earnings have been very much increased and a portion of the board is known to favor a distribution of part of the increased profits. The Butte-Alex Scott Copper Co. sought its Eastern market in Pittsburg, and until recently was one of the active features on the Pittsburg Stock Exchange. Last week the issue was stricken from the list because of the non-compliance to the rule requiring the maintaining of a transfer office in Pittsburg. The old Blair property in Nevada, more recently known as the Pittsburg Silver Peak Gold Mining Co., headed by William Flinn, of Pittsburg, divided its surplus and paid an initial dividend of 16%, payable July 1. The amount required to pay the dividend is approximately $450,000.

At the recent meeting of the Tonopah Extension Mining Co., stockholders were informed that dividends would probably be declared in July. The Butte & Superior Co., of Butte is about to install a hoist, similar to the one put in by the Tuolumne Copper Co. The hoisting plant of the latter company is now in full commission and last week the Tuolumne made its record output for one day, hoisting and sending to the smelter 400 tons of first-class ore. The Butte & Superior Co. has been growing in public favor in the East, and the shareholders apparently feel that their long patience will eventually be richly rewarded.

The end of the boom appears to have arrived, or if not arrived, at least to be clearly in sight at Porcupine. Some of the recent travelers returning thence report a condition bordering an actual physical distress. Men have been forced to abandon wives and families in an attempt to secure a 'stake' elsewhere, and in not a few cases these have come to actual want before they could be sent for. Under these conditions it is hardly possible to expect anything in the way of market features from the camp.

JOPLIN, MISSOURI

Record Price for Zinc.—Mines Resuming.—Tailing Treatment.—Wages Raises.—Barytes Ores.

Ore from the Big Western mine sold for $61.65 in May. This is the highest price ever paid for zinc ore in the United States. The previous high figure, $60, paid in 1905, was only maintained for a few weeks, but the present market conditions are good, with no prospects of a slump. The present production of the Missouri, Kansas, and Oklahoma districts is 5500 tons of blende, 400 tons of calamine, and 900 tons of galena per week.

Southwest of Joplin, the Gordon Hollow camp is now producing 150 tons of concentrate per week, after several unproductive years. A large custom mill handles the bulk of the tonnage, although two small individual plants are worked. At Spring City the Birthday Mining Co. has erected a modern concentrating plant which will be able to treat profitably the calamine ores with 40% zinc which come from this camp. The Boyd mine at Sarcoxie, twenty-five miles east of Joplin, has resumed, with a force of 80 men, after a shut-down of several months. A heavy flow of water necessitated the use of powerful pumps. Tailing from the Vesuvius mine at Carthage is being treated in a tailing mill formerly operated on the Morning Hour ground at Joplin. This mine was once a bonanza, and much zinc-blende was lost in the waste. The rise in the price of zinc has led to the starting of another tailing mill on the Joplin-Kentucky lease of the St. Louis-Joplin land, where the Zinc Milling & Manufacturing Co. has just completed a new plant. Prospecting abandoned shafts and old workings has also been stimulated by the rise in the metal market. With the advanced ore prices the miners at many mines have demanded their share of increased profits. Machine men, formerly paid $2.75 per day, asked $3. Helpers, who received $2.25, asked $2.50. Shovelers, who got 5c. per 1000-lb. car, asked for 6c. A compromise was effected to avert a threatened strike. At some of the mills in the Joplin district, which are troubled with barytes in the gangue, experiments are being conducted in roasting. Sufficient heat will cause the grains of heavy spar to explode, after which screening will separate the blende from the barytes.

General Mining News

ALASKA

Chitina

The railway bridge across the river has been repaired and train service has been resumed.

Circle City

Prospects for an active season are excellent. The Berry & Lamb hydraulic plant on Eagle creek, the Clarence Berry giants on Mammoth creek, the Herrington & Leveridge hydraulic plant on upper Mastodon, and the Elmer dredge on Mastodon creek are all preparing for the season's run. A hydraulic plant is also being erected below the mouth of Twelvemile creek and numerous parties of laborers are preparing for hand work.

Fairbanks

The output for 1912 is estimated locally at $5,000,000, with Goldstream at the head with $800,000. The lode mines are credited with $250,000, as against $50,000 for 1911.

Iditarod

The Guggenheims are reported to have bought placers on Flat creek, and the Bonanza creek dredge at Dawson has been dismantled for shipment to this district.

Juneau

The report of the Alaska Treadwell G. M. Co. for April states that 75,292 tons of ore was crushed and 1410 tons of concentrate saved. The estimated value of the free gold was $97,472.11; of concentrate, $80,967.53. The value of the total production was $178,439.64, with a realizable value of $176,655.25. The estimated net profit was $69,887. Development work to the extent of 785 ft. was carried on.

Katalla

The Alaska Development Co. has distributed $25,000 among stockholders as part proceeds from sale of properties to the Amalgamated company. The Development company is one of the enterprises of C. F. Mundy. It was organized in 1897 and this is the first profit.

Nome

The first passenger steamers are expected about June 11, though smaller mail boats may arrive sooner. About 650 have engaged passage on the *Victoria*, sailing from Seattle June 2.

Five new dredges are being built by the Union Construction Co. for Nome companies.

ARIZONA

Cochise County

The Governor has appointed Jack Bolan of Bisbee to be Mining Inspector. Mr. Bolan has been actively engaged in mining for years and was also a member of the constitutional convention.

Gila County

The Inspiration Con. Copper Co. has begun active construction work. The program outlined by W. H. Aldridge, managing director, calls for an expenditure of $7,000,000 in the next two years. The concentrator will be built a mile east of the Inspiration mine and a mile north of the town of Miami. The flow-sheet adopted on the recommendation of J. M. Callow, who has been testing the ore for the past year, follows the roughing system developed by the Utah Copper Co. The design of the mill and the purchase of machinery will be left to the company's engineers, Repath and McGregor. The mill will consist of six sections of 1250 tons capacity each, and in addition a steam-power plant for generating a minimum of 7500 hp. will be erected.

The April report of the Miami gives the production of the mill at 2,688,792 lb. of copper from 83,465 tons of ore mined. Over 6600 ft. of underground development work was done during the month, virtually all in ore, and one churn-drill operated in the northeast territory. The company is planning to start diamond-drilling soon to explore the ground below the 570-ft. level. Of the ore mined during the month, 75% came from development and square-setting next to the capping, 9% from the stock pile, and only 16% from the shrinkage stopes.

Churn-drill hole No. 1 of the South Live Oak Development Co. is 525 ft. deep in granite. At a depth of 435 ft. the drill went through carbonates and silicates of copper, and the samples still show a small amount of these minerals. Commercial ore is reported below a depth of 495 ft. The hole was started with a 17½-in. bit, and a 12-in. bit is now being used.

At the Copper Reef mine, 15 miles south of San Carlos, an Ingersoll-Rand 5-drill compressor and a Stover distillate engine and pump have been installed. Development work will be resumed on the California adit, which is in about 1000 ft. The adit is driven to cut four veins, with good surface showings of copper, at an expected depth of 1200 feet.

The fourth section of the Kingdon shaft of the United Globe mine of the Old Dominion Co. is nearly completed, giving 710 ft. of finished concrete lining. It is believed that the remaining 300 ft. can be finished in one section. The work is being done under contract by C. H. Weideman and Paul Michaelson, construction engineers.

Pinal County

The report of the Ray Consolidated Copper Co. for the first quarter of 1912 announces an extension of underground workings of 26,487 ft. This development produced 97,000 tons of ore, and 209,000 tons was produced by actual mining operations. Approximately 30% of this output came from territory tributary to the No. 2 shaft. The total amount of ore treated at the mill was 301,674 tons, containing an average of 1.71% copper. The average extraction was 68.85%, making 17,637 tons of concentrate averaging 20.19% copper. The total copper content of the concentrate was 7,122,943 lb. The average cost per pound of net copper after the deduction of smelter allowanges was 10.19c. The net profits from operations were $358,625.92, this earning being based on a price of 15.42c. per pound of copper. This high price resulted from delay in shipments of concentrate to El Paso and in delays in delivery of refined metal to seaboard. The average cost of milling for the quarter, including all charges, was 56.07c. The improvement in results throughout the quarter is indicated in the following table.

	January.	February.	March.
Tonnage treated	99,195	93,794	108,685
Cost per ton of milling.....	63.91c.	56.12c.	48.86c.
Cost per pound net copper..	10.98c.	9.82c.	9.72c.

At the present rate of tonnage only four of the five completed sections of the plant are operated. The work on the sixth section is progressing slowly, so it will be ready for ore about August 1. Since the middle of February all concentrate has been delivered to the A. S. & R. plant at Hayden, and the decrease in cost is largely due to this fact. One furnace of this new smelter was put in operation about May 1, and the plant is being rapidly put into full commission.

CALIFORNIA

Amador County

(Special Correspondence.)—The 20-stamp mill of the East Eureka has been at work since the first of the month on ore taken from development work on the 300-ft. level and is giving good results. It is expected to soon resume work at sinking the north shaft. The Lincoln shaft of the Lincoln Con. has been unwatered to the 1950-ft. level, where development work is in progress. Two shifts are at work driving toward the Wildman shaft to intersect the large orebody known to exist in the bottom of the Wildman, now a part of the Lincoln holdings. Andrew Noer is superintendent. At the Keystone, under the direction of C. R. Downs, shaft-sinking is in progress, and a depth of 1500 ft. has been reached. It is hoped to find the orebody in the hanging wall which proved productive on the upper levels. At the Bunker Hill 40 stamps are at work and a regular monthly dividend of 7½c. per share is being paid. The Kennedy Extension lying south of the Argonaut, has filed suit

for trespass against the latter company. Near Jackson, south of the Zeila the South Jackson is purchasing machinery and preparing to sink a shaft.

The shaft of the Plymouth Consolidated Co. is unwatered to the 1100-ft. level. The management hopes to have all the water out late in July or early in August, and will then sink 300 ft. deeper. The Alpine, the property just north of the Plymouth, which has been involved financially, has made arrangements for additional funds and expects to resume work in a month or two.

Jackson, May 29.

BUTTE COUNTY

The Nimpshen Ridge Mining & Development Co. incorporated under the laws of Arizona, will resume operations this month. The main adit has been run a distance of 397 ft., and the company plans to run the sluice-boxes into this so that the dirt will be washed as it is mined.

INYO COUNTY

The April production of the Skidoo Mines Co. is given in its report as $12,508.99 from 1068 tons of ore milled. The cost of operation and development for the month was $8993.73, giving a net profit of $3515.26. Only 10 stamps were in operation on account of a shortage of water.

NEVADA COUNTY

(Special Correspondence.)—The North Star Mines Co. has opened a shoot of ore 1 to 3 ft. wide on the 1600-ft. level of the Merrifield mine, one of the Champion properties. The main Champion shaft has been unwatered to a point below the 2300-ft. level. Drifts will be extended from the 2400-ft. level as soon as this point is attained. South drifts are being extended from the Providence shaft toward the Summit claim. At the Spanish Ridge mine the vein recently uncovered by C. Meyer is said to be about 12 ft. wide, with free gold and pyrite scattered through the full width. The surface outcrops of this vein have been traced for 100 ft. Hamilton Bros. have this mine under lease and are operating the 20-stamp mill about 10 days each month.

Grass Valley, May 27.

COLORADO

GILPIN COUNTY

From the Topeka mine is reported the discovery of a 3-ft. vein in the 1100-ft. west level close to the shaft. The ore assays from $40 to $300 per ton and is apparently continuous up to the 900-ft. level. Another orebody has been found by diamond-drilling in a parallel vein on the 1200, 1400, and 1500-ft. levels. The present output of this mine is from the 500-ft. level from a vein 2 ft. wide which is nearly exhausted.

TELLER COUNTY (CRIPPLE CREEK)

The owners of the Bolivia mine plan to sink a two-compartment shaft to a depth of 400 ft., in the hope of finding some of the rich flat veins which have been opened up on Tenderfoot hill. The chief stockholders of the Bolivia are bankers of Pueblo. They have allowed the property to remain idle for years, but have now decided to prospect it thoroughly.

The Progressive Mining & Leasing Co., operating the Chicken Hawk mine on Guyot hill, owned by the Katinka Gold Mining Co., has made a first shipment of two carloads of milling ore from the upper levels. Development work is being carried on at the 1000-ft. level.

Electric hoists have been installed on many of the lessees' claims this spring. On the Mountain Beauty a 15-hp. hoist has been placed in order to work the mine to a depth of 250 feet.

A new ore-shoot has been opened up on the 300-ft. level of the Empire State mine in the Emma vein. Four feet of ore is reported in the face of the drift averaging $24 per ton.

IDAHO

ADA COUNTY

Governor Hawley has called a meeting of mining men at Boise for August 1 to 3. The purpose of the gathering is to outline needed legislative reforms in mining. Other states will hold conventions later in the fall, and the matter will be taken up by the Northwest Mining Convention in Spokane in February 1913.

COEUR D'ALENE

(Special Correspondence.)—The Bunker Hill & Sullivan M. & C. Co. in 1911 treated 464,750 tons of ore, having a gross value of $3,306,360. Extraction cost $1,239,260, with $1,239,260 additional for reduction and transportation. Repairs and improvements cost $256,236, forming a total expense account of $2,507,612, and leaving net profits of $797,748. Including the April dividend of 1912, this company has disbursed a total of $13,388,550 in profits to stockholders. The par value of the issued stock is $3,270,000. With the recently completed new unit, the concentrating plant has a capacity of 35,000 tons per month and is said to be the largest silver-lead plant in the world; 750 electric horse-power is required to operate the plant, and the new unit cost about $375,000. The works are mounted on concrete foundations, with the native timber superstructure fireproofed throughout. The mill-bins have a capacity of 3000 tons, permitting a two-days run of the plant without drawing upon the mines. Under the new plan of treatment the jig feed is de-slimed in classifying jigs; fine middling reduced by a fine-grinding Hardinge mill, and fine screening conducted through Bunker Hill & Sullivan screens. Esperanza drag-type classifiers and Calumet classifiers are also employed. Gelasio Caetani and Roy S. Hardy were the metallurgists in charge. The company is maintaining a daily production of 1200 to 1400 tons of concentrating ore. Most of this is coming from levels opened below the Kellogg adit, which intersects the vein at a depth of 2000 ft. below the apex. Below this adit three new levels have been driven at intervals of 300 ft., with the latest level being opened 3200 ft. below the surface. Ore conditions in the lowest workings are understood to be particularly satisfactory. A new electric hoist, capable of operating to extensive depth, has been installed. It is operated by a 200-hp. induction motor and will be used exclusively for hoisting ore. The machinery was furnished by the Allis-Chalmers Company.

The Federal company produced a total of 817,100 tons in 1911 from its Mace, Wardner, and Morning mines, with 384,600 tons coming from the last. Total gross earnings aggregated $5,430,253, of which the Mace properties contributed $2,029,440. Total costs reached $4,469,000, leaving net earnings of $961,253. The Mace mines alone yielded net profits of $582,675. To date this company has paid dividends of $6,821,000 on preferred and $2,708,250 on common stock, a total of $9,529,250.

The Hecla Mining Co. claimed third position in the Coeur d'Alene as a producer in 1911. The output was 136,479 tons, valued at $1,001,344. Total costs aggregated $714,242, leaving net profits of $287,102. This company has paid a total of $2,430,000 in dividends. Ore is being mined from the 1200-ft. level and the shaft is going down to the 1600-ft. point. The plant has a capacity of 300 tons per day. The production is 1500 to 1800 tons of crude ore and concentrate per month which is shipped to the smelter of the International S. & R. Co. at Tooele, Utah. About two-thirds of this is concentrate and the rest is crude ore.

Including the Bunker Hill & Sullivan, Federal, and Hecla mines, the nine leading Coeur d'Alene properties produced in 1911 ore to the gross value of $13,375,178. This represents an increase of over $1,000,000 above the 1910 figures. The total dividends disbursed amounted to $2,827,769, a gain of about $175,000 over 1910 and approximately $700,000 in excess of the 1909 record. The Snowstorm Mining Co. reported a loss of $6232, but improvements and repairs represented an expenditure of $35,547. The company is completing a new concentrating mill at Mullan, the slime from which will be treated in the leaching plant. By this means it is expected to turn the large deposits of low-grade ore to advantage.

IDAHO COUNTY

Work on the Mascot claim has developed an orebody in

the face of the adit 370 ft. from the surface. A 2-stamp mill and a Huntington mill to follow the stamps have been ordered and will arrive as soon as the roads are in shape for the hauling of heavy freight.

Shoshone County

Milling operations have been resumed by the Marsh M. Co. and several shipments of concentrate sent to the International S. & R. Co. at Tooele, Utah, which has a five-year contract for handling the output of the Marsh company. These shipments are said to average $65 per ton, or about $50 per ton above freight and treatment charges. It is the plan of the management to continue regular shipments of about 160 tons of concentrate and 350 tons of

MAP OF IDAHO.

crude ore per month, and there is now a large tonnage blocked in the mine. A big electric pump has recently been removed from the No. 2 tunnel to the lower No. 4 level and development work started, with east and west drifts from the cross-cut. The faces of these drifts are now 90 ft. apart and ore is exposed for the full length.

ILLINOIS

The new plant of the American Z. L. & S. Co. at Hillsboro, is reported as nearly completed and is expected to start early in August. The officials claim that this will be the 'show plant' of the country for appearance, workmanship, and material, and also for economical operation.

MONTANA

Silverbow County

(Special Correspondence.)—The Davis-Daly C. Co. reports a body of ore with about 3% copper and over 4 oz. silver per ton in the 1900-ft. level of the Colorado mine. Cross-cutting is proceeding both north and west, and the management expects to block a good body of shipping copper ore. The Butte-Ballaklava is averaging about three carloads per week to the East Butte smelter. Development and mining on the 1400 and 1600-ft. levels are producing this ore. It is expected that the suit with the Anaconda company involving the question of ownership of ore will be brought up in the federal court this month. The East Butte company smelter will not be in a position to increase production before August 1. Two months ago the company commenced the work of increasing the furnace capacity by lengthening two furnaces. Sixty days more will be required to complete the first furnace, and four months will elapse before the second furnace is finished. When the work is completed the smelter capacity will be about 2,000,000 lb. of copper per month, instead of the present rate of 1,250,000 lb. The cross-cutting north and south from the shaft on the 2800-ft. level of the North Butte mine is proceeding at the rate of 5 ft. per day, but the company does not expect to reach the Edith May and Jessie veins for a few weeks. Development is going on at the 2000, 2200, and 2600-ft. levels, and the production is continuing at about 2,000,000 lb. of copper per month. It has been stated in Eastern papers that the ore reserves have been greatly diminished, but this is absolutely denied, and it is announced that the mine is in as good condition as at the time of the last annual report. Experiments in electric drills have not yet been successful, but will be continued. The foundation for the concentrator of the Butte Central Copper Co. will be completed in about two weeks, and the building material and machinery are expected on the ground by that time. The superintendent says he will have the mill in operation by October 1, with an initial capacity of 200 tons per day. Plans are made for a possible enlargement to 500 tons per day later. Shipments of ore to the Washoe smelter have been stopped by order of the directors, and all ore will be held for the new mill. Development on the 200, 300, and 500-ft. levels is blocking out a large body of second-grade ore. The first unit of the Butte & Superior company smelter is now treating about 400 tons per day and the management is attempting to increase capacity to 500. Delivery on the new surface plant of the company is expected in a few weeks and work will be immediately commenced on erection. There will be no curtailment of operations during this construction, as enough ore is stored at the surface to keep the concentrator in operation.

Butte, May 27.

NEVADA

Esmeralda County

(Telegraphic Correspondence.)—The April report of the Goldfield Consolidated Mining Co. shows the total output of the mines for the month as 28,360 tons, containing $610,708.20, or $21.53 per ton. The mill treated 27,928 tons, with an extraction of 93.77%, and 432 tons of ore averaging $28.60 was shipped. The net recovery on all the ore treated averaged $20.20 per ton. The operating costs, including a construction charge of 25c., were $6.53 per ton. The total net realization was $392,056.17. Development for the month totaled 3396 ft. An encouraging discovery is reported in the 1300-ft. level of the Grizzly Bear workings, where a cross-cut passed through shale into quartz with low-grade ore, containing gold, silver, and copper. The seam is from 1 to 3 ft. wide and samples have assayed from $15 to $50 per ton. No driving has been attempted, as the face of the cross-cut is still in ore. This is apparently the downward extension of the base orebody exposed in the 1000-ft. level of the Clermont. The showings in the Mohawk, Combination, and Laguna are highly satisfactory.

Goldfield, May 29.

The management of the Pittsburg Silver Peak announces a wage cut, effective June 1. The wage scale of this company has been the highest in the state of Nevada, machinists, electricians, and skilled laborers receiving 50c. per day more than in Tonopah, while shovelers' wages have been higher than in Goldfield. The property is operated through adits, and conditions for working are healthful.

The new plant of the Goldfield Merger Mines Co. was put in operation last week, after a champagne christening and speeches from the company officials. The new headframe covers a shaft 7 by 18 ft. in the clear, which had been driven to a depth of 1000 ft. with the original equipment. Sinking will now be resumed from this level.

Nye County

The Tonopah Belmont Development Co. reports net profits of $143,005 for the month of April from the milling of 8390 tons. Good progress has been made on the

construction of the new mill which is planned to treat 15,000 tons per month. On the concentrating-floor all tables are now in place with motors and driving pulleys, and on the floor above the light tube-mills are also ready to start. On the tank floors pipe connections are being made. The roofing and sides of the building are completed, and the electrical wiring is being rushed. The new triple-compartment shaft is now sunk to a depth of 145 ft. Underground development on the 1100 and 1200-ft. levels has been continued and additional low-grade ore opened in the drifts.

For the West End mill, 12 new Deister concentrating-tables have been ordered. The operation of these tables will increase the output of the mill by 20 tons daily. Shipments of the richer ore to the smelters will continue at irregular intervals. The company will this week take over the Santa Rosa lead mine, 26 miles from Keller in Inyo county, California, and S. H. Brady will act as consulting engineer in the further development of the mine. The property is now producing ore netting $40 per ton and the present output of the mine will be greatly increased. The MacNamara mill is reported as treating 65 tons of ore daily with excellent recovery. The development on the mine has opened an orebody on the 300 and 375-ft. level averaging $25 per ton.

The Tonopah M. Co. reports 3348 tons of ore crushed at the mill in April with 98 out of the 100 stamps constantly dropping. The average value of the ore was $17 per ton, and the extraction for the month was 90%. The total tonnage treated was less than in March by 864 tons, but with the increased price of silver and higher grade ore the total profits have been above dividend requirements.

The annual meeting of the stockholders of the Tonopah Extension company was held in New York on May 10. The financial statement presented shows gross earnings for the year of $590,418, with a mining cost of $240,551 and a milling cost of $165,278. Refining and express charges bring the total cost up to $417,000 for operating expense. The average mineral content of the ore was 16 oz. silver and 0.17 oz. gold per ton. The mill is now treating an average of 147 tons daily, and development has demonstrated strong orebodies. The Montana-Tonopah reports 1000 tons of ore treated per week with 89.1% extraction. The shaft of the Halifax-Tonopah M. Co. has now reached a depth of 1200 ft. Several small stringers of ore have been cut. At the Gipsy Queen an electric hoist and compressor plant has been installed and work on repairs to the shaft timbers has commenced. It is intended to start driving on the vein at the 500-ft. level and thoroughly prospect this vein for an orebody. The surface equipment for the 76 Consolidated M. Co. is being installed and sinking has been suspended until the new hoisting machinery and head-frame are in place.

The Manhattan Eagle M. Co. has been organized by C. E. Mayne to take over the Manhattan Blue Jay property. A 200-ft. shaft is planned.

Storey County

The Ophir company has filed a statement with the tax collector which shows for the first quarter of 1912 a gross tonnage of 3396, the bullion yield of which was $96,893. The extraction costs were $68,365; transportation $1643; reduction and selling $13,836. The net yield was $13,048. The Comstock-Phoenix mine, operating on the Brunswick lode south of Sixmile canyon, shipped to Fisher mill during the first quarter of the year 350 tons. The gross bullion yield on this ore was $27,048, with the cost of extraction, transportation, and reduction $15,804. Consolidated Virginia for the first quarter of the year extracted 255 tons from the mine, but there were no milling returns, as the reduction of the accumulated ores did not start until May. The Yellow Jacket company for the first three months of the year milled 2138 tons of ore from the dump, the gross yield from which was $10,497, with transportation charges of $970.

The Belcher company did no milling for the quarter, but extracted 223 tons of low-grade ore. Crown Point milled 4586 tons of ore at the Yellow Jacket mill, the gross yield being $23,765, with costs of $23,576. The Cholla Leasing Co., operating at the croppings of Chollar and Potosi shipped 2615 tons to the Butlers plant under lease, yielding $15,378. The cost of extraction was $10,790, transportation $784, and reduction $6613.

NEW MEXICO

Grant County

The Chino Copper Co. reports for the quarter ended March 31 an output from the steam-shovel pits of 229,000 tons of ore at a cost of 14.47c. per ton. The total material removed includes 619,000 cu. yd. of stripping at a cost of 27.28c. per yard. Beginning with the second quarter of 1912, a charge of 30c. per ton will be made against all ore mined, to cover the shipping cost. The concentrator treated 160,400 tons in two sections. The third section of the mill was finished and ready for operation at the end of March. The production of the concentrator was 8048 tons of concentrate containing an average of 20.33 lb. of copper per ton. This low content was due to the fact that the ore mined was from the upper part of the orebody, where the copper occurs in carbonates. The average cost per pound of net copper after deducting smelter allowance was 7.48c. The net income for the quarter amounted to $228,021, figured on an average price of 13.85c. per pound for copper.

Socorro County

(Special Correspondence.)—The unwatering of the Deadwood mines is about completed, after which development work will be pushed in the lower levels. The upper levels are producing a fair tonnage from development drifts, and in the third level a good orebody has been found. The daily ore treatment is 60 tons, part of which comes from custom ore. The Pacific mine of the Oaks Co. shipped 34 tons from 20 ft. of development, and the Johnson mine shipped 21 tons mined in sinking the shaft 18 ft. This ore was treated at the Deadwood mill, and the Deep Down mine is also shipping ore to the mill from the development conducted by lessees. The Socorro mines milled 1250 tons during the week, drawn largely from the lower levels. The Treasure Mining & Reduction Co. milled 480 tons for the week. The company claims to have enough ore broken in the stopes to supply the mill for six months and to have a good showing in the lower levels from development work.

Mogollon, May 24.

OREGON

Baker County

The Ben Harrison mine, 28 miles west of Sumpter, has been opened to a depth of 500 ft., and one ore-shoot has a width of 9 ft. and a length of 250 ft., while another is 100 ft. long and 6 ft. wide. Plans are being made for the erection of a 200-ton all-sliming cyanide plant. Work on the new dredge near Sumpter is progressing rapidly. The derrick and other machinery used in construction is operated by electric power.

Lane County

The Oregon Highgrade G. M. Co. has been organized to operate on claims located 45 miles southeast of Eugene last fall by Leslie Furlong. While placering Mr. Furlong found float which he followed to a vein outcropping in the hillside. From this he took 105 lb. of specimen rock that sold for over $600. He put down several pits, located five claims, and drove an adit 17 ft. It is claimed that 36 in. of quartz assays $188. The new company is composed of San Francisco men, including R. F. Petry, W. A. Scott, and M. J. Seeley.

UTAH

Salt Lake County

The April production of the Utah Copper Co. was reported as 9,069,237 lb. copper, and the output of Nevada Consolidated as 6,115,059. The tenth section in the Arthur mill is now treating ore, and the eleventh section is ready for operation. At a recent meeting of the directors of the Michigan-Utah Consolidated Co., Duncan MacVichie resigned as president, and Norman C. Haire was elected to the position.

WASHINGTON

King County

(Special Correspondence.) The United States S. R. & M. Co. has established a branch office of its exploration department at 1303 Hoge building, Seattle, Washington, with D. D. Muir, Jr., engineer in charge. Apparently the United States company is preparing to get a holding in Alaska, as it announces it is prepared to examine for purchase any meritorious metal properties in the Northwest and Alaska.

Seattle, May 24.

Stevens County

The United Copper mine at Chewalah is producing 110 tons of ore per day, of which 75 tons is milled and 35 tons shipped. A mill, to cost $35,000, is to be built at the Gwinne mine, Gifford, near Colville.

CANADA

British Columbia

The Consolidated Mining & Smelting Co. has planned to expend $100,000 in improving its smelter at Trail. Furnaces will be built for treating the raw matte direct, eliminating the preliminary roasting. An addition will also be made to the lead refinery to accommodate 84 additional tanks, giving the plant a total of 324 tanks and increasing the capacity 100 tons per day.

A new stamp-mill with a daily capacity of 70 tons is in operation on the Mother Lode mine on Sheep creek. The company claims to have 50,000 tons of free-milling ore averaging $25 per ton blocked out.

The report of the Hedley G. M. Co. for the first quarter of 1912 shows that 16,958 tons has been crushed, yielding a profit of $76,676. The gold content of the ore varies from month to month, but is not far from $10.50 per ton. The average profit per ton during 1911 was $5.34.

Ontario

The Dome mine has made a recent shipment of bullion valued at $20,000. This brings the total output of six weeks' operation of the mill up to $61,500. This does not represent full capacity, as the entire stamp battery was not in operation nor the mill in perfect running order. The mill is now speeding up and bullion shipments will be made twice a week. Work on the Hollinger mill is being rushed and the concentrating machinery has been placed. The wiring and piping still remains to be done, but the management hopes to start operations soon after June 1. The building of the refinery will be pushed, in order to be ready for the first amalgam from the plates.

Yukon

The first dredge of the Yukon Gold Co. began work on May 3. Seven out of nine boats are now at work. There is plenty of water and everything is running smoothly.

MEXICO

Sonora

It is expected that the May output of the Greene-Cananea will be between five and six million pounds of copper. The converting capacity will be immediately enlarged to handle the increased output of matte.

Jalisco

The El Favor mine, in the Hostotipaquillo district, sent out 10 carloads of ore during the first ten days of May. Shipments of high-grade ore from the Mololoa mine have been delayed by making air connections. The new machinery recently received at the El Favor plant is in course of erection.

HONDURAS

The Chanton mine, in the department of Comayagua, is regarded as of much promise. It is under the direction of United States people and American machinery has recently been forwarded to the mine, together with engineers to install it. Petroleum was found on Guare mountain, department of Comayagua, some years ago, by Calixto Marin, and recent exploration indicates that the oil is of excellent quality and the supply abundant.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

J. F. Newsom has gone to Alaska.

O. B. Perry was at Palo Alto this week.

Alfred Williams is visiting California.

W. M. Wither has gone to Council, Alaska.

R. G. Smith leaves today for Nome, Alaska.

F. L. Wilson has gone to Ingot, California.

C. T. Nicholson is leaving for the Yukon and Alaska.

A. J. Heister has gone to Chicago from Golden, Colorado.

Earl M. Bagley has returned to Alameda from Jackson.

W. W. Mein is removing from San Francisco to New York.

Max J. Welch will be in Los Angeles during June and July.

Edward J. May has moved from Cobalt to Colorado Springs.

J. Morgan Clements has gone to northern British Columbia.

T. T. Read has been visiting the Mother Lode mines of California.

J. W. Abbott has gone to Los Angeles on his way to Pioche, Nevada.

Stewart Blackburn is taking a trip through Arizona and New Mexico.

R. M. Jones has spent the past week at Manhattan and Round Mountain.

W. P. Hammon was in New York last week, but has returned to London.

Howland Bancroft has removed his office to 730 Symes building, Denver, Colorado.

G. H. Russell passed through San Francisco this week on his way to Council, Alaska.

Joseph H. Playter was in San Francisco recently and has returned to Golconda, Nevada.

Z. Cushing was in San Francisco this week on his way to Juneau and other Alaskan points.

Roy H. Allen, who has been at Villa Escobedo, Chihuahua, Mexico, is now at Lunenburg, Massachusetts.

R. B. Lamb is leaving Toronto for an extended professional trip to Swastika, Porcupine, and Gowganda.

Robert B. Moran has removed his office from 519 California street to 220 Insurance building, San Francisco.

Charles A. Chase has removed his office from 921 Equitable building to 734 First National Bank building, Denver.

James Hodgson, of Ishpeming, Michigan, has succeeded Parker L. Woodman as superintendent of the Copper Queen mine.

F. C. Newton has gone East to become superintendent at the Perth Amboy plant of the American Smelting & Refining Company.

R. W. Pringle has opened offices in Union buildings, Gatooma, South Rhodesia, for mining engineering and metallurgical work.

J. R. Finlay delivered an address at the commencement exercises at the School of Mines, University of Missouri, at Rolla, on May 30.

The firm Worthington & Pickard has been dissolved, and B. O. Pickard will serve his clients from an independent office at Phoenix, Arizona.

George J. Hough, formerly in the custom assay business at Salida, Colorado, recently received a government appointment in the Bureau of Chemistry at Washington, D. C.

J. G. Kirchen had a narrow escape from drowning while fishing with C. M. Schwab at Martins Creek, Pennsylvania. It is related that after he was rescued the two fishermen returned undisturbed to the task in hand.

Market Reports

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	May 29.
Camp Bird Ltd	$ 7/8
El Oro	4 1/2
Esperanza	7/8
Oroville Dredging	1 1/2
Santa Gertrudis	6 1/2
Tomboy	5/8

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, May 29.		Closing Prices May 29.
Adventure	$ 8	Mohawk	$ 63
Allouez	43	North Butte	28 3/4
Calumet & Arizona	75 1/4	Old Dominion	56 1/4
Calumet & Hecla	485	Osceola	119 1/2
Centennial	23 1/4	Quincy	87 1/2
Copper Range	58 1/4	Shannon	15
Daly West	5 1/2	Superior & Boston	2 1/16
Franklin	12 1/2	Tamarack	42
Granby	53	Trinity	6
Greene Cananea, ctf.	10	Utah Con	12 3/4
Isle-Royale	28 1/2	Victoria	3 1/4
La Salle	6 1/2	Winona	6 1/4
Mass Copper	7	Wolverine	108

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, May 29.

Atlanta	$ .27	Mayflower	$ .02
Belcher	.70	Mexican	2.72
Belmont	10.00	Midway	59
B. & B.	.05	Montana-Tonopah	2 70
Booth	.10	Nevada Hills	1.95
Cholar	.06	Ophir	1.25
Combination Fraction	.17	Pittsburg Silver Peak	1.20
Con. Virgina	.61	Round Mountain	.44
Florence	1.35	Savage	.16
Goldfield Con.	4.25	Tonopah Extension	1.97
Gould & Curry	.05	Tonopah of Nevada	7.00
Jim Butler	.56	Union	1.00
Jumbo Extension	.38	Vernal	.18
MacNamara	.28	West End	2.07

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, May 29.

Amalgamated	$75.00	Palmer Union	$ .18
Associated Oil	44.50	Premier	.53
Caribou	1.00	S. F. & McKitt	12.75
De Luxe	.75	Silver Tip	.90
Empire	1.20	Sauer Dough	1.12
Maricopa 36	.65	S. W. & B.	.20
Paraffine	.50	United Oil	.32
Palmer	.55	W. K. Oil	2.00

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. May 29.		Closing Prices. May 29
Amalgamated Copper	$ 82 1/4	Miami Copper	$ 26 1/4
A. S. & R. Co.	85	Mines Co. of America	3
Braden Copper	6 3/8	Nevada Con	21 1/4
B. C. Copper Co.	5 1/4	Nipissing	7 3/4
Chino	29 3/4	Ohio Copper	1 1/8
First National	3	Ray Con	18 1/4
Giroux	5 3/4	Tenn. Copper	44 1/4
Goldfield Con.	4 1/2	Tonopah Belmont	10
Greene-Cananea	9 1/4	Tonopah Ex	2
Hollinger	11	Tonopah Mining	7
Inspiration	19	Trinity	6 1/4
Kerr Lake	2 1/8	Tuolumne Copper	3 1/4
La Rose	3 3/8	Utah Copper	61 1/2
Mason Valley	12	West End	2 1/4
McKinley-Darragh	1 3/8	Yukon Gold	3 3/8

ASSESSMENTS ON COMSTOCK MINES.

Company	No.	Del. Board	Sale Day	Amt.
Julia Con.	19	May 9	June 5	.05
Caledonia	86	May 17	June 11	.10
Exchequer	22	May 21	June 13	.05
Andes	76	May 25	June 18	.05
Savage	24	May 25	June 26	.10
Alpha Con.	18	May 28	June 19	.05
Seg. Belcher	50	June 1	June 28	.05
Best & Belcher	99	June 3	June 27	.10
Challenge	59	June 8	July 2	.10
Crown Point	12	June 24	July 17	.10

LOCAL METAL PRICES

San Francisco May 29.

San Francisco is not a primary market for the common metals except quicksilver. The prices quoted below therefore represent sales of small lots and are not such as an ore-producer could expect to realize. Ore contracts usually call for settlements on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksilver, which is quoted in dollars per flask of 75 pounds.

Antimony	11—11 1/2c	Quicksilver (flask)	42
Electrolytic Copper	17—17 1/2c	Tin	50—51 1/2c
Pig Lead	4.45—5.40c	Spelter	7 1/4—7 3/4c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, May 29.—During the past week copper has been strong and advancing. The demand continues good, both in this country and abroad. Lead and spelter prices are quiet but firm.

Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
May 23	16.35	4.20	6.73	61
" 24	16.35	4.20	6.73	
" 25	16.35	4.20	6.73	61 1/8
" 26	Sunday.	No market.		
" 27	16.40	4.20	6.73	61
" 28	16.48	4.20	6.73	
" 29	16.53	4.20	6.73	—

SILVER

Below is given the average New York quotation, in cents per ounce, of fine silver for the months indicated:

	1911.	1912.		1911.	1912.
Jan.	53.81	56.25	July	52.57	....
Feb.	52.23	59.06	Aug.	52.17	....
Mch.	52.76	58.37	Sept.	52.43	....
Apr.	52.32	59.20	Oct.	53.37	....
May	53.31	61.00	Nov.	55.77	....
June	53.04	....	Dec.	54.85	....

COPPER

Daily quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Below are average monthly quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	12.29	14.09	July	12.47	....
Feb.	12.26	14.08	Aug.	12.41	....
Mch.	12.14	14.68	Sept.	12.20	....
Apr.	12.02	15.74	Oct.	12.19	....
May	11.99	16.05	Nov.	12.61	....
June	12.39	....	Dec.	13.55	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months.

		U. S.	European.
January	1910	141,766,111	244,961,280
January	1911	122,030,195	230,264,280
September	"	133,441,501	191,215,360
October	"	140,894,856	191,945,600
November	"	134,997,642	176,816,640
December	"	111,785,188	164,151,680
January	1912	89,454,695	178,329,920
February	"	66,280,643	153,820,800
March	"	62,939,988	141,125,680
April	"	62,367,557	137,806,000
May	"	65,295,368	134,176,000

UNITED STATES PRODUCTION AND CONSUMPTION

(Compiled from reports of the Copper Producers' Association)

	Production.	Domestic deliveries.	Exports.
April, 1911	118,185,223	52,407,650	62,129,599
May	126,962,544	64,543,963	61,078,557
June	124,554,312	61,655,561	71,460,519
July	112,167,934	56,982,582	74,880,658
August	125,493,667	59,935,364	69,885,660
September	115,588,950	57,311,584	50,824,011
October	118,255,442	64,068,656	60,084,349
November	111,876,601	68,039,776	67,049,279
December	122,896,697	65,988,474	79,238,716
Total for 1911	1,431,938,338	709,611,945	754,932,733
January 1912	119,337,753	62,343,901	80,167,904
February	116,035,809	56,228,368	63,148,096
March	125,694,601	67,847,556	58,779,566
April	125,694,001	69,513,846	53,252,326

LEAD

Lead is quoted ordinarily in cents per pound or dollars per hundred pounds delivered at St. Louis or New York. The difference is normally 15c per hundred pounds, and any larger or smaller difference is promptly met by sales. The daily price in New York is published each week in this column. Below are the average quotations by months:

	1911.	1912.		1911.	1912.
Jan.	4.48	4.43	July	4.50	....
Feb.	4.44	4.33	Aug.	4.50	....
Mch.	4.39	4.07	Sept.	4.48	....
Apr.	4.41	4.20	Oct.	4.27	....
May	4.37	4.20	Nov.	4.30	....
June	4.34	....	Dec.	4.45	....

ZINC

Zinc is quoted as spelter, standard Western brands, and based upon St. Louis or New York delivery. While New York quotations, as a matter of convenience, are commonly used, relatively little spelter actually goes to or comes from New York. The bulk is shipped direct from the plants in the Mississippi Valley to manufacturers, due allowance being made for freight. New York daily quotations are published in this column each week. Below are given averages by months:

	1911.	1912.		1911.	1912.
Jan.	5.45	6.42	July	5.70	....
Feb.	5.52	6.50	Aug.	5.95	....
Mch.	5.56	6.57	Sept.	5.86	....
Apr.	5.40	6.63	Oct.	6.10	....
May	5.35	6.70	Nov.	6.38	....
June	5.50	....	Dec.	6.30	....

Zinc-dust is quoted separately, the price being based upon the cost of spelter in Illinois and the cost of preparation. About half the zinc-dust used in the United States is imported through San Francisco. Delivery prices are determined largely by quantities and contracts.

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average monthly quotations, in dollars, per flask of 75 lb., are given below:

	1911.	1912.		1911.	1912.
Jan.	44.60	43.75	July	48.00	....
Feb.	48.40	46.00	Aug.	50.00	....
Mch.	52.50	46.00	Sept.	47.50	....
Apr.	50.90	42.25	Oct.	46.12	....
May	46.50	41.75	Nov.	45.50	....
June	46.50	....	Dec.	44.50	...

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations, averaging about 5c. per lb. higher than New York, are quoted weekly in this column. Below are given average monthly New York quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	41.25	42.53	July	42.40	....
Feb.	41.61	42.96	Aug.	43.32	....
Mch.	40.16	42.58	Sept.	39.75	....
Apr.	42.18	43.92	Oct.	41.18	....
May	43.11	46.12	Nov.	43.12	....
June	44.61	....	Dec.	44.65	....

Current Prices For Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ℔ 100 lb	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ℔ 100 lb	1.00	1.50
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ℔ lb	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ℔ lb	0.09½	0.12
Acid, muriatic, com'l, carboy, ℔ 100 lb	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ℔ lb	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ℔ lb	0.10½	0.15
Acid, nitric, com'l, carboy, ℔ 100 lb	5.25	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ℔ lb	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ℔ lb	0.12½	0.15
Argols, ground, bbl., ℔ lb	0.20	0.25
Borax, cryst. and conc., bags, ℔ 100 lb	2.75	3.85
Borax, powdered, bbl., ℔ 100 lb	3.00	4.00
Borax glass, gd. 30 mesh, cases, tin lined, ℔ 100 lb	10.00	[illegible]
Bone ash, 60 to 80 mesh, bbl., ℔ 100 lb	4.50	5.50
Bromine, 1-lb. bottle, ℔ lb	0.55	0.65
Candles, adamantine, 12 oz., 40 sets, ℔ case	3.50	4.15
Candles, adamantine, 14 oz., 40 sets, ℔ case	4.00	4.75
Candles, Stearic, 12 oz., 40 sets, ℔ case	4.35	5.50
Candles, Stearic, 14 oz., 40 sets, ℔ case	4.85	5.20
Clay, domestic fire, sack, ℔ 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, ℔ lb	0.20½	0.24½
Cyanide, 98 to 100%, 200-lb. case, ℔ lb	0.20	0.24
Cyanide, 120%, 100-lb. case, ℔ lb	0.27½	0.28½
Cyanide, 120%, 200-lb. case, ℔ lb	0.26½	0.27½
Lead acetate, brown, broken casks, ℔ 100 lb	8.75	9.05
Lead acetate, white, broken casks, ℔ 100 lb	10.00	10.25
Lead acetate, white, crystals, ℔ 100 lb	11.75	12.25
Lead, C. P., test., gran., ℔ 100 lb	13.00	15.00
Lead, C. P., sheet, ℔ 100 lb	15.00	18.00
Litharge, C. P., silver free, ℔ 100 lb	10.50	13.00
Litharge, com'l, ℔ 100 lb	7.50	9.00
Manganese ox., blk., dom. in bags, ℔ ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ℔ ton (85% MnO_2—1% Fe)	42.50	50.00
Nitre, double ref'd, small cryst., bbl., ℔ 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., ℔ 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., ℔ 100 lb	7.25	8.00
Potassium bicarbonate, cryst., ℔ 100 lb	12.00	15.00
Potassium carbonate, calcined, ℔ 100 lb	15.00	18.00
Potassium permanganate, drum, ℔ lb	0.11	0.12½
Silica, powdered, bags, ℔ lb	0.03	0.05
Soda, carbonate (ash), bbl., ℔ 100 lb	1.50	1.75
Soda, bicarbonate, bbl., ℔ 100 lb	2.00	2.50
Soda, caustic, ground, 98%, bbl., ℔ 100 lb	3.15	3.50
Soda, caustic, solid, 98%, drums, ℔ 100 lb	2.65	2.85
Zinc shavings, 850 fine, bbl., ℔ 100 lb	11.80	13.00
Zinc sheet, No. 9—18 by 84, drum, ℔ 100 lb	10.00	11.25

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, ℔ ton	*$20.00	$22.50
Arsenic, white, refined, ℔ lb	0.04	0.04½
Arsenic, red, refined, ℔ lb	0.08	0.09
Asbestos, according to length and quality of fibre, ℔ ton	100.00	350.00
Asbestos, lower grades, ℔ ton	5.00	50.00
Asphaltum, refined, ℔ ton	15.00	20.00
Barium carbonate, precipitated, ℔ ton	42.50	45.00
Barium chloride, commercial, ℔ ton	42.50	45.00
Barium sulphate (barytes), prepared, ℔ ton	20.00	30.00
Bismuth ore, 10% upward, ℔ ton	*75.00	upward
Chrome ore, according to quality, ℔ ton	10.00	12.50
China clay, English, levigated, ℔ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ℔ lb	2.50	
Coke, foundry, ℔ 2240 lb	13.50	15.00
Diamonds:		
Borts, according to size and quality, ℔ carat	2.00	15.00
Carbons, according to size and quality, ℔ carat	50.00	90.00
Feldspar, ℔ ton	5.00	25.00
Firebrick:		
Bauxite, ℔ M	175.00	
Magnesite, ℔ M	190.00	275.00
Silica, ℔ M	42.50	47.50
Flint pebbles for tube-mills, ℔ 2240 lb	16.50	22.50
Fluorspar, ℔ ton	10.00	15.00
Fullers earth, according to quality, ℔ ton	20.00	30.00
Gilsonite, ℔ ton	35.00	40.00
Graphite:		
Amorphous, ℔ lb	0.01½	0.02½
Crystalline, ℔ lb	0.04	0.13
Gypsum, ℔ ton	7.50	10.00
Infusorial earth, ℔ ton	10.00	15.00
Magnesite, crude, ℔ ton	5.00	7.50
Magnesite, dead calcined, ℔ ton	23.50	27.50
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ℔ ton	10.00	25.00
Manganese, prepared, according to quality, ℔ ton	30.00	70.00
Mica, according to size and quality, ℔ lb	0.05	0.30
Molybdenite, 95% MoS_2, ℔ ton	400.00	500.00
Monazite sand (5% thoria), ℔ ton	150.00	200.00
Nickel metal, refined, ℔ lb	0.45	0.60
Ochre, extra strength, levigated, ℔ 100 lb	2.25	3.25
Platinum, native, crude, ℔ oz	40.00	45.00
Sulphur, crude, ℔ ton	15.00	25.00
Sulphur, powdered, ℔ ton	40.00	45.00
Talc, prepared, according to quality, ℔ ton	20.00	50.00
Tin ore, 60%, ℔ ton	450.00	475.00
Tungsten ore, 65%	390.00	455.00
Vanadium ore, 15%, ℔ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, ℔ ton	*15.00	20.00

California Gem Stones

As is well known, a variety of gem stones are found in California and a number of local firms are engaged in cutting and selling them. The price per carat varies according to color and quality. Below are quoted representative sale prices. Crude material sells for much less, and there are no regular quotations. The prices here given serve to indicate the relative value of the gems:

Tourmaline.—Stones from ½ carat up to 4 carats, at from $4 to $8 per carat, diamond cut; this price for the pink, red, green, yellow, blue, and water color; stones cut cabachon (with a smooth curved surface), $2 to $8 per carat.

Kunzite.—San Diego and Riverside county stones in shades of a delicate rose pink, brilliant amethystine purple, deep lavender, rich golden yellow, and water color; diamond cut, ¼ carat up to 10 carats; $5 to $10 per carat.

Hyacinth.—Cut cabachon, from 1 to 10 carats in size, 75c. to $3 per carat.

Californite (Vesuvianite or California jade).—Cabachon cut, stones 1 to 20 carats in size, $1 to $2 per carat.

Washingtonite.—Cabachon cut, stones 1 to 4 carats in size, $3 to $5 per carat.

Beryl.—Diamond-cut beryls, red, pink, yellow, aquamarine, citron yellow, and wine color, from ¼ carat to 3 carats, $3 to $5 per carat; emerald beryls, ¼ to 3 carats, $10 to $30 per carat; cabachon-cut beryls, red, pink, yellow, aquamarine, citron yellow, and wine color, $2 to $4 per carat; emerald beryl, cabachon cut, 1 to 3 carats, $8 to $20 per carat.

Peridot.—Diamond cut, 1 to 3 carats, $3 to $5 per carat.

Topaz.—White, $1.50 to $3 per carat; royal, $3 to $5 per carat; yellow, $2 to $4 per carat; sea-green, $3 to $5 per carat; wine color, and smoky topaz, $1.50 to $3 per carat.

Turquoise.—Clear and matrix turquoise in both oval and round shapes, from 1 to 10 carats in size, 50c. to $1 per carat.

California Ruby (Garnet).—Diamond cut, 1 to 4 carats, $1.50 to $3 per carat.

Eldorado Gem.—This is the latest gem on the market and when mounted one of the most beautiful; it is found in Eldorado county, and is a delicate canary yellow color; 1 to 2 carats, $10 per carat.

Green Chalcedony (Chrysophrase).—Stones cut rounding or cabachon, 1 to 20 carats, 75c. to $2 per carat.

Jasper.—Stones from 1 to 20 carats, cabachon cut, 50c. to 75c. per carat.

Benitoite.—Rare; 1 to 2 carats, diamond cut, $10 to $20 per carat.

Amethyst.—Diamond cut, 1 to 5 carats, 75c. to $1.75 per carat; cabachon cut, 1 to 10 carats, 50c. to $1 per carat.

Rock Crystal.—Cubes one inch square, $1 each.

Azurite-Malachite.—2 to 10 carats, 50c. to $3 per carat.

Rose Quartz.—Cabachon cut, 2 to 20 carats, 50c. per carat.

California Moonstone.—Cabachon cut, 1 to 10 carats, 25c. per carat.

Jasperine.—Cubes one inch square, $1 each.

Moss Agate (Chalcedony).—Cabachon cut, 2 to 4 carats, 75c. per carat.

Utahlite.—Cabachon cut, 1 to 3 carats, $2 per carat.

Chrysocolla.—Cabachon cut, stones from 1 to 5 carats, 75c. per carat.

Bloodstone.—Cabachon cut, 1 to 10 carats, 75c. per carat.

Amazon Stone.—Cabachon cut, 1 to 5 carats, 75c. per carat.

Rutile Crystal.—Transparent quartz crystals, penetrated with long slender crystals of brilliant red rutile (oxide of titanium); cut in small cubes and polished for paperweights, $1.50 each; crystals uncut, $1.

Chlorite Phantom Crystals.—Quartz crystals, with peculiar inclusions of chlorite; cubes one inch square at $2 each; uncut crystals, $1 to $5 each.

Axinite.—Diamond cut, $5 per carat.

Labradorite.—White, yellow, red; cabachon cut, 1 to 5 carats, $1 per carat.

James Lewis & Son's Copper Report

Standard copper during April varied in value to the extent of £2 per ton, opening at £70 17s. 6d. for cash, rising to £71 5s. 0d. on April 2, and falling to £69 5s. 0d. on April 10. After improving to £70 13s. 9d. on April 16 it declined to £69 8s. 9d. on April 23, recovered to £70 11s. 3d. on April 24, but reacted the same day to £70. Up to £70 13s. 9d. was paid on April 29, and the closing value May 1 was £70 3s. 9d. cash and £71 three months prompt. Sales for the month represent about 52,000 tons. Refined copper has been in good demand since the termination of the coal strike, English consumers chiefly supplying their wants from the stock of American copper held in England, the quantity of which is steadily diminishing. American producers, being well sold for delivery over the next two months, hold for 16c. per pound, or the equivalent of £74 per ton c.i.f.

German consumption for the first three months of this year shows an increase of 15,219 tons—54,325 tons as compared with 39,106 tons in the same period last year. This makes the total European consumption 106,106 tons this year as against 84,434 tons last year, an increase of 21,672 tons, the increase in American consumption being 12,224 tons, or a total increase of 33,896 tons for the three months. Against this there is an increase of 2237 tons in American production and imports and a decrease in the imports into Europe from other countries of 5030 tons, or a total decrease of 2793 tons. American shipments from Northern ports for April are given as 22,341 tons. European stocks have decreased 2208 tons, and the visible supply 1183 tons during the month. Imports are 2106 tons less and deliveries 733 tons greater than during the same period last year.

The total arrivals in England and France for April were 14,956 tons, and the deliveries 16,385 tons fine. The arrivals in England from Chile during April were 1449 and the deliveries 1053 tons fine, and from other countries 7136 and 8578 tons fine respectively. The arrivals at Liverpool and in Swansea from the United States have been 2225 tons bars, etc., and 102 tons plates, etc., equal to about 2302 tons fine copper, in London 726 and in France 4145 tons fine. The Chile charters for the month are advised as 2900 tons, including 1725 tons for the United States. Quotations May 1 were: Standard, £70 3s. 9d. for cash and £71 0s. 0d. three months' prompt; English best selected ingots, £74 5s. 0d. to £75 5s. 0d., and tough cake, £74 5s. 0d. to £75 5s. 0d. per ton, less 2½% delivered Birmingham. Electrolytic wire bars, £74 0s. to £74 10s. net cash c.i.f.; 12s. 3d. to 12s. 6d. for ore of 20%, and 12s. 9d. to 13s. 0d. per unit for Chile regulus or American matte free from silver.

STOCKS OF COPPER (TONS FINE)

	1912			
	Jan. 1.	Mar. 1.	Apr. 1.	May 1.
Chilean in—				
Liverpool and Swansea	4,225	4,429	4,807	5,203
France	714	672	633	778
American in—				
Liverpool and Swansea	12,939	10,637	9,825	8,215
France	4,033	4,746	5,248	4,690
Sundries in—				
Liverpool and Swansea	786	739	741	1,148
London and Newcastle	6,462	5,628	5,377	5,060
Birmingham	346	440	767	850
France	507	558	537	567
English in—				
Liverpool and S. Wales	17,346	15,183	14,215	14,210
Total, England and France	47,358	43,032	42,150	40,721
Sundries in—				
Germany and Holland	13,400	11,500	10,900	10,121
Total European stocks	60,758	54,532	53,050	50,842
Afloat as advised by mail and cable to date—				
From Chile	1,575	2,675	2,325	2,050
From Australia	8,350	5,800	5,700	7,000
Total visible supply	70,683	63,007	61,075	59,892

Recent Publications

California State Board of Health. Monthly Bulletin. 17 pp., ill., index. Sacramento, January 1912.

Bulletin of the Massachusetts Institute of Technology. Summer Courses 1912. 22 pp. Boston, March 1912.

Choptank Folio, Maryland. Geological Atlas of the United States, No. 182. U. S. Geol. Surv. Washington, 1912.

California State Board of Health. Sewage Disposal. Monthly Bulletin. 16 pp.; ill., index. Sacramento, November, 1911.

Bismark Folio, North Dakota. By A. G. Leonard. Geological Atlas of the United States. U. S. Geol. Surv. 12 pp. Washington, 1912.

Monthly Summary of Internal Commerce of the United States. Bureau of Statistics. 72 pp.; tables, index. Washington, February 1912.

The Use of Permissible Explosives. By J. J. Rutledge and Clarence Hall. Bull. No. 10, Bureau of Mines. 34 pp.; ill., index. Washington, 1912.

California State Board of Health. California Tuberculosis Commission. Monthly Bulletin. 32 pp.; ill., index. Sacramento, December 1911.

Rensselaer Polytechnic Institute Bulletin. General Information, Curricula, Illustrations. 40 pp.; ill. Troy, New York, December 1911.

Roads and Road Material of Alabama. By Wm. F. Prouty. Bull. No. 11, Geol. Surv. of Alabama. 148 pp.; ill., tables, map, index. Montgomery, Alabama.

Reconnaissance Report of the Fayette Gas Field, Alabama. By M. J. Munn. Bull. No. 10, Geol. Surv. of Alabama. 65 pp.; index, maps. Montgomery, Alabama.

Report on the Mining Accidents in Ontario for January, February, and March, 1912. The Bureau of Mines, Bull. 10. By E. T. Corkill. 11 pp.; table, index. Toronto, 1912.

Circular of the Bureau of Standards. No. 33. United States Government Specifications for Portland Cement. 28 pp.; ill., index. Washington, May 1, 1912.

The Production of Sand-Lime Brick in 1911. Advance Chapter from Mineral Resources of the United States, Calendar Year 1911. 5 pp. U. S. Geol. Surv. Washington, 1912.

The Use of Mice and Birds for Detecting Carbon Monoxide after Mine Fires and Explosions. By George A. Burrell. Bureau of Mines. Technical Paper II. 15 pp. Washington, 1912.

Report of the Department of Sanitation of the Isthmian Canal Commission for the Month of February 1912. By W. C. Gorgas. 49 pp.; index, tables. Washington, 1912.

The Production of Talc and Soapstone in 1911. By J. S. Diller. Advance Chapter from Mineral Resources of the United States, Calendar Year 1911. 9 pp. U. S. Geol. Surv. Washington, 1912.

The Production of Monazite and Zircon in 1911. By Douglas B. Sterrett. Advance Chapter from Mineral Resources of the United States, Calendar Year 1911. 6 pp. U. S. Geol. Surv. Washington, 1912.

Annual Report of the Director of the Mint for the Fiscal Year Ended June 30, 1911, and also Report on the Production of the Precious Metals in the Calendar Year 1910. 403 pp.; tables, index. Washington, 1912.

Production of Slate in 1911. By A. T. Coons. U. S. Geol. Surv., Adv. Chapter Mineral Resources. 19 pp. Washington, 1912. The output of slate in 1911 was valued at $5,728,019, a decrease of $508,740 from the value for 1912.

Slack Cooperage Stock, 1910. Forest Products No. 3. Bureau of the Census. Compiled in co-operation with the Department of Agriculture; Forest Service, Henry S. Graves, Forester. 8 pp.; tables. Washington, January 20, 1912.

Pulp-Wood Consumption, 1910. Forest Products No. 1. Bureau of the Census. Compiled in co-operation with the Department of Agriculture; Forest Service, Henry S. Graves, Forester. 10 pp.; tables. Washington, December 20, 1911.

Lumber, Lath, and Shingles, 1910. Forest Products No. 2. Bureau of the Census. Compiled in co-operation with the Department of Agriculture; Forest Service, Henry S. Graves, Forester. 45 pp.; tables. Washington, February 20, 1912.

Statistics of the Mineral Production of Alabama for 1910. Compiled from Mineral Resources of the United States. By Charles Arthur Abele. Bull. No. 12, Geol. Surv. of Alabama. 51 pp.; index, tables. Montgomery, Alabama.

Mining Conditions under the City of Scranton, Pa., Bureau of Mines, Bull. 25. Report and Maps. By Wm. Griffith and Eli T. Conner. With a preface by Joseph A. Holmes and a chapter by N. H. Darton. 89 pp.; ill., maps, index. Washington, 1912.

Petroleum and Natural Gas in Alabama. By M. J. Munn. Part II.—Mineral Fuels. Advance Chapter from Contributions to Economic Geology (Short Papers and Preliminary Reports), 1910. Bull. 471—A-2. 25 pp.; maps. U. S. Geol. Surv., Washington, 1912.

Petroleum and Natural Gas in Utah. By E. G. Woodruff. Part II.—Mineral Fuels. Advance Chapter from Contributions to Economic Geology (Short Papers and Preliminary Reports), 1910. Bull. 471—A-4. 29 pp.; maps. U. S. Geol. Surv. Washington, 1912.

Production of Mica in 1911. By Douglas B. Sterrett. U. S. Geol. Surv., Adv. Chapter Mineral Resources. 9 pp. Washington, 1912. This paper covers the occurrence, nature, and uses of mica, as well as figures of production. The total value of the mica output in the United States in 1911 was $355,804, being $18,707 greater than in 1910. The sheet mica production amounted to 1,887,201 lb., and scrap mica to 3512 short tons.

Geysers. By Walter Harvey Weed. Pub. on Yellowstone Park. 29 pp. Dept. Interior, Washington, 1912. Price 10 cents. This pamphlet, which may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., includes a map of Yellowstone Park showing the situation of the various geysers, and numerous illustrations of them. The text covers the nature of geysers and a description of the more important geyser regions of the world. The paper will be of especial interest to intending visitors.

New Zealand. Royal Commission on Mines. 453 pp. Wellington, 1912. This volume covers reports on the Prevention of Accidents; Ventilation of Mines; Underground Sanitation of Mines; Change and Bath Houses for Miners; Profitable Utilization of the Soft Bituminous and Lignite Coals of the Westport District; and Minutes of Evidence and Exhibits. The report is based upon studies of a commission consisting of N. D. Cochrane, John Dowgray, J. S. Evans, George Fletcher, H. S. Molineaux, W. E. Parry, and Frank Reed. It is replete with data of interest to both metalliferous and coal miners.

Production of Graphite in 1911. By Edson S. Bastin. U. S. Geol. Surv., Adv. Chapter 'Mineral Resources.' 38 pp. Washington, 1912. This report covers the origin, properties, and uses of graphite; the production, considered by states and countries; markets and prices; foreign deposits; and a bibliography of the subject. It is, in fact, a handbook in miniature, and an excellent one. In 1911 the United States imported 20,702 short tons of graphite valued at $1,495,729, and produced 3618 short tons of natural graphite valued at $288,465, with 5072 short tons of manufactured graphite worth $664,000.

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

LABORATORY MANUAL FOR TESTING MATERIALS OF CONSTRUCTION. By L. A. Waterbury. John Wiley & Sons. Pp. 270, index. For sale by the *Mining and Scientific Press*. Price $1.50.

As the title implies, this book is written for the use of students as a text-book in laboratory testing practice. The subject matter covers testing of all known building materials, and is treated under the heading of general instructions, laboratory work, preparation of reports, description of apparatus, tests of cement, tests of concrete, concrete, iron, steel, wood, brick, sand, gravel, stone, and asphalt. Appendices supplement the matter in the body of the text and give the reports of the sub-committees of the various engineering societies bearing upon the subject, and include progress report on uniform tests of cement, standard specifications for cement, method suggested for the analysis of limestones, raw mixtures, and portland cements, progress report of special committee on concrete and reinforced concrete, standard specifications for structural steel for bridges and buildings, standard specifications for open-hearth boiler plate and rivet steel, and requirements for paving brick. The entire book is comprehensive in its treatment of the various subjects and replete with information. An excellent index facilitates ready reference to any detail contained in the subject matter.

OBSERVATIONS ON THE WEST OF ENGLAND MINING REGION. By J. H. Collins. Pp. 683. Ill., index. Printed for the author by Wm. Brendon & Son, Ltd., Plymouth, England. 1912. For sale by the *Mining and Scientific Press*. Price $7.

This volume, which is No. XIV of the Transactions of the Royal Geological Society of Cornwall, is essentially a discussion of the mineral deposits of Cornwall and Devon. It opens with an introductory chapter on ore deposits in general, which is followed by several describing the particular forms of deposits that are found in Cornwall. These in turn are followed by detailed descriptions of the individual mines. The descriptive chapters are supplemented by several discussion underground water, lode fillings, metamorphism, ores and vein stones, the age of the veins, and similar general topics. There are several appendices, including one that is made up of an alphabetical list of the mines. The book is really a discussion of ore genesis with illustrations taken from Cornwall, and it has been written by one who knows both the area and the literature of his subject.

Cornwall was well known to the earlier mining engineers, but there are many now active in the profession who not only have never visited the country but have no clear conception of it and its classic deposits. To them, particularly, Mr. Collins has rendered a valuable service, since he has brought together in one convenient and accessible volume a great mass of previously scattered data. The tin lodes of Cornwall will probably always stand as one great type of deposit, and with a view to general discussion of ore genesis Mr. Collins' book is especially welcome. Cornwall is peculiar not only in its deposits and methods but in its language, and to read about the country one needs always a special dictionary lest he stumble over killas, petuntzyte, elvans, or other things for which the world in general has other names. If Mr. Collins has not altogether escaped from the maze of local, and to foreigners barbarous, names for simple things he has at least made an earnest attempt and removed some of the obstructions from the road. The book is too large and too detailed to review adequately here, and none but a Cornishman would dare to question an authority such as Mr. Collins. It is evidently based upon close observation, long thought, and wide reading, and it is sure to be extremely helpful to those of us who must depend upon others for a knowledge of the Duchy to which all mining men owe so much.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

INVALID LOCATION—NO INCREMENT TO LOCATOR

An attempted location of a mining claim, based upon a discovery within a then valid and subsisting claim, is absolutely void for the purpose of founding an adverse claim, and does not attach upon the subsequent failure of the first locator to do the required annual assessment work.

Swanson *v.* Sears, (U. S. Supreme Court) 32 Supreme Court Reporter, 455. April 1, 1912.

LOCATION OF FORFEITED CLAIMS IN ARIZONA

In Arizona a state statute requires that a notice of location of mining property which has been forfeited for failure to do the necessary assessment work, must state that the claim located has been forfeited or abandoned. On appeal to the United States Supreme Court it was held that this statute does not conflict with the federal mining laws.

Clason *v.* Matko, 32 Supreme Court Reporter, 392. March 11, 1912.

TAKING ORE—LESSORS JOINTLY LIABLE

Where the lessees of one party entered upon another party's land and extracted gold therefrom, and paid a part of the gold so extracted to their lessors as royalties from the lessors' land, the lessors being cognizant of and acquiescing in the taking of the ore, were jointly liable with their lessees to the injured party, to the extent of the royalties which they received.

G. & P. C. Merriam Co. *v.* Saalfield, (Alaska) 190 Federal, 927. October 28, 1911.

OIL AND GAS LEASE—IMPLIED COVENANT FOR DILIGENCE

Where an oil and gas lease gives the lessee the right to explore and develop the property and operate wells thereon without limitation as to time, but provides for substantial royalties to be paid the lessor, there is an implied covenant on the part of the lessee to develop the property and operate the wells drilled thereon with reasonable diligence and in good faith. A failure to commence development for nearly six years was in this case held to entitle the lessor to cancel the lease.

People's Gas Co. *v.* Dean, (Kansas) 193 Federal, 938. November 28, 1911.

COAL LAND LAWS NOT TO BE FRAUDULENTLY EVADED

Two corporations, disqualified under the coal-land laws from making more than one location, each procured 40 persons to make locations and assign said locations to the corporations in question. The perpetrators of the fraud were indicted for conspiracy to defraud the Government. Held, that the law limiting locations could not be evaded by such subterfuge, and that there was no intention on the part of Congress to except the unsurveyed coal lands of Alaska from the operation of restrictions which apply to surveyed lands.

United States *v.* Munday, (U. S. Supreme Court) 32 Supreme Court Reporter, 53. December 4, 1911.

COAL LANDS NOT TO BE ACQUIRED UNDER HOMESTEAD LAWS

Where the Government had been induced to patent certain lands containing coal deposits to homesteaders by false and fraudulent proof that the land in question was chiefly valuable for agriculture, the grantee of such patentees was held not to be a bona fide purchaser, and the patents were held to be therefore subject to cancellation at the suit of the United States. Coal lands are 'mineral lands' within the United States statutes providing for the sale of the public domain therefore cannot be legally acquired under the homestead laws.

Washington Securities Co. *v.* United States, (Washington) 194 Federal, 59. February 13, 1912.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

ONE gram of gold is worth P1.329. Silver is variable, but a common value of 1 gram is P0.032.

BORAX is used in the enameling industry, which consumes about one-half of the total borax production of the United States. This, according to the Geological Survey, amounted in 1910 to 42,357 short tons, valued at $1,201,842.

LEAD production in the United States by decennial periods is summarized in 'Metal Statistics' as follows: 1830-9, 122,500 tons; 1840-9, 247,000; 1850-9, 168,000; 1860-9, 153,900; 1870-9, 547,780; 1880-9, 1,345,711; 1890-9, 1,798,294; 1900-9, 3,051,318.

BORAX deposits of the United States are of great extent and there seems to be little danger of their exhaustion. In 1910 the production was, according to the U. S. Geological Survey, 42,357 tons of crude borax, valued at $1,201,842, while the value of the imports amounted to only $12,397, approximately 1% of the domestic production.

INCREASE in temperature with depth is a common phenomenon. It is usual to assume an increase of 1°F. for each 65 ft. of depth, but the actual increase is variable. Recorded figures are, 1°F. for each 33 ft. on the Comstock lode; 208 ft., on the Rand; 77 ft. at Bendigo; 80 ft. at Ballarat; 43.5 ft. in the Thames field, New Zealand; 32.8 ft. at Waihi.

CEYLON graphite is well known and widely used. An American firm, Pettinos Bros., of Bethlehem, Pennsylvania, is the principal exporter. With the exception of the operations of this firm and a limited amount of mining on the tea estates, the industry is in the hands of natives. Approximately 50,000 men, women, and children are employed in the industry.

TIN production in 1911 is estimated at 109,600 tons of 2240 lb. each. Of the total, 55,100 tons came from the Straits Settlements, 22,600 from Bolivia, 15,000 from Banka Sales in Holland, and 5300 from Cornwall. The remainder was from Australia, South Africa, Java, China, and the United States. The last is the largest user of tin, but an insignificant producer.

RIPARIAN rights are not recognized in Nevada. Priority of appropriation dates from filing an application with the State Engineer before commencement of work. After approval and publication of the notice in some newspaper by the State Engineer, a certificate is issued which must be filed within thirty days of its issuance both in the county where water is diverted and in the county where used.

ACCIDENTS are more common on night shift than on day shift, and it has been proposed that the midnight shift, in particular, be forbidden. The Royal Commission on Mines in New Zealand, which investigated the matter, came to the conclusion that night work in mines, as elsewhere, "may be more detrimental to men than the day shift, but not so as to warrant us in making any recommendation thereon."

WHERE a broad vein apexes in breadth, partly upon each of the adjoining claims, that is, when the joint boundary line of the claims splits the apex, the extralateral rights go to the senior locator. The locator has the right to follow the vein to which he has extralateral rights into the ground of all mineral locations and entries, whether patented or not, whether of an earlier or later location than his own; but he must follow the vein from his own ground.

MOLYBDENITE is used in the manufacture of molybdenum steel and for the manufacture of molybdenum salts, which are used in chemical analyses, for fireproofing, as a disinfectant, in the manufacture of glazes, and in coloring leather and rubber. Ferro-molybdenum is also used for electrodes for arc lamps. There is a good market for ores containing 90 to 95% molybdenite at $400 to $450 per ton, but the supply is almost entirely drawn from foreign sources, chiefly Australia.

LITHIUM minerals of economic importance are: amblygonite, a fluophosphate of aluminum and lithium, $Li(AlF)PO_4$, containing theoretically 7.6 to 9.5% Li; spodumene, a silicate of lithium and aluminum, $LiAl(SiO_3)_2$, containing theoretically 4.5 to 7% Li; lepidolite, a lithia mica, $R_2Al(SiO_3)_3$, R being generally Fe, Mg, and Li in varying proportions; and lithophilite, a phosphate of Fe, Mg, and Li containing 8 to 9% Li. All of these minerals occur in workable quantities in the United States, in parts of California, Maine, Massachusetts, New Hampshire, North Carolina, and in the Black Hills of South Dakota.

GEYSERS are hot-water fountains. They occur only in volcanic regions and in acid volcanic rocks. In Iceland and New Zealand the volcanic fires are still active. According to W. H. Weed, geysers occur along lines of drainage, on shores of lakes, or in other situations where meteoric waters naturally seek the surface, and they are fed from meteoric waters that have not penetrated to great depths but have been heated by ascending vapors. The supply of heat is derived from great masses of lava slowly cooling from a former state of incandescence, heating waters which, descending to the hot rocks, ascend as highly heated vapors. The intermittent spouting of geysers is due to the gradual heating of water accumulated in fissures or tubes in the rocks, the only mechanism necessary being a tube, which may or may not have local expansions or chambers.

ALUMINUM and its alloys in automobiles, dirigible balloons, and aeroplanes is in constantly increasing use. In the form of magnalium it is used in the beams of analytical balances, and other new alloys are being constantly brought to public attention. The metal is also employed in paper decorations and for wrapping. It is reported to have been used in the textile industries, where it has been combined with silk, to which it imparts a peculiar brilliancy, particularly adapted to theatrical and ceremonial costumes. It has found and is constantly finding a host of applications in smaller articles of everyday use and ornamentation. The Ordnance Department of the United States Army recently awarded a contract for 60,000 or more aluminum canteens and cups. The metal is now being used in various other ways in the light field equipment of the Army.

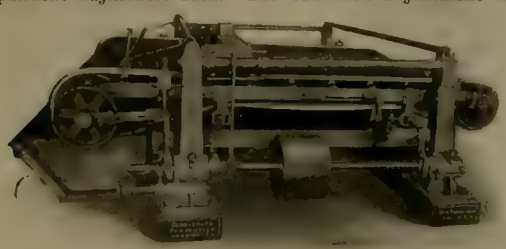
MICA prices vary with the size of the sheet. According to D. B. Sterrett, of the U. S. Geological Survey, it is not possible to give absolute prices of manufactured sheet mica from the lists of dealers, since discounts allowed vary with the nature of the purchases. The prices of the sizes given in the table below are quoted from a standard list for 1911. Discounts ranging from 70 to 10% are allowed on stove mica and from 60 to 10% on electrical mica.

Price per pound quoted for stove and electrical mica for 1911:

Stove Mica.		Electrical Mica.	
Size, in.	Price.	Size, in.	Price.
1½ by 2	$1.20	1 by 3	$1.75
2 by 2	2.00	1 by 6	5.50
2 by 3	3.50	1½ by 4	2.75
3 by 3	5.75	2 by 4	3.50
3 by 4	7.00	2 by 7	7.25
4 by 6	9.50	3 by 9	11.00

Pan Motion Concentrator

While the idea of concentration by means of either side or end-shake vanning machines is well known, the combination of both in connection with an endless traveling belt is a new idea. The Senn Pan Motion Concentrator combines a side and end shake into one continuous circular, or pan motion. The results thereby attained are claimed to be greatly superior to those of their side or end-shake machines. The separation of material occurs almost instantly on coming in contact with the belt. The half-circle backward motion of the belt downward gives the heavy particles a chance to settle on the belt, and as the other half-circle going forward uphill starts its motion, the gangue is left behind, and the heavy particles are carried with the belt forward by means of an independent adjustable feed. The belt feed adjustment varies



from 3 to 6 ft. of belt travel per minute to suit the different grades of material.

The machine consists of a lower steel frame, which is suspended from the four stands and an upper frame, rigidly supported on the lower one. The lower frame gets a side shake by means of two eccentrics on the drive-shaft. A third eccentric gives an intermittent forward and backward motion to the upper frame in addition to the side shake given by the lower frame, thereby producing a perfect circular motion of 1½-in. diameter, with every revolution of the drive-shaft. As the feed engages the driving drum only during the forward travel of the frame, any point on the belt describes an advancing circular motion. The machine for a 6-ft. belt covers a floor space of about 9 by 9 ft., is guaranteed for a capacity of from 40 to 50 tons in 24 hours, and a closer saving than known on any existing concentrator. The saving in power, water, wear and tear, and floor space is considerable, compared with the capacity of other machines. The machine is placed on the market by the Senn-Smith Pan Motion Concentrator Co., 1024 Hearst Bdg., San Francisco.

Air-Compressor Lubrication

The lubrication of air-compressors and pneumatic tools is a feature deserving careful attention. A common fault is to use too much oil, and oil that has too low a flash point. An air-compressor does not require as much oil as a steam cylinder, it is better, in fact, to limit the use of oil to a minimum. Oil tends to cause the valves to stick and thereby necessitates frequent cleaning. If kerosene is used to remove the deposit the valves must be taken out, although engineers have been known to introduce kerosene through the air-inlet valves for this purpose. Kerosene will clean the valves, but it is also equally effective in producing an explosion.

The sanest method is to lubricate air-compressor cylinders with soapy water and flake graphite. Such a mixture provides economical, efficient, and safe lubrication and keeps valves clean. A little oil should be introduced when shutting down the compressor to prevent any tendency of the soapsuds to cause rusting. By this method all dangers attending the use of oil are overcome. Flake graphite has a strong tendency to attach itself to metal surfaces, and, when thoroughly worked into the inequalities of surfaces, imparts a superficial glaze or veneer of great smoothness, high polish, and endurance that prevents actual contact of metal to metal, and make it possible for relatively small quantities of fluid lubricants to provide a safe and sufficient film or lubricating layer.

Flake graphite is an inert mineral; its normal smoothness is quite unaffected by any degree of heat attainable in the air-compressor cylinder. Under no conditions can it be volatilized, carbonized, or baked into a hard or gummy mass to interfere with the free action of the valves. On the contrary, its presence upon working surfaces is a guarantee of smooth operation. One of the best booklets on the subject is 'Air Compressor Lubrication,' published by the Joseph Dixon Crucible Co., Jersey City, N. J. Everyone in any way interested in the operation of compressors should read this booklet. Copies may be obtained from the above company upon request.

Commercial Paragraphs

The Redwood Manufacturers Co. of San Francisco has completed the erection of the wooden tanks at the new mill of the Tonopah Belmont Development Co. at Tonopah.

W. P. Dinsmoor, for several years manager of the Sullivan Machinery Co. at Denver, Colorado, has been appointed manager of the Chicago sales office. George W. Blackington, associated with the general offices of the company at Chicago for several years as general sales manager, will succeed Mr. Dinsmoor in charge of the Denver office.

The Taylor Iron & Steel Co., High Bridge, New Jersey, has within the last few years entered into the manufacture of the standard types of chain in manganese steel. As compared with the ordinary iron and steel chains, the manganese chain is said to last longer, especially in handling gritty and abrasive materials. It has resulted in reducing the items of breakage or renewal of equipment, so that in spite of its higher initial cost the new chain is cheaper in the long run. The detachable type of chain was the first to be perfected in this material. On account of difficulties encountered in casting, it was not practical to make any smaller size than the No. 88, but this size and the larger ones are now on the market. Many special chains are now being made, and practically all of the standard types for conveying and elevating work can also be procured. Sprockets or traction wheels are made in manganese steel for all of the various types of chains, and the results secured are said to be fully as good as those obtained from the chain.

The following interesting figures showing the consumption of hides in one large shoe factory were submitted by the F. Mayer Boot & Shoe Co., manufacturers of the well known Mayer Honorbilt Shoes. These figures cover one year's operation in the big Mayer shoe factory at Milwaukee: Total number of hides consumed last year, 382,573, divided as follows: 55,447 steers, 28,676 cows, 51,602 calves, 62,160 sheep, 2320 horses, 1360 kangaroo, 181,008 goats. All these animals placed in a single file would make an unbroken line reaching from Chicago to Detroit. The requirements for one day's operation make a line over a mile long. To work this quantity of hides into shoes requires over a thousand people, who draw enough wages to keep a city of 5000 people well fed and happy. Milwaukee, Wisconsin, where the factories of the F. Mayer Boot & Shoe Co. are situated, is the greatest leather market in the world, affording this company advantages in the selection of hides, one reason for the superiority of its product. This company is a large manufacturer of miners' boots.

An interesting booklet has just been issued by the Hyatt Roller Bearing Co. of Newark, New Jersey, which illustrates twelve standard makes of mine-car wheels now equipped with the Hyatt type of roller bearing. Each make of wheel is illustrated in cross-section, showing the details of its construction, and a brief but comprehensive description of each type is also given. The information contained in this booklet should be of great interest and value to any mine operator or superintendent.

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EDITORIAL

A PUBLIC personage has declared, "I used to think that Roosevelt was crazy, but I have come to the conclusion the public is." Everything gets handed on to the ultimate consumer these days.

REVOLUTIONS make business for bankers. Mexico is borrowing $10,000,000 in the United States, and China has taken the first installment of her $300,000,000 international loan.

MONEY made in mining finds its way into all the avenues of industry, and beyond. Some $15,000,000 from South Africa is to go to various charities by virtue of the will of Sir Julius Charles Wernher.

CORNELL UNIVERSITY has been given a sufficient sum to provide new shops for the mechanical department, and it is most appropriate that this gift, by Mrs. F. O. R. Rand, is to be a memorial to J. R. Rand and his son, who have done so much in application of mechanical engineering to industry.

ORGANIZATION of the Canadian Mining & Exploration Company, with a paid-up capital of $2,500,000, is a notable event in Canadian mining. The personnel of the company augers well for its success, and not the least of its assets is an engineer so well qualified as Mr. W. W. Mein.

SEARCH for tin in the United States has been conspicuously unsuccessful, despite the large demand and high price obtaining. Last season Seward Peninsula placers produced a small tonnage at good profit, and it is now reported that a great tin-bearing lode has been discovered in the Hot Springs district of the Tanana valley. Confirmation of this report would be the best of good news not only for Alaska but the whole country.

AN interesting suggestion growing out of the *Titanic* disaster, is that of Mr. Lewis Nixon, in the *North American Review*, that lifeboats be housed over to make their launching safer, fitted with automobile engines, and lowered by their own power. As Mr. Nixon says, there are now more men who know how to run an automobile than to pull a boat, though it takes a striking statement such as this to remind us how far we have gone on the road from muscle to machinery.

NOME is again in touch with the rest of the world by steamer, and what promises to be a particularly busy season has opened. One firm has contracts for erecting five dredges, and other work is under way. The revenue cutter *Bear* arrived June 3 with the winter's accumulation of mail, and diggers in the drift can now read up on the 'muck-raking' magazines. The *Bear* reports no ice, and the route has been opened unusually early. The *Umatilla* sailed from San Francisco June 1, the *Victoria* from Seattle the next day, and the *Senator* and others later. This annual rush to Nome is one of the events of the year and all the steamers were crowded. Late comers had to stand aside because of the new rule regarding life-boat accommodation, but there

were no restrictions as to fresh vegetables. At Nome in the spring there is a hearty welcome for all heads, be they human, lettuce, or cabbage.

SIMPLE individual problems become difficult when grouped, according to the old fable of the bundle of sticks, and the metallurgist is not lacking in pertinent examples within his own field of work. One of these is illustrated in the investigation by Mr. Will H. Coghill, which is concluded in this week's issue, where the association of silver with oxides of manganese render it unamenable to cyanidation. The remedy is apparently simple; to subject the ore to a preliminary reducing action; but the securing of a cheap and efficient method of doing this opens a field for investigation. Numerous other instances at once occur; the association of pyrite, chalcopyrite, and zinc-blende, the occurrence of barite in ores, tetrahedrite as an associate of silver, and titanite in iron ores, to name but a few. The importance of mineral associations does not always receive the attention it deserves in studies in economic geology, and mineral colligation might well be elevated to the rank of subdivision of the general topic of economic geology, and studied at some length. The problems of technical work are daily becoming more complex, by the solution of the simple problems, and technical schools continually feel the pressure to equip with a more adequate training men to solve these as they arise. The best equipment is that founded on accurate and thorough training in the basic principles of scientific work, for the experienced civil engineer may find himself called upon to manage a mine, while the mining engineer is commonly called upon to solve problems in civil, mechanical, electrical, and chemical engineering in the practice of his profession.

Metallurgy and the Rand

American metallurgists are highly complimented in an article on 'Metallurgical Progress on the Rand' appearing in *The South African Mining Journal*, April 13. That there has been great improvement in Rand practice is evidenced by the decrease in cost and increase in recovery from the 85 to 86 per cent of pre-war days, to the 95 to 96 per cent obtaining at present. Despite this, our contemporary points out that technical progress on the Rand has been due more to adoption of devices invented elsewhere, particularly in America, than to local invention. The work of Mr. W. A. Caldecott is cited as exceptional, and indeed his contributions to technology have deserved and received wide recognition. In the main, it is insisted, recent improvements in cyanide practice have come from America. Pachuca agitators, Merrill filter-presses, and Merrill zinc-dust precipitation, Trent agitators, Dorr slime thickeners, are all quoted in evidence. The work at the Portland mill at Colorado Springs, including the building of large revolving-drum filters, giving better washing and deeper submergence of solution, is an instance of the activity of American metallurgists in improvement of cyanidation. Such recognition coming from a foreign technical journal of high standing is flattering. To the list cited by the *Journal* many names might be added, for the metallurgists of North America, including the United States and Mexico, have, in fact, made important contributions to cyanide practice. They have made the process practical under widely different conditions, and, what is more to the point, they continue to devise and invent.

If American engineers have been more inventive than those of South Africa, something must be credited to the genius of the people, and something to differences in conditions. At first glance it would seem that South Africa and North America offer the same inducements to invention. Both are still in the stage of pioneering, both have been settled by mixed races. New conditions are met in each land by men of many types and of widely varying experiences. In the long run the Union of South Africa and the United States of America seem sure to develop much in common. At present they are both great mining countries. When the possibilities of South Africa come to be recognized and the attitude of the people toward colonists changes slightly, reclamation will make possible there, as in the Western United States, a large agricultural development. At present the burghers look upon the division and sale of land as almost treasonable, and in the absence of a working population of small landowners, physical labor by white men around the mines is discouraged. Men become inventors because of the wish to minimize their work, and where it is possible to "let George do it" there has not been the acute personal incentive to perfect a machine. There being no necessity, few inventions have been born.

Other important factors, relating to gold-mining especially, have been the organization of the industry and the simplicity and great size of the Rand orebodies. It was early seen that the field was unique in the security offered as to amount and uniformity of ore reserves. Any standard practice was profitable, and methods soon reached a degree of perfection that assured a good profit. The rush was then toward large-scale operations. On this the only check has proved to be the limited supply of native labor. In the development of the Rand the London share market has been the controlling motive. Anything which threatened the immediate price of shares was not to be thought of, however much it might promise for the future. The great scale of operations made any change in treatment expensive, and, if the new plan proved unsuccessful, thousands of dollars would be lost before the result could be determined. In the meantime shares would have been unsettled; and that fact was kept always before the Rand manager. These difficulties are successfully met elsewhere and might, we believe, have been better met on the Rand. At the Alaska Treadwell, after the cyanidation plant was completed, a question arose as to whether it would not be better to abandon amalgamation and send all material directly over vanners to the cyanide plant. To test the matter, 20 stamps were at once set aside and the flow was rearranged on the new plan. These stamps have now been fed for nearly a year with the same ore as has gone to the 20 next them operating according to the ordinary plan. In a short time it will be possible to tell exactly whether the new or old plan is better, and in the meantime routine operations have not been interrupted. While tests on a large scale have been run on the Rand, not enough of such work has been done, and in general it has been merely the trying out of practice developed elsewhere. Even in this there has been surprising conservatism. Butters filters, despite Mr. Charles Butters' intimate connection with Rand affairs, have only just been introduced, and only now, under the guidance of Mr. F. L. Bosqui, is zinc-dust precipitation coming into its own in South Africa. The margin of possible additional saving on the Rand is admittedly small, and the necessary capital expenditure considerable, but the tonnage still to be treated is enormous, and nothing less than the best should be tolerated. Cyanidation was first successful on a large scale on the Rand, and we would not rate the contributions to metallurgical progress made by Rand metallurgists as low as does our South African contemporary, but still it has been less than is in consonance with the magnificent scale of things in the world's greatest goldfield, and there has been far too much of truth in current gibes at the 'crusted conservatism' of the Rand. The field is no longer young; a generation, as

professional practice goes, has been trained in South Africa; practice in South Africa has borrowed heavily from all the world, and payment should be more in kind and not alone in coin.

Courtesy and Etiquette

Courtesy, like morality, is partly basic and partly customary. Certain acts are fundamentally right and wrong, others are merely inexpedient, but the distinction is not always clearly made. A serviceable definition of etiquette is that it is customary courtesy, a convenient catalogue of actions that experience has shown to be generally desirable or undesirable, so that relations with others may be guided without the necessity for deciding each case upon its individual merits. Curiously enough, etiquette is frequently designated courtesy, and we speak of the professional courtesy between physicians, engineers, and other professional men, meaning thereby such customary relations as experience has shown to produce the maximum of mutual satisfaction and convenience. Those whose work is along professional lines are necessarily aware of these relations and the reasons therefor, though to an outsider they may appear strange and, at first sight, even unreasonable. The etiquette of the engineering profession has been much discussed, and it is our present purpose to refer at some length to the etiquette of journalism and literature, a field in which customary courtesy is no less important from being frequently misunderstood or overlooked. To the experienced writer it is already familiar, but to those whose ventures into authorship are but occasional and infrequent some further discussion will be useful.

Perhaps the commonest breach of journalistic etiquette is the sending of anonymous contributions. This is a breach of the post-office regulations, as well as of etiquette, and is entirely unnecessary, in addition. Under certain circumstances it may be undesirable for an author to attach his name to an article or letter containing information of sufficient interest and usefulness to the profession to justify its publication. Such being the case, it is not only possible but proper to obscure the identity of the author behind a *nom de plume*, while securing the benefit of his contribution. But in every such instance the writer must be known to the editor, otherwise opportunity would be afforded for those so disposed to say covertly what they are unwilling to allege openly, and unpleasant situations and legal complications may arise. Every communication sent to a periodical must therefore have the author's name attached. Whenever it is requested for good reason that the true name be not published it will be withheld.

Another convention frequently ignored is that requiring that corrections or criticisms shall be sent to the periodical in which their object appeared. Where criticism is not personal in character or apparently actuated by motives other than a desire for accuracy, and contains useful information, it is rare for a journal to refuse to accord it equal prominence with the article or statement criticized. When criticism is addressed elsewhere, the critic both ignores the conventions of common courtesy and journalistic etiquette, and fails to secure the attention of the larger number of those who may have read the statement criticized. Any criticism of a statement of fact should invariably be published in the journal in which the misstatement appeared, otherwise students or investigators may later come upon the erroneous statement, but fail to find its correction, and thereby be misled.

In matters of usage and style, etiquette is important, the more so because frequently, almost commonly, it fails to be recognized. The practised writer gradually forms a style of writing which is peculiarly his own and which is graceful, pleasing, and accurate to a greater or less degree, according to his measure of skill and experience. It is not so commonly known that all the more important journals have also a style of their own, founded not only upon the opinion of the editorial staff as to what is preferable, but also upon mechanical considerations necessarily taken into account if uniformity of appearance, and the securing of accuracy and efficiency in composition and proof-reading, is to result. Whether 'program' is spelled with or without a final 'me' is largely a matter of individual preference, but to spell it both ways upon the same page not only produces an unattractive appearance, but reacts to produce a careless habit of mind that will bear fruit in inaccuracy in matters of more importance. As a guide to authors, editors, compositors, and proof-readers, the University of Chicago Press, for example, has prepared a 150-page 'Manual of Style,' and the proof-readers associations of the larger cities have adopted voluminous regulations, which might, from an engineering standpoint, be called specifications, as to spelling, punctuation, and other matters of usage in style. The style followed by the *Mining and Scientific Press* is essentially that developed in 'A Guide to Technical Writing,' by Mr. T. A. Rickard. It follows, therefore, that the style of an article as it appears in print conforms to that of the journal in which it is printed rather than that of its author, if the two conflict. To most authors this is not a matter of importance, but others who take pride in their peculiar style, sometimes feel a sense of injury at changes made in their contributions. This is natural but unwarranted. It is not practicable for a journal to change its style to suit the individual wishes of its contributors any more than it is practicable for a street-car to stop before any house along the line in order to suit the individual convenience of a patron.

Since the introduction of the typewriter and carbon paper the submitting of manuscript to more than one journal at a time has become a not infrequent breach of journalistic etiquette, which doubtless arises from a lack of precision of ideas in regard to the publication of an article in more than one journal. Addresses and statements by those in authority, either by reason of office or professional standing, are likely to contain so much of interest and value as to warrant publication as widely as possible. Scientific investigations, similarly, may justify republication, and it is customary in such cases for the author to ask permission to republish elsewhere, which is almost invariably accorded. This is so well recognized that weekly scientific journals commonly publish excerpts and abstracts from the proceedings of learned societies, with the usual footnote of acknowledgement, without waiting to secure permission to do so. The publication of any article depends upon a variety of considerations, and it may easily happen that when an article is submitted to two journals simultaneously it may be accepted by both, whereas neither would have accepted it knowing that it would be published elsewhere. Convention requires that manuscript should be submitted to only one journal at a time, and where this is productive of too great inconvenience, as in the case of engineers living in remote places, it is possible and proper to endorse upon the manuscript that if it cannot be accepted for publication within a given period it will be submitted to another journal; any editor will be glad to observe the author's wishes in this regard.

Many other points of journalistic etiquette can receive but the briefest mention. Technical journals differ from daily papers in many respects, and the best way to prevent information leaking out, is to accord it freely, with a request that it be withheld from publication. Where it is desired that information be not given out before a certain date it should be so marked, and the request will invariably be respected. But the best guide as to the observance of journalistic etiquette is innate courtesy, aided by an intelligent observation of the usage of others.

Genesis of Silver-Lead Ores in Wardner District, Idaho—II

By Oscar H. Hershey

Sullivan Pyrite Dissemination

Most of the rock in what may be called the 'vein zone' in the Sullivan, Bunker Hill, and Last Chance mines has a rather dark gray color which is generally due solely to the dissemination of fine-grained pyrite. The microscope shows that the grains have good crystal outlines and many of them are perfect cubes. They are perhaps most abundant in the sericitic matrix, but also occur in the quartz grains. This is another case of metasomatic replacement, and it has occurred on a large scale for it is present in practically all the Lower Revett quartzite between the Sullivan and Buckeye faults, though in places it is so light that the rock retains its white color, and in other places it is so abundant that the rock appears like a very fine grained aggregate of solid pyrite. Going northwestward between the Sullivan and Buckeye faults, the Lower Revett is succeeded by Upper Burke strata. The first 600 to 900 ft. is largely 'white Burke' in which there is little disseminated pyrite, then comes a band of distinctly, but not very strongly pyritic rock, followed by a narrower band in which the disseminated pyrite is fairly strong, the whole having an average width of about 1500 ft. Beyond that is barren light-colored rock. The most favorable rock is the lightly sericitic quartzite of the Lower Revett.

I regard the Sullivan fault as the original foot-wall limit to this pyrite replacement, because the heavy dissemination generally thins rapidly in the few feet of sheared rock over the gouge, gets a further marked decrease at the gouge, and beyond that occurs only as a light irregular fringe not usually extending more than 10 or 15 ft. beyond the gouge. On the hanging-wall side, the pyrite extended in places much beyond the Ollie McMillin fault, and the Buckeye fault marks the approximate limit, though it is more recent in age. The country beyond the vicinity of these faults has some pyrite, but it is sporadically distributed and is of a different type. The pyrite zone is of the nature of the 'fahlbands' so common in some districts. The main portion of it is a block of Lower Revett quartzite which, before faulting by the Cate faults, was at least 4000 ft. long and a large part of it 800 to 1200 ft. wide, dipping southward with the bounding faults. The amount of pyrite apparently does not change in a vertical depth of 1200 ft. or what was, before the Cate faulting, 2500 ft. Generally the mineralization was exclusively pyrite, but I am not certain that disseminated siderite that occurs in parts of the zone is not genetically related to the pyrite. The pyrite is clearly older than any lead mineralization that has produced commercial orebodies. Further, most of the fault gouges in the mines owe their dark color to grinding of the pyritic rock. In fact, the thorough distribution of the pyrite in the zone required the absence from that zone of any strong gouges or zones of shearing.

In constructing sections, it became apparent that most of this block differs structurally from any other of the district in that it is the only one in which the Lower Revett stands a fair chance of persisting to very great depth. It was thrust, by the Ollie McMillin fault, whose displacement may be over 10,000 ft., far down into the Prichard slate, so deep that perhaps it reached the zone of flowage and became impermeated by hot solutions under great pressure which ascended along the beds. Indeed, it may have reached the vicinity of the monzonitic magma and the ascending solutions may have come from the superheated zone near the magma. The iron may have been derived from the iron carbonate so abundant in the rocks of the region and sulphur may have been supplied by the magma in the form of hydrogen sulphide emanations. It is true, also, that the Prichard formation may have furnished the necessary constituents, and magmatic influence is not indispensable. The solutions did not at depth come into contact with any rocks bearing lead and zinc, although the disseminated lead and zinc deposits were already in existence in a neighboring block and the two mineralizations overlap in the Middle Blue Bird tunnel. The solutions broke through the small Ollie McMillin gouge and also penetrated into the Upper Burke within the zone until the physical characters of the strata became too unfavorable.

Phil Sheridan Type

The Phil Sheridan mineralization consists chiefly of siderite and coarse pyrite, with subordinate amounts of quartz and zincblende, but no galena. Its outcrops consist of cavernous masses of limonite with a skeleton of quartzite fragments and quartz seams. This usually yields, upon assay, a little zinc and silver, and sometimes traces of gold, but little or no lead. The masses are usually without definite limiting features, grading irregularly into the unaltered quartzite, but in a few places they may be limited on one side by a fault gouge. The quartzite fragments remaining in the mineral masses do not usually have the character of those of an ordinary breccia and the relation between them and the iron minerals suggests, as pointed out by R. D. George, metasomatic replacement. Even where the Phil Sheridan minerals constitute the bulk of the rock, the original bedding planes are apparent. The quartzite fragments have disseminated pyrite as in the same beds at a distance from the Phil Sheridan bodies. I am inclined to see a close relation between the two types of mineralization, the Phil Sheridan perhaps representing the extreme phase of the replacement process, of which the Sullivan dissemination of pyrite is a weaker and earlier phase.

A large body of oxidized Phil Sheridan mineralization occupies a zone 100 to 150 ft. wide, paralleling the Hoffman fault on the south side. Samples have assayed up to 6.60 oz. silver per ton and one yielded 0.5% zinc. I have seen a little chalcopyrite in places. Bunches of limonite are distributed thence northwest along the Buckeye fault in a zone mostly 80 to 140 ft. wide to the centre line of the Last Chance claim. Down through the Last Chance and Bunker Hill mines, this zone may be seen at a number of points. It occupies the hanging-wall side of the vein zone and where it sets in the lead-bearing ground practically ceases. It is a characteristic of the Phil Sheridan bodies that they tend to have an oblique position in the vein zone, diverging from the foot-wall toward the west.

Southeast of the Hoffman fault it is widely distributed within the vein zone, but its strongest development was in a comparatively narrow zone accompanying the Motor seam. Thence eastward Phil Sheridan bodies are scattered as far as the vein zone may be traced. The outcrop of one is said to assay 3 or 4 oz. silver per ton, but no lead. Another is associated with several thin nearly vertical fault gouges. Some of it is said to assay 5 to 6 oz. silver per ton and no lead. Several bunches of quartz, chalcopyrite, and argentiferous tetrahedrite, some of which assayed 42.8 oz. silver per ton and 8.66% copper, with no lead or gold, are probably special concentrations of the copper and silver minerals that are present sparingly in the siderite-pyrite bodies, and elsewhere; also, the silver appears to be in association with tetrahedrite.

The Phil Sheridan mineralization seems to characterize an east-southeast belt that lies two miles south of the South Fork of the Coeur d'Alene river from Kellogg to Mullan. On Placer creek a tunnel exposes large irregular bodies, largely of siderite, some pyrite, a trace of copper minerals, but practically no lead. A siderite zone said to average 100 ft. wide and traceable 17,500 ft., south of Mullan, seems to be essentially barren of lead. I have seen small bodies near the Polaris mine and at three prospects in Moon gulch. In short, the Phil Sheridan mineralization may have been widely developed in the Coeur d'Alene dis-

trict in connection with the east-southeast faults of the second system, in a period preceding the formation of commercial orebodies, and many large outcrops of limonite and quartz are of no prospective value because they do not go down into Phil Sheridan mineralization. The Phil Sheridan solutions generally did not come into contact with lead or else they were chemically unfitted to dissolve and redeposit it. The latter is improbable, especially as they were able to handle zinc.

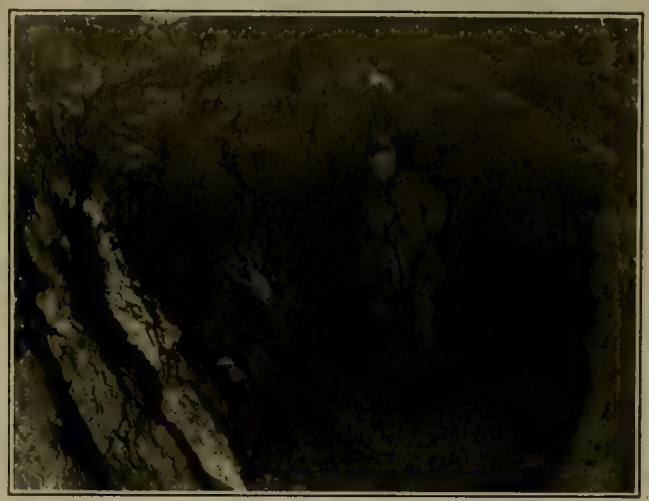
Blue Bird Type

The Blue Bird ores are characterized by the presence of considerable pyrite. Local variations, which will be described separately, may not all be of the same age, but they apparently represent a distinct stage of mineralization succeeding the Phil Sheridan stage. They are connected genetically with the reverse faults of the fourth system. The Government Gulch, Elk Creek, West Fork, and Big Creek (as mapped) faults, all normal, with north-northwest courses, nearly vertical dips, and downthrow on the east of 2700 ft. in one case and probably more in the others, constitute the third system, due to progressive subsidence toward the east or progressive uplift toward the west. The Jackson, Buckeye, Oakland, and Norman are the principal faults of the fourth system and mark a series of thrusts from the southwest. Subsidiary faults, of displacement varying from 25 to 200 ft., include the Sierra Nevada, Caledonia, Viola, Motor, McNally, Williams, East, Bryan, Governor, and seams 'A,' 'B,' 'C,' and 'D.' The Blue Bird ores are connected with the small faults rather than the more important ones.

Small seams and pockets of pyrite, zincblende, and galena are scattered through a block between the Upper Cate and Buckeye faults, under Blue Bird gulch. The percentage of zincblende is unusually high, even for the Blue Bird type; fine-grained dark brown blende is as abundant as the galena. This is also the block in which the disseminated zinc and lead deposits enter the region of Blue Bird seams and pockets. The natural inference is that the Blue Bird blende and galena were derived from the disseminated deposits, the latter being notably richer in blende than galena. Elsewhere in the mines where the Blue Bird ores are farther from the disseminated deposits, the percentage of galena is higher. It is a matter of common observation in the Coeur d'Alene district that veins become proportionally richer in sphalerite with depth, presumably toward the source. I consider that we have here evidence pointing toward the disseminated zinc and lead mineralization as the source of the lead and zinc of the Blue Bird orebodies. The pyrite may have come from the Sullivan pyrite dissemination and the relatively small amount of siderite present from the disseminated siderite. Thus we have, in earlier mineralizations, the elements of the Blue Bird and all we need is a new set of fractures to change the course of the ascending currents and cause the deposition of galena in a zone in which formerly deposits free from it were formed. The Blue Bird solutions primarily circulated along cracks in the quartzite, possibly attacking the walls somewhat; but it is true throughout the mines, with one important exception, that fissure filling and not metasomatic replacement of quartzite was the predominant characteristic of the Blue Bird stage. It is a curious fact that, with one notable exception, the Motor zone, the solutions avoided the large bodies of Phil Sheridan mineralization; the latter cemented the rock into masses that were not easily broken, and so were generally impermeable to the Blue Bird solutions.

The most important development of the Blue Bird type is in the block bounded by the Buckeye, Hoffman, Upper Cate, and Lower Cate faults and extending also into the Upper Burke beyond the Tyler fault. The hanging-wall limit is the large body of Phil Sheridan mineralization until it dies out, and thence the Buckeye fault to the Lower Cate fault. This great mass of rock, which, near the surface, is about 3500 ft. long and mostly 200 to 500 ft. wide, is traversed by a network of galena-bearing veinlets that, collectively, constitute a gigantic 'stringer lead.' They are connected with a series of small faults whose prevailing course is about N. 70° W., practically parallel to the strike of the bedding planes. Some of them are only bedding plane slips, though most of them cut the bedding at small angles and are much steeper than the Cate faults. A characteristic feature, especially in the Last Chance mine, is the presence of many veinlets of ribbon quartz. The quartz is of a fine-grained, hard, slightly bluish type. A rather fine-grained pyrite, a rather light-colored zincblende, some galena, and a little siderite, tend to be distributed along fine parallel lines, giving the rock a banded appearance.

The seams vary from a fraction of an inch to 30 inches in thickness. They generally strike approximately parallel to the small faults mentioned above, but dip at much lower angles, 30° or even less being quite common. Any one seam cannot be followed far on the dip, but as they occur in unbroken succession one above another, stopes can be carried up on them, these stopes being much steeper than the individual seams. The ribbon seams were certainly deposited in open fissures; they were produced by slight movements along the small steep gouge seams, which cracked the intervening brittle quartzite, and dragged the blocks apart, making a 'giant breccia' through which water circulated readily until the fissures were cemented. The fact that the seams are so much flatter than the faults indicates that the movement along the steep gouge seams was an upward thrust of the hanging-wall side. The pyritic Lower Revett yielded more open fissures than the softer Upper Burke.



BUCKEYE FAULT.
(Photo by W. J. Elmendorf.)

In large portions of the block, particularly toward the hanging-wall side, the seams are too small and widely separated to permit of mining. They increase in size and numbers, until the amount of waste required to be handled is small enough to permit of profitable stoping. In some of the stopes the individual seams are followed, but in others the mineralization has proceeded to such an extent as to make a veritable breccia of quartzite and ore minerals, and then large chambers are opened. In the larger and better shoots there are cores in which the ore is very rich, in places considerable bodies of nearly pure galena. The roof of the Drew stope in the Last Chance mine at one time appeared to have practically solid galena 10 by 15 ft. in cross-section. In this Drew area, it is evident that the mineralization was effected in two stages; the lower grade ore is ordinary Blue Bird with pyrite and blende quite noticeable, but the higher-grade ore is chiefly galena with some siderite.

In short, the so-called ore-shoots of this block have a commercial limit, that is, there is merely a gradual fading of the degree of seaming, except in a few places where the N. 70° W. seams cause a decided decrease in the ore-seams or where post-mineral faulting has brought rich ground against poor. Changing economic conditions will enlarge or decrease the size of the shoots. Four principal shoots or rich cores may be made out. They pitch about S. 50° W. When considered in relation to the seams of the N. 70° W. system with which they are connected, they are seen to stand *en echelon* to each other, being intimately related to the foot-wall limit of the Blue Bird zone, whereas the gouge seams are oblique to that limit, having been controlled largely by the bedding. The details of these ore-shoots would unreasonably lengthen this paper. The most eastward, the Hatton, has been stoped from the surface to the Cedar level of the Bunker Hill mine and has produced about 160,000 tons of ore. A great group of more or less connected stopes represents the Roberts shoot which extends from the surface to a vertical depth of about 700 ft., and has probably produced about 600,000 tons of ore. The heart of the Fan ore-shoot was one of the most persistent and straightest orebodies in the district and is represented by a nearly continuous series of large filled stopes in the Last Chance mine and a new stope in the Bunker Hill mine. It extends from the base of the oxidized zone to a vertical depth of 1000 ft. and has produced probably over 600,000 tons of ore. The most westward shoot, the Edna, is exceedingly irregular, but can be traced from the base of the zone of oxidation to a vertical depth of 1300 ft., and to that depth will produce probably 150,000 tons of ore.

The block of Lower Revett quartzite lying southeast of the Flint fault, and between the Motor and Sullivan faults, contains seams and orebodies of Blue Bird type that lie in zones that strike W. to N.70°W. and are relatively steep. As they are much steeper than the Motor seam, they must enter the Phil Sheridan zone that accompanies that seam. The solutions while arising in the steep seams, upon reaching the large body of siderite and pyrite of the Motor zone, would naturally attack it and replace much of the siderite by galena, blende, and other Blue Bird minerals. On the No. 9 level of the Sullivan mine, the Motor zone is exclusively Phil Sheridan mineralization, and a group of Blue Bird seams lies under it. They first reach the zone in the Morgan raise and begin to form an orebody of the Motor system. This, at first, is very small. The solutions, once introduced into the zone, were able to spread as they ascended. For this reason, the orebodies lengthen upward. Other steep Blue Bird seams reached the Motor zone at higher levels farther west and started new ore-shoots upward in the zone. The solutions were at first confined to the lower part of the siderite-pyrite zone under the present seam, but as they ascended they penetrated higher in the zone until no part of it was free from them. The main current continued up along the Motor seam and formed a great orebody that has been mined up to the zone of oxidation. A little of the Phil Sheridan mineralization was missed in places. Practically all of the Motor ore, amounting to over 700,000 tons already mined, I attribute to the solutions introduced into the Motor zone by the most southeastward belt of Blue Bird seams. The explanation is such a simple and rational one that it hardly admits of doubt. Furthermore, it constitutes the best evidence that the solutions that deposited the Blue Bird type of ore were ascending.

The total amount of ore of the Blue Bird type produced by the two companies in whose mines it occurs may have been over 2,500,000 tons. It is a magnificent showing for this type of mineralization.

Buckeye Type

The Buckeye is a product of the Blue Bird stage that is confined to the vicinity of the Buckeye fault and consists chiefly of coarse grained dull lustred pyrite containing clusters of moderately fine grained galena that, either by crushing or part decomposition, readily breaks down into a powdery black substance. Dark brown fine-grained blende may be present. In the vicinity of the disseminated zinc and lead deposits (which the Buckeye fault has brecciated) assays range up to 11% lead, but no commercial orebodies have been developed on this type.

Ontario Type

Faulted areas of the 'vein zone' may be found northwest of where the Cate faults first cut off that zone. They are occupied by Upper Burke strata, most of which is barren and light-colored, but here and there, especially in the bands of white heavy-bedded brittle quartzites and along the Cheyenne and Ontario Footwall faults, there are irregular bodies of Ontario type whose mineralization varies from a light stain along cracks to bodies of good grade ore, tons in amount, as on the Ontario Deep level. This ore is a breccia of non-pyritic quartzite cemented by rather fine grained galena, with a little white quartz in seams and pockets and traces of blende. Southeastward, it passes through a phase rich in fine-grained pyrite into typical Blue Bird seams. The Ontario gets its character from being deposited beyond the zone of disseminated pyrite. It is sporadically developed throughout the mineral belt from Deadwood to Corrigan gulch.

The fifth system of faults, including the Iron Hill, Bulah, and Last Chance, the first with a probable displacement of 1000 ft., are simple gravity faults that may be due to lengthening of the arc through a general bulging up of the whole Coeur d'Alene region. The sixth system is made up of a number of normal faults of small displacement that cut the Blue Bird orebodies. They include the Fan, Cloke, Dago, Rowe, Sanger, McGatlin, and Lackawana 'seams,' some of which do not reach the surface. They were probably due to slight subsidence toward the southwest. Compression again came into play and the faults of the seventh system may be due to a slight thrust from the south.

Jersey Type

Under this heading I will describe a system of veins that have courses generally lying between east and northeast and, with a few exceptions, dips south to southeast. They are commonly known in the district as 'fissures'; they are more like the quartz veins of other districts than are any other of the Wardner orebodies. They are the product of a distinct set of fractures, largely thrust faults (the seventh system) of comparatively small throw, quite at variance with those of earlier and later periods. They are very crooked and badly cut by post-mineral faults generally of small throw, but the great pitching troughs and arches are probably original. Quartz and galena are the predominating minerals; more or less brown zincblende is generally present and a little chalcopyrite and tetrahedrite. Siderite is common, though not conspicuous, and pyrite is present only in small amount. A characteristic feature is a relatively high silver ratio, apparently due largely to argentiferous tetrahedrite. Besides the fissure proper, there is generally much galena scattered in seams and pockets in a zone 10 to 50 ft. wide on one or both sides of the quartz vein and, in the better stopes, much of the ore comes from this breccia.

The Jersey fissure, which has been extensively mined in the Last Chance mine and is now being stoped in the Bunker Hill mine, originally extended from the vicinity of the Sullivan fault to beyond the Buckeye fault. Starting at the surface in Upper Burke strata, with depth it passes the Tyler fault into the hard pyritic Lower Revett. It has a dark gray to black gouge. A typical specimen of Jersey ore consists of a breccia of white quartz fragments cemented by galena and other minerals. Where the quartz greatly predominated it is likely to be a thoroughly shattered mass with galena developed along the cracks. Sometimes pebble-like pieces of quartz may be picked from the galena, leaving a rounded cast. There were evidently two stages in its formation; in the first the hard white quartz vein was formed without much galena. Subsequent movement along the fault shattered the quartz and enabled galena-depositing solutions to ascend along it. The main ore-shoot averages several hundred feet in length and is clearly traceable from Bunker Hill No. 9 level to the Last Chance O level, 2000 ft. on the dip. It has a straight course, almost due south, which is practically straight

down on the dip of the vein as a whole. In ascending, the main ore shoot gradually improved to a point a little below where it passed from Lower Revett into Upper Burke quartzite, and thence there was a gradual decrease. This was connected with the development of a great concave curve which becomes of less radius as height is attained. This favored the maximum of crushing of the quartz vein and neighboring quartzite. The production of the Jersey fissure when it has been exhausted down to Bunker Hill No. 9 level will considerably exceed 400,000 tons.

The Francis vein is known only below Bunker Hill No. 9 level. It originally ended near the Sullivan fault; it extends thence to the Lower Cate fault, which has cut and dragged it northwestward. It has a small blue-gray gouge like that always found with the Jersey fissure. The ore consists of much-shattered white vein quartz cemented by sulphides and siderite. Subsequent movement has granulated and sheared much of the galena near the gouge, so that it now appears as extremely fine-grained steel-gray bodies, often a foot thick. The zincblende in places is in irregular brown patches as much as 6 in. or 1 ft. thick. There is in places very rich lead ore several feet in thickness, besides bunches of coarse galena in the neighboring quartzite. There is a well-defined main ore-shoot between 250 and 300 ft. long which is apparently related to a sharp bend in the fissure, making of it a steeply pitching anticline. There is much additional stoping ground. Because the Jersey and Francis have the same general strike and direction of dip, are identical in structural and mineralogical characters, and may be fitted together in a manner supported by other features of the vein zone, I consider them parts of one vein faulted by the Cate faults. This vein passes obliquely through ore-shoots of the Blue Bird type without any of the characteristic seams of the latter cutting it; hence it represents a distinctly younger stage of mineralization. It may have derived its galena at great depth from the Blue Bird ore seams and it probably will yield more or less ore until it passes entirely to the eastward of the Blue Bird ground.

The Barr fissure lies over and is approximately parallel to the Francis fissure, though uniting with the latter at one place. It generally lacks the brown zincblende of the Francis. On Bunker Hill No. 12 level it has a strong shoot of good ore.

The 'N' fissure near the surface is a persistent vein between the Lower Cate and Republican faults, lying under and roughly parallel to the Jersey fissure. A notable feature is its crookedness and tendency to rapid changes of strike and dip. It was produced by a thrust that may have been five times as great as in the case of the Jersey. It starts at the surface in Upper Burke and, with depth, crosses the Buckeye and Tyler faults into Lower Revett quartzite. Two ore-shoots are discernible; they are probably related to the section where the vein passes the Tyler fault at a very acute angle. The Kemp fissure on Bunker Hill No. 10 level probably represents the vein under the Cate faults. It originally ended near the Sullivan fault. The production of the vein above the No. 9 level will probably reach 100,000 tons. Shorter and much less important fissures of the same system occur at various places in the mines.

The Sierra Nevada vein has the form of an anticline whose axis strikes S.45°W. and descends 85 ft. in 800 ft., until it reaches the Oakland fault, after which it pitches more steeply. The thrusting and arching of the rock over the fault opened spaces of lenticular shape in which the vein proper was deposited. Perhaps there was also some metasomatic replacement. The main ore-shoot occupied the nearly flat portion near the axis of the anticline, with some lenses probably 6 ft. thick. Much of the ore was oxidized and in 1887, according to Ransome, carried 47% lead and from 60 to 90 oz. silver per ton. The production of the mine is unknown. The vein is extremely crooked and is cut off on the northeast by the Cate faults.

The Caledonia vein is probably a portion of the Sierra Nevada vein. As faults I place them in the fourth system, but there was probably renewed movement and mineralization in the Jersey stage. The Caledonia vein is extremely crooked and is cut by many faults of small throw that do not seriously disturb its general position. There is always at least a little gouge, with small quartz lenses distributed along it, and more or less quartz in seams and pockets in the neighboring quartzite, often extending 10 to 20 ft. from the fissure proper. In a few places where it is parallel to the stratification, the gouge is very thin and the mineralization light. Galena seems to have been developed largely in distinct shoots, but tetrahedrite seems to have been much more thoroughly distributed along the vein, which may be an indication of two periods of mineralization. The metal salts have been largely leached from the vein near the surface and carried down to enrich the lower portion of the oxidized zone. Thus we find much limonite in the vein near the surface, but not much of silver or lead minerals and no visible copper mineral. In descending on the ore-

JERSEY VEIN IN BARNEY DRIFT.
(Photo by W. J. Elmendorf.)

shoot, lead carbonate and silver salts become apparent and even much native silver appears in places. Lower, oxidized copper minerals are added to these and small bunches of very rich ore are found. The copper comes from tetrahedrite. Some of this is said to assay as high as 3000 oz. silver per ton. The main ore-shoot, characterized by much galena ore of high grade, is about 400 ft. long by the crooks of the vein and its western limit goes down on a course S. 15° E. It is flanked by less definite shoots characterized by rich argentiferous tetrahedrite with little or no galena.

The Senator Stewart vein is a narrow zone of mineralized rock which is the fissure proper, generally only 6 in. to a foot thickness of quartz and galena; where the vein is 20 to 30 ft. thick it consists largely of brecciated quartzite cemented by galena, blende, and some quartz. It varies in dip from nearly flat to over 45°. The vein is cut by several vertical faults that are ore-bearing.

The Silver King and Crown Point mines developed a

series of veins of the Jersey type, of which the main Crown Point vein dipped 20° to 30° northeast and the ore was cut off by the New Era fault. The orebody is reported to have ranged from 1 to 20 ft. in thickness; first-class ore is said to have carried 65% lead and 80 oz. silver per ton.

In the block of Prichard slate that lies north of the Osburn and New Era faults from Deadwood gulch west, there is a group of east-west veins that are nearly vertical or dip southerly at high angles. They are mostly ribbon quartz, with pyrite, blende, and a little galena. They are unfortunate in their environment. The veins of the Canyon Creek group near Burke are of the Jersey type, except that they have northwesterly courses and very steep dips. It has been pretty well established that they cease to carry ore in commercial quantities after they reach the Prichard slate. The same may be true in the Wardner district—we are willing to concede that it is. I do not say that any of the known veins under discussion are the roots of any of the known Jersey type of veins south of the Osburn fault, but that they are members of the same system, those in the Prichard slate very low in lead content.

(To Be Continued.)

Record Sinking on the Rand

*The southeast shaft of the Government Gold Mining Areas (Modderfontein) Consolidated was sunk 233 ft. during March, which is certainly a record for the Rand and, it is believed, the world's record. Great credit attaches to Martin H. Coombe, the manager, and to Messrs. Lowson, Readhead, and Robar, the sinkers, for this remarkable achievement. The previous record was 213 ft. at the Modder Deep, beating that of the south shaft of Brakpan Mines in July 1907. These shafts are of three and seven compartments, respectively. During the quarter, 583 ft. were sunk at the State Mines, which is also a record; at any rate, it compares with 532 ft. at the Brakpan Mines. It is usually considered that record sinking can only be attained in the Kimberley slate, and it has been said that a monthly record depends largely on the date at which the Kimberley slate is entered, so that the greatest possible distance during the calendar period can be sunk in that formation. This was, however, not the case at the State Mines, less than 80 ft. being in the slate shales.

The shaft in which the calendar month's record has been made is of seven compartments, the excavations being 45 by 10 ft., equal to 450 cu. ft. area, or 37.5 tons per foot of shaft in the solid. The total tons tallied for the month as hoisted for the 233 ft. sunk were 8155, equal to 35 tons per foot, which comes very close to the estimate. The sinking was done through quartzites and slate shales, 155 ft. of quartzites and 78 ft. of shales being pierced during the month. It is noteworthy that only one-third of the distance was in the Kimberley shale; previous records have been almost entirely in that formation. The record was made from 1738 to 1971 ft. Natives do all the hand drilling and shoveling, 82 natives with a leading sinker and a white assistant forming the shift's sinking crew. Eight-hour shifts are worked seven days a week. The majority of the 'boys' drill double hand, using 7-lb. hammers, the end benches only having 'single-hand boys' at work on them. The shaft is laid out with its long axis on the dip, advantage being taken of the bedding planes, the great majority of the holes being inclined to the north against the strata.

Sinking with a skip, one of the main objects striven for is a flat bottom, an ideal bottom having a bench only at each end. The reason of this is the greater facility for loading the broken rock into the skips and getting each skip in its turn into the bottom at approximately the same level. It is obvious that if the 'benching' system were in use in a skip shaft with the engine running double and the skips landing at the bottom of different levels, innumerable difficulties would be encountered, such as tipping, risk of kinking the rope, either running the skip away empty or taxing the boys unduly by shoveling the rock three or four feet higher into the skip; in fact, many unforeseen troubles would be encountered which would cause delay and probably accidents. Blasting takes place every 8 hours. From 40 to 45 holes completes a round for a shift and 'squares' the shaft. These holes are drilled from 3 ft. 6 in. to 5 ft. in depth. Four are drilled abreast for the length of the shaft. The side holes are given from a plumb-line hung from the bottom set. Gelatine used is ⅞ in. diameter; 66⅔% used is of Cape Explosives Co. manufacture and 33⅓% of Modderfontein. Bickford Smiths '27 Special' fuse is used, and Edgar Allen & Co.'s green label ⅞-in. steel. There is no pump in the shaft below 600 ft., the water, 30 skips a shift, being handled with the sinking skips from 'rings' at various points.

Four timbermen are employed in each of the four shafts which are being sunk on the State Mines. Two men and six 'boys form the crew at the bottom, one man and four 'boys' are on the hitches, bearers, and permanent guides, and one man and one 'boy' on the brattice. All timbermen work morning shift only, from 7 a.m. to 3 p.m., and only for urgent reasons is overtime allowed. After the sinking shift is in the bottom and hoisting has commenced, the two bottom crew men go down with their lines, stage planks, blocks, wedges, and helpers. Their first duty is to block the next to the bottom set of timbers, using the bottom set to carry their stage planks. They are not allowed to interfere with the skips once they have reached their place of work, until the sinker has finished cleaning up, has his drills down, and has started his 'boys' drilling. Then the engines are handed over to the timbermen, who take them to hang the next set. From the time the banksman shackles on the first pair of wall plates until the set is hung, filled in, tightened up, and temporarily blocked, and the timbermen are up to surface with their stage planks and 'boys', is an hour to an hour and a half. Timbermen are not allowed to deal with tight ground on the timber. The sinker is responsible and is compelled to take it down. Knowing this, he is careful with his line. If a set of permanent guides is required or a set of bearers to be taken down, as soon as the timbermen have hung their wall-plates and had their filling in timber sent down, they hand the engine over to the other man, who goes on with that particular work. Fifty-seven skips, or 114 tons of rock, has been hoisted from the bottom, one set blocked, another hung and filled, four 30-ft. guides hung and bolted up, the shaft drilled over in the usual manner and blasted a quarter of an hour before the end of the shift. All hitches are cut, bearers placed, and timber dropped while the shift is at work in the bottom. The shafts carry six 8-in. and 4-in. penthouses, two, one above another, in each 'dummy' compartment. Running four skips in a 7-compartment shaft gives each end and the centre compartment clear. In these the penthouses are placed.

There are 132 cu. ft. of pitch pine in each set. The timbers are 7-ft. centres, 6 ft. 3 in. between; wall-plates and end pieces 9 by 9 in.; centre studdle over the joint, 10 by 7 in.; corner studdles, 8 by 8 in.; intermediate studdles, 10 by 4 in.; dividers, 9 by 7 in. The guides are 8 by 4 in. pitch pine, carried on channel brackets bolted to the dividers. One inch 'joggling' is used. Lagging, when any is used, is 12 by 12 in. pitch pine. Bearer sets are put in approximately every 12 ft., each bearer being made up of three pieces. Under the end pieces three 9 by 9 in., making a bearer 27 by 9 in.; under the dividers, three 9 by 7 in., making a bearer 27 by 7 in. Hitches are cut to a minimum of 4 in. in the solid surface. Wire plumb-lines are dropped once a month to check the timber and timbermen's lines. All the framing, guides, ladders, and rings are prepared for the four shafts by three men by hand. To date of writing, in this shaft, 64 sets of 7-ft. centre timber has been put in position in 61 consecutive days. This in itself constitutes a record, and is one that will be difficult to beat. Six hanging bolts on each side are required, three for each half-plate. 'Waverley' 1⅛-in. iron is used for the bolts.

*Advance proof from the *South African Mining Review.*

The wall-plates are in two halves, and are simply butt jointed on a divider, no plating or bolting being used. The length of the two wall-plate halves is, respectively, 22 ft. 9½ in. and 20 ft. 8½ in., making a total length of 43 ft. 6 in. The dividers are 6 ft. 6 in., giving a shaft width over the timber of 8 feet.

Compartment sizes are as follows: The south or pump compartment is 8 ft. 6 in. by 6 ft. 6 inches in the clear. The other six compartments are each 6 ft. 6 in. by 5 ft. in the clear. The pump compartment is divided as follows: 2 ft. 8 in. ladderway, 3 ft. 6 in. for repairing cage, the 'runners' 4 in. and 4½ in., being bolted to the wall-plates, and 2 ft. 4 in. for pipe bearers and columns. The power cables are carried down in the space between the wall-plates and the repairing cage ends. All lights used in the shaft are carbide.

No fan or pipes are in use. A wooden chimney is built above the headgear the entire area of the pump compartment. A ⅞-in. brattice between the pump compartment dividers is carried down with the timber. This gives a natural draught of from 20,000 to 25,000 cu. ft. of air per minute passing over the shaft bottom. Ten minutes after blasting, the bottom is clear of smoke and fume.

The shaft is equipped with a modern steel headgear, 110 ft. from collar to platform, covering, of course, all the compartments. Two double-drum engines are in use, one a geared Robey 10½ by 33-in. cylinder, one a Fraser & Chalmers direct 22 by 48-in. cylinder. All the drums are 8 ft. diameter. The boilers are Babcock & Wilcox

MAP OF SOUTH AFRICA.

Dutch-oven type. A 50-drill Fullerton compressor is also erected, but is not being used. The winding ropes are 1⅛ in. diameter. Sinking skips of 45 cu. ft. capacity are used. White and native 'change'-houses and workshops are of the most modern design and construction. Massive concrete collars have been put in, built up from the solid rock to from 5 to 6 ft. above the surface. The shaft is one of four of the same plan being sunk on the property, which probably constitutes a record for the world. The average sinking for March in the combined shafts was 694 ft., an average of 173 ft. 6 in. for each shaft. The total tonnage hoisted was 24,290.

The officials in direct touch with the shaft are mine captain, engineer, and foreman boilermaker. No shift-bosses or foremen timbermen are employed. The opinion is held that a shift-boss hinders and acts as a stumbling-block in the way of the man who is doing the work. The men are of the best type and work on the bonus system. The greater the footage the greater the pay and the cheaper the shaft per foot sunk. All men directly connected with the sinking join in the bonus list. Engineers work an 8-hr. shift, six to a shaft. The whole system works like clockwork and the result is efficiency of the highest order and good sinking. The State Mines is breaking, hoisting, and putting on the dump from the bottom of the shafts, rock at a cheaper price per ton than the great majority of the producing mines can stope and hoist it. That is the difference in efficiency, though concentration of work has something to do with it. The highest tonnage broken per hole averaged over the month was 2.23, the gelatine consumption being 0.457 lb. The average number of natives per shift was 82.

Geology of Morocco

By Maxwell Blake

The following notes concerning the geology of Morocco are of interest in view of the fact that present conditions in Morocco are likely soon to permit the inauguration of long-proposed railway projects which will result in the development of the country. These are not offered as of authoritative nature, but are generalizations gathered from persons of more or less experience whose observations have carried them into various parts of Morocco.

The general geological formations are of Paleozoic age, with outcrops appearing in the high ridges of the Atlas hinterland, and again in the vicinity of Casablanca and along the Mediterranean sea from Ceuta to Alheucemas. The wide areas between these outcrops are composed mostly of Tertiary sediments, between which are irregular layers identified as Mesozoic. Granites are abundant in the vicinity of Marrakesh, but northeast of that place they disappear or develop into melaphyres. Of igneous rocks of the Tertiary period, basalts and andesites have been reported. Copper, lead, antimony, manganese, and iron ores have been repeatedly discovered, while gold is said to exist in the regions of Sus. In the Tertiary sediments, large deposits of salt are obtainable, and the possibility of extracting potash salts is said to be favorable. In the outcroppings near Melilla, rock salt exists in association with large deposits of iron ore, reported to be of high quality. Deposits of gypsum are abundant in various places.

The opportunity for developing the mineral resources of the country is being eagerly awaited by persons who have secured denunciations. These denunciations signify that the mineral wealth within a radius of four miles of a certain point has been filed upon as the maximum which any individual may claim upon pre-emption. The only requirement for such a claim is an authorized survey by some qualified mining engineer acceptable to the legations of the nations concerned, and the filing of maps and reports of the discovery with the legation of the claimant.

Pending the promulgation of an international mining law, which has been under advisement and discussion by signatories to the act of Algeciras, including the United States, no mineral rights have yet been definitely acquired, but allocation of them is to be recognized upon priority by international adjudication. Already four or five mining syndicates have been organized, but only the preliminary field work has so far been attempted. Owing to the experienced character of some of the persons who have interested themselves in the mineral exploitation of the country, present expectations do not appear to be speculative, especially as regards the existence of copper and iron.

In view of the accessible location of Morocco and its extensive coast line, both along the Atlantic and the Mediterranean, mineral wealth, in whatever part of the Empire it may be found, is not likely to encounter serious transport difficulties, especially should the building of initial railway enterprises be given materialization. In any event, present conditions appear to warrant serious inquiry on the part of responsible persons in the United States interested in mining developments.—*Daily Consular and Trade Reports.*

A railway is to be extended by the Sorocabana railway through the state of Sao Paulo, Brazil, from Salto Grande to the port of Tibirica. The government will supply the capital for the construction on a basis of $16,000 per kilometre plus $440,000 for the purchase of rolling stock. In addition to this, the company transfers to the government all its rights in the concession for the line from Sao Joao to Santos.

Month Ending	Mill Run Date	Tons per Day	Tons Crushed	Assay Value of Ore: Gold	Assay Value of Ore: Silver	Theoretical Extraction, Cyanide: Gold	Cyanide: Silver	Concent'n: Gold	Concent'n: Silver	Total	Bullion Realized: Gross Value	Smelter Deductions	Net Value	Concentrates and Slag Realized: Gross Value	Smelter Deductions	Net Value	Grand Total Weight: Gold	Weight: Silver	Value	Marketing Expenses	Net Value
Jan 29	27	201	5437	10 3	355	67 7	67.7	22 4	15 6	86 7	94285 76	3526 49	90759 27	24420 31	1095 91	23324 66	50.410930	1362.254	114 083 87	2052 21	112.031 66
Feb 26	27	201	5425	10 4	355	71 3	74.6	20 5	15 6	89 8	100711 42	3837 76	96870 66	23470 50	1164 02	22306 48	58 333110	1064 663	119 245 14	1659 78	117 585 36
Mar 26	25	2005	5012	8 5	361	69	69 8	22 -	14 5	87 7	73585 15	2760 53	70824 62	20025 71	886 42	19139 29	39 746290	1258 057	89 963 91	1382 68	88 581 23
Apr 23	26 9	201	5407	9 3	335	69 4	70	21 7	15 3	88 3	89751 48	3408 57	86342 91	23201 71	1226 55	21975 18	46 775600	1521 804	108 258 09	1978 32	106.279 77
May 21	25	203	5080	9 3	335	69 6	71 3	22 1	15 2	89.1	84733 29	3714 18	81539 11	21594 54	1064 25	20500 26	44 031050	1438 180	102 039 37	2761 65	99 277 72
June 18	26 8	2015	5402	10 2	356	72 5	73.3	20 2	13 5	90.1	100145 85	3719 89	96425 96	22614 72	1169 90	20828 82	51 658466	1610 079	117·250 38	3306 67	113 944 11
July 16	26	2016	5242	8 5	320	69 2	68.9	21.7	12 3	86.1	79920 36	3060 40	76859 96	19968 77	1019 97	18948 95	41. 662780	1355 133	95 808 71	2034 38	93 774 33
Aug 13	25 6	208	5324	8 2	330	66 6	71 2	23 4	13 3	87 2	82387 86	3201 10	79186 76	23201 08	1550 68	21650 40	42 163070	1517 950	100 837 16	1726 69	99 110 47
Sept 11	22 4	219	4910	8 3	324	64 6	68.8	26 6	14 7	87 4	72103 83	2785 44	69318 39	24132 45	1129 35	23003 10	39 980840	1323 807	92 321 49	1415 57	90 905 92
Oct 8	26.25	233	6120	7 5	312	75 1	75.1	23 3	12 5	92.4	94869 59	3660 16	91209 43	21841 60	1090 57	20751 03	45. 679160	1682 . 700	111 961 51	1978 03	109 982 48
Nov 5	27.1	238	6453	7 8	336	77.8	75 7	19 8	12 1	92 2	109091 39	4102 80	104988 59	20998 66	887 20	19910 46	48 970740	1855 139	124 905 05	2405 02	122 500 03
Dec 3	27 5	254	7004	7	293	76.1	74 8	19 7	11 7	90.9	104132 28	4030 10	100102 18	19876 68	766 54	19110 14	46 847230	1759 976	119 212 82	3195 71	116.016 61
Dec 31	27 [illegible]	257	6971	8 2	272	71 8	72 2	[illegible]	12 6	93.	113304 11	4392 01	108 912 10	21781 86	931 32	20851 54	53 883510	1841 622	129 763 64	2206 05	127 557 59
	339 [illegible]	219 [illegible]	73795	8 6	324	7[illegible] 1	72 2	21 6	13 6	89 7	1199042 37	45614 43	1153447 94	286 316 [illegible]	14016 64	272 307 10	613 588780	20390 710	1425 650 04	28107 76	1 397 547 28

MILL REPORT, 1911.

Mining

Months 28 days	Ore [illegible]	Exploitation: [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**	Various	Total	Tons	Ore Reserve Broken in Mine: No. 1	No. 2	Tons No. 1	Tons No. 2
1	1.64	[illegible]	2.77	61	.70	[illegible]	1.21	[illegible]		21	6.01	4636	3.66		1000	
2	1.49	48	3.65	58	86	44	1.24	04		18	6.47	4437	3.13		1000	
3	1.40	33	2.87	56	.73	27	98	.04		.17	5.95	4922	3.70		1100	
4	1.76	42	3.33	63	80	28	99	05		23	6.93	4205	3.50		1000	
5	2.23	.44	1.90	61	77	33	90	.04		28	5.27	4432	3.32		1000	
6	2.49	36	1.81	59	60	29	1.26	05		23	5.25	4567	2.66		1000	
7	2.37	32	2.30	50	.62	40	98	04		48	5.44	5027				
8	1.79	32	2.03	61	64	35	1.08	.04		.23	5.36	4932				
9	1.99	44	2.02	41	55	41	98	04		.25	5.08	4461				
10	1.34	28	1.90	44	45	31	98	04		24	4.62	5728				
11	1.37	.10	1.62	49	42	30	61	03	54	.23	4.64	6453				
12	67	21	2.44	34	34	21	32	03	44	.18	4.51	7004		3.56		1879
13	92	.20	1.98	31	35	20	22	**05	.27	.15	3.76	7571		2.33		4408
Average per Month	1.62	35	2.33	50	60	31	90	04	41	.24	5.33	5261	3.39	2.95	6100	6287

Aerial Tramway

Months	[illegible]	Repairs	Total	Tons
1	55	11	66	5437
2	.61	07	68	5495
3	50	13	63	5012
4	41	07	48	5413
5	.36	20	56	5080
6	.54	03	.57	5402
7	57	07	64	5242
8	54	.09	63	5324
9	69	.44	1.13	4910
10	93	15	1.08	6120
11	80	.07	87	6453
12	44	02	46	7004
13	36	08	44	7571
Average per Month	56	12	68	5722

Milling

Months	[illegible]	[illegible]	Battery	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Total	Tons
1	14	—	1.74		17	1.48	34	05	.12		07	4.68	5437
2	14	06	1.40		17	2.41	34	03	16		07	4.74	5425
3	15	07	69		13	2.20	20	04	15		11	3.84	5012
4	14	.07	89		11	1.96	13	04	16		08	3.54	5413
5	14	.07	70		12	1.98	16	04	18		09	3.43	5080
6	14	.02	99		14	2.15	.21	04	16		08	3.33	5402
7	14	07	99		19	2.38	25	04	14		02	4.26	5242
8	14	.07	1.78		32	2.38	.33	04	17		07	4.77	5324
9	15	.02	99	47	19	2.36	24	04	.30		08	4.84	4910
10	.13	.07	38	06	12	1.87	38	04	17	1.46	06	4.41	6120
11	12	02	26	14	07	1.93	03	.02	17	68	06	3.52	6453
12	11	07	27	10	06	1.82	03	03	15	63	05	3.77	7004
13	11	.07	22	27	06	1.87	09	03	18	53	05	3.43	6571
Average per Month	13	07	.81	21	14	2.21	19	04	17	86	07	4.05	5676

Marketing

Months	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Total	Tons
1	03	25	[illegible]	02	01		38	5437
2	13	11	02	02	.02		.30	5425
3	10	12	02	01	02		27	5012
4	17	10	02	08			37	5413
5	14	10	03	25	02		54	5080
6	25	11	03	12		10	61	5402
7	16	13	03	02	.04		38	5242
8	16	08	03	.02	01	.02	32	5324
9	15	05	04	01	03	.01	29	4910
10	06	19	03	04			32	6120
11	17	10	02	05	01	03	38	6453
12	30	08	02	.02	01	.02	45	7004
13	05	20	02	02	01	.01	31	6971
Average per Month	14	13	03	05	01	03	38	5676

General Expense

Months	Salaries	[illegible]	[illegible]	[illegible]	Telegraph	[illegible]	[illegible]	Insurance	Taxes	Legal	Repairs	Hospital	Various	* Total	Tons	Grand Total
1	30	15	[illegible]	[illegible]	.00	02	14	[illegible]	18	07	03	07	12	1.12	5437	13 90
2	30	15	13	08	01	05	07	01	27	03	04	03	15	1.32	5425	15 01
3	33	18	12	10	01	05	16	01	39	04	07	.02	15	1.52	5012	15 66
4	29	14	16	18	.02	07	08	03	24	.03	02	02	15	1.53	5413	14 61
5	34	15	07	15	01	.06	15	02	28		06	03	16	1.46	5080	13 51
6	30	14	10	09	07	10	05	06	04	02	08	03	11	1.24	5402	14 09
7	.32	09	08	.12	01	04	13		23	06	05	02	.11	1.26	5242	14 50
8	33	11	14	08	01	.03	07		27	12	08		12	1.38	5324	14 61
9	.33	09	20	09	01	.04	.13		.11	02	15	.03	24	1.44	4910	14 69
10	25	07	21	10	01	02	03		.10	02	06	02	07	.96	6120	12 93
11	27	07	19	11	01	04	17		16	07	02	02	10	1.27	6453	12 05
12	25	07	15	11		.04	09		24	08	02	02	09	1.16	7004	10 52
13	26	[illegible]	10	09		02	12		10	03	02	.02	14	1.02	6971	9.68
Average per Month	30	11	13	11	.01	04	10	03	20	03	.05	02	.13	1.28	5676	13.34

Details of Operating Expense of the Amparo Mining Company, 1911.

Costs are in pesos. The grand total includes mining, transportation, milling, marketing, general expense, but not reserve broken in mine, including shaft sinking.

* Power is made a separate item and not distributed during tenth month. ** Charged to exploitation for ore drawn from ore reserve in Mine No. 1.

Work of the Amparo Mining Company

This company, organized in 1902, with an authorized capital of 3,000,000 shares of $1 each, which has since been decreased to 2,000,000, owns the San Juan y Santo Domingo, La Union, Buen Suceso, Canada, Navidad, and other mines, covering an area of 300 pertenencias in Jalisco, Mexico. The company is owned by Americans and its main office is in Philadelphia. The mine office is at Etzatlan. The 50-stamp mill has 1050 lb. stamps, Krupp tube-mills, Wilfley tables, Dorr classifiers and thickeners, and Pachuca agitators. Details of operating expense are given in the tables. The failure of electric power and change to steam are responsible for some of the fluctuations.

During 1911 the mill ran 339.675 days, crushing 73,793 dry metric tons and producing in bullion, concentrate, and slag ₱1,425,650; from mine, ₱6702.64; shipping a total of ₱432,352.64.

Operating Expenses.		Per Ton.
Mining	₱356,430.43	₱5.22
Tramway and breaker	49,731.68	0.67
Milling	296,623.66	4.02
Marketing	28,102.76	0.38
General expenses	93,621.66	1.26
Totals	₱824,510.19	₱11.55

Value of Gold and Silver Produced.

	Gold.	Silver.	Premiums.
Bullion	₱670,233.10	₱591,808.97	.....
Concentrate, slag ..	180,692.87	102,965.71	₱2,660.16
Total	₱850,926.27	₱694,774.68	₱2,660.16

Ore sent to mill was produced as follows: Stoped, including ore produced by development, metric tons, 68,389; drawn from reserve dump at times ore from mine was not obtainable, due to accidents and failure of power, 6004; total, 74,393.

Engineer's estimate of ore in mine: Ore fully blocked out, 587,856 tons; partly developed, 118,779 tons; total, 706,635 tons.

Ore broken in reserve in mine: Reserve No. 1, 9838 tons; No. 2, 6295 tons; total, 16,133 tons; reserve in mill-bins, 600 tons.

Written off for depreciation of plant, ₱78,237.51.

Net profit for year, ₱406,750.13.

Dividends declared, 12% on $2,000,000 capital.

The cost of fuel during the year amounted to ₱107,000 to supplement defective electric-power service. The ore fully blocked out is sufficient to run the mill eight years, crushing at the rate of 73,000 tons per year.

		Mining		Development		Tramway & Breaker		Milling		Marketing		General Expense		Total Costs	
Date		Amount	Cost per Ton	Amount	Cost per Ton	Amount	Cost per Ton	Amount	Cost per Ton	Amount	Cost per Ton	Amount	Cost per Ton	Amount	Cost per Ton
Jan. 29		27870.65	6.01	5678.83	1.04	3598.93	0.66	25468.37	4.69	2052.21	0.38	6136.76	1.12	70805.75	13.90
Feb. 26		28701.03	6.47	8089.64	1.49	3728.06	0.68	25721.98	4.75	1659.78	0.30	7159.57	1.32	75066.12	15.01
Mar. 26		29322.26	5.95	6906.19	1.40	3166.25	0.63	19507.05	3.89	1382.68	0.27	7614.08	1.52	67898.51	13.66
Apr. 23		29126.68	6.93	9527.65	1.76	2625.37	0.48	19162.87	3.54	1978.32	0.37	8265.00	1.53	70683.87	14.61
May. 21		23378.32	5.27	11449.03	2.26	2881.57	0.56	17468.51	3.43	2761.65	0.54	7388.73	1.46	65327.81	13.51
Jun. 18		24106.29	5.25	13461.78	2.49	3015.85	0.57	21284.27	3.93	3306.67	0.61	6681.29	1.25	71916.13	14.10
Jul. 16		27395.59	5.44	13222.55	2.52	3363.30	0.63	22270.76	4.26	2034.36	0.38	6624.43	1.25	74911.01	14.50
Aug. 13		26429.55	5.36	9390.39	1.75	3351.63	0.63	25390.67	4.77	1726.69	0.32	7364.27	1.39	73602.58	14.22
Sep. 10		23594.60	5.08	9494.17	1.91	5443.98	1.13	23764.81	4.84	1415.57	0.29	7014.02	1.44	70787.15	14.69
Oct. 8		26457.04	4.62	9664.50	1.58	6670.38	1.08	26994.40	4.41	1978.03	0.32	5897.73	0.97	77662.08	12.98
Nov. 5		29956.14	4.64	8869.17	1.37	5212.28	0.80	22732.33	3.52	2405.02	0.38	8194.97	1.21	77369.91	11.98
Dec. 3		31575.93	4.51	4687.39	0.67	3288.28	0.46	22926.45	3.27	3195.71	0.45	8118.70	1.17	73792.47	10.53
Dec. 31		28510.23	3.78	5670.84	0.92	3328.40	0.44	23931.19	3.43	2206.05	0.31	7102.11	1.02	70748.91	9.88
		356430.43	5.22	116062.11	1.57	49731.68	.67	296623.66	4.02	28102.76	.38	93621.66	1.26	940572.30	13.12

AMPARO MINING CO. STATEMENT OF COSTS (MEXICAN CURRENCY) FOR YEAR ENDED DECEMBER 31, 1911.

Sulphur, Pyrite, and Sulphuric Acid

In 1911 sulphur was produced in Louisiana, Utah, and Wyoming, according to W. C. Phalen of the U. S. Geological Survey. The principal producer was Louisiana, but in both Utah and Wyoming the output in 1911 was greater than during the preceding year. The production of sulphur in the United States in 1911 amounted to 265,664 long tons, valued at $4,787,049, a substantial increase both in quantity and value compared with 1910. It is estimated that the production for 1911 is very close to the present rate of consumption in this country.

The production of pyrite in the United States in 1911 amounted to 299,904 long tons, valued at $1,162,261, an increase of 58,292 long tons in quantity and of $184,283 in value compared with 1910. These figures are the maximum ever recorded by the Geological Survey for the pyrite industry. Though low-grade sulphide ores of copper containing considerable quantities of pyrite and pyrrhotite and zinc sulphide concentrates have been used in recent years in the manufacture of sulphuric acid, the output of pyrite has shown a great increase during the last five years, which has been a time of rapid development of the by-product sulphuric acid industry.

The output of sulphuric acid in 1911 amounted to 2,688,456 tons of 50° Baumé acid. Compared with the figures of the censuses for 1899 and 1904, this shows increases of great magnitude.

Six cars of high-grade ore will go out of Cobalt during the present year to Germany. The Crown Reserve company has renewed its contract with the Government of Saxony to supply a car of ore every second month, the cars to average 120,000 oz. of silver each. The Saxony smelters are operated by the Government for the benefit of the silver mines of the country, which are low-grade properties, and the Cobalt ore is required to raise the average to a point which will pay for treatment. The price received by the Crown Reserve for its ore in Savony is a little better than the New York price of silver, the increase in price being sufficient to pay all the charges of shipping the ore the extra distance. Judging by the output of the mine last year, the Crown Reserve will deliver one-fifth of its total output to Germany, where the treatment of cobalt-bearing ores is highly developed.

Refractory Manganese-Silver Ores—II

By Will H. Coghill

(Continued from Page 754.)

The sample of the Jalisco ore tested, amounted to about one-third of the sample screened and could not be assayed because sampling would have involved crushing, but calculating from the table (IV) gave 16.99 oz. silver per ton and 8.16% manganese. Three products were made: the first looked like pure pyrolusite, the second contained small pieces of dioxide and quartz cemented together, which, if the reader will excuse a Joplin term, was 'chatty'; the third looked like nearly pure quartz. (The term quartz is used for simplicity and includes many light-colored silicates.) For want of better names, I will call these 'concentrate,' 'middling,' and 'tailing,' respectively. The analyses of these products bring to light some astonishing relations. The amount of silver found in the concentrate and tailing was about as expected, but the discovery of a middling containing practically the same amount of silver as the concentrate, and only about one-half as much dioxide, would make one feel that he has got some light on a problem which has perplexed so many. In fact, this explains at once why J. B. Empson reported of one of these ores that in a concentration test the tailing contained as much silver as the concentrate, and why E. M. Hamilton, after attempting to concentrate a refractory manganese-silver ore, stated that "the tailing assayed rather higher than the concentrate." Now since the tailing, as shown by Table VI, contains only 12.80 oz. silver and 71.1% (3.6 + 2.5 + 65) of the material in the middling is the same as that in the tailing, it is apparent that there must be some very rich grains in the middling. Thus the part that I had expected to throw away became the most interesting, and indicated that the amount of refractory silver varies, not as the amount of dioxide, but as the amount of cementing material and is therefore at the contact of the dioxide and quartz. Sixty hours grinding in cyanide, during which time the solution was changed twice, extracted 61% of the silver in the tailing (65). Under similar treatment the concentrate (63) yielded on 13.4% and the tailing from this test was given subsequent treatment as shown in Table VII.

TABLE VII

JALISCO ORE

0.5 A. T. Concentration (60-hour treatment in KCN):

			No.	Mg. of Ag	% Total Ag
Solution			66	2.28	13.4
Residue (treated in H_2SO_3)	Solution		67	0.10	0.6
	Residue (15 minutes treatment in dilute NH_4OH)	Solution	68	0.68	4.0
		Residue	69	12.44	73.3
		Error		1.50	8.7
				17.00	100.0

Here it seems that the silver is slightly soluble in sulphurous acid or ammonia, but subsequent tests proved that the amount is small and depends on the conditions. The 'error' may be due to the difficulty experienced in fluxing the residue containing the manganese salt, to the silver being put into such a state that some of it adhered to the jar, or more likely to a loss incurred by splitting the sample into four parts.

The most interesting feature of this table at the time the tests were made was the insolubility of the silver in ammonia. This was supposed to prove that cement silver was not present, but later it was found upon making a test on silver leaf that the metal is practically insoluble in ammonia, though some texts say that it is soluble. During a two-days test on silver leaf in ammonia with frequent aeration, the silver finally decomposed, forming a dark-brown cloud and later a dark-brown flaky precipitate, but this change was too slow to be of consequence. There seemed to be reason to suspect the formation of cement silver (resulting from partial precipitation) in the sample as it was indicated that the acid had exerted at least some solvent effect on the silver. Now, if it had all been converted into a sulphate or sulphite and remained as such, it would have been soluble in the amount of solution used, but since the greater part of it remained with the residue, it seemed quite probable that it had been dissolved and then partly precipitated by the iron of the iron oxide, thus making cement or colloidal silver. All fears of cement silver being formed by the action of iron oxide upon the silver salt were dispelled by the test (70) following: A sample of the ore was treated with sulphurous acid to which was added a known amount of a solution of silver nitrate (the nitrate was of course converted at once into a sulphite or possibly a sulphate). The test was allowed to stand 15 minutes after the dioxide had all dissolved, thus exposing the silver salt to the reducing action of the iron, and was then filtered and washed. The assay of the residue showed that none of the silver was put into an insoluble state. (71) The insolubility of elemental silver in sulphurous acid was indicated by a test on silver leaf, the silver leaf remaining undissolved and without discoloration for two days in a stoppered bottle in the presence of that acid. It then took on a color similar to that of bornite and remained in this condition for several weeks. Therefore, it is seen that elemental silver is soluble in neither NH_4OH nor H_2SO_3; that a sulphate or sulphite is not formed, for if it were it would remain soluble and not be decomposed by the iron oxide, making cement silver.

TABLE VIII

JALISCO ORE

	No.	Mg. Ag recovered	% Total Ag	Gm. of product assayed.	Oz. Ag per ton of product assayed
0.2 A. T. concentrate treated in H_2SO_3:					
Solution	72	...	...	....	....
Sand	73	0.52	7.6	1.498	10.10
Slime	74	6.00	88.3	0.460	380.00
Error		0.28	4.1		
		6.80	100.0		

Before investigating Table VIII, which contains valuable information, a certain property of native manganese dioxide must be considered. When the dioxide is dissolved in sulphurous acid a light colored nearly gelatinous precipitate is formed which remains in suspension with great persistence. This consists probably of barium and calcium sulphates formed by the reaction of sulphuric acid in the sulphurous acid upon the oxides which exist as impurities in the dioxide. Now, in dissolving the dioxide in these ores the same sort of a precipitate forms, except it is colored a brick red due probably to the limonite in the ore.[1] (The solution, on account of conditions which

[1] In fact, admixtures of manganese oxides and limonite are known to occur in all proportions, ranging from manganiferous limonites to manganese ores carrying only a trace of iron.

were not determined, may become red, due probably to ferric sulphate, and in turn be decolorized upon bottling.) This brick red slimy material is called 'slime' in Table VIII. The heavier particles consisting mainly of silica are called 'sand.' These were separated very easily by decantation.

The amount of silver in the sand (73) corresponds closely to that in the tailing (65), but the concentration of silver in the slime (74) sufficient to give an assay of 380 oz. per ton gives a clue that is valuable, for the number of mills treating sand and slime separately runs up into the hundreds and in no case is there such a segregation of silver in either sand or slime. This indicates, then, that here we have to deal with silver in a form that has never been previously met in an ore.

After demonstrating that silver is released during the dissolution of the dioxide, forming such a light slimy product, it seemed best to make a series of tests to determine its chemical deportment, that is, to find whether it belongs to class *x*, *y*, *z*, or *w*.

Silver. { Artificial { *x* Elemental; *y* Combined
Native { *z* Elemental; *w* Combined

If it is an artificial product, it would be expected to partake of the properties of any precipitate and form slime. If it is still in the native metallic state, remaining unchanged while dioxide dissolves, sliming is not to be expected. If in the native combined state, sliming is quite possible, for it is likely that the mineral stephanite (brittle silver) or any mineral as brittle as chalcopyrite, for instance, would segregate in the slime, though not to such an extent.

TABLE IX

JALISCO ORE

			No.	Mg. Ag	% Total Ag
0.2 A. T. middling (treated in H_2SO_3 and washed):					
Solution			75	0.18	2.7
Residue	Solution		76	0.12	1.8
(treated 15 minutes in acetic acid, decant and wash)	Residue (15 min. vigorous shaking with Hg)	Mercury	77	0.00	0.0
		Residue	78	5.75	86.0

In Table IX (76) shows the insolubility of the silver in acetic acid, and in so doing, it certainly eliminates Ag_2O from *y* and probably *w*, though I am not informed in regard to its action, if such a native compound exists. The rest of the table deserves notoriety such as a criminal receives, therefore I will ask the reader not to place much emphasis on (77), which shows that the silver was refractory toward mercury. However, it led me to make some calcining tests, which are shown in Table X.

TABLE X

CALCINATION TEST, DIOXIDE TAILING, JALISCO ORE

(Calcined ½ hr. after H_2SO_3 treatment, then amalgamated 2 hours.)

No.	Temp.	Per cent Extracted.
79	640	14.0
80	757	9.0
81	885	7.0

The so-called 'dioxide tailing' used in this table and tests following is the result of thoroughly cyaniding a hand-sorted sample containing about one-third dioxide. It assays 20.25 oz. silver. The amalgamating was done by grinding with mercury. An increased temperature of calcination is shown to have reduced the percentage of extraction. After failing to amalgamate by the methods outlined in tables IX and X, what could one do but turn to wet reagents? The results were as follows:

(82) Oxalic acid and oxalic plus sulphuric, common solvents for MnO, converted a part of the silver into an oxalate and sulphate, respectively. In several tests the dioxide was first dissolved in sulphurous acid and then given the above treatment. The results were all erratic and proved nothing except a slight solubility in all cases, the highest extraction amounting to 72.8 per cent.

(83) 'Hypo' was tried both in the presence of sulphurous acid and after the dioxide had been dissolved, but proved also a poor solvent, though as high as 50% of the silver was extracted in one case.

In a series of tests, in all of which the dioxide had been dissolved, a solution (84) of KI + HgI, with subsequent treatment in NaCl extracted 47% of the silver; (85) agitating 15 minutes in 20% HCl cold chloridized 46.3%; (87) a 10% HNO_3 solution (cold) extracted 66.7% in 45 minutes; (86) fourteen hours agitation in 5% H_2SO_4 extracted 7.4%; while (88) a hot solution of the same strength extracted 75.4%; (89), a concentrated brine solution, failed absolutely.

I will not burden the reader with a further recital of tests which show the perversity of this mineral, though I have before me, tabulated, the results of 40 assays which were made by a student to determine the dissolving power (after the dioxide had been decomposed) of the following reagents which I will repeat in the order of decreasing dissolving efficiency: HNO_3 hot, HNO_3 cold, KI + HgI_2, oxalic + H_2SO_4, oxalic, 'hypo,' H_2SO_4, NaCl, NH_4OH. Suffice it to say that the best is a poor solvent. What, then, was my surprise to find, (90), that a 3% cyanide solution dissolved 89% in 15 minutes, and (91) 96.3% in 1 hour, a dissolving rate comparable with that of silver chloride in trough lixiviation. Of course, I was quite aware that cyanide was a good solvent, but such rapid action is not the ordinary rôle of KCN. Now, what about the criminal referred to in (77) which indicated that mercury was a solvent? This test was repeated and made (92) in the same manner as before, with the addition of an ammonia treatment which followed the acetic acid. The mercury extracted nearly all the silver. In short, it developed that a small part of one cubic centimetre of dilute acetic acid was sufficient to put the silver into such condition that an amalgamation was impossible. No visible films were formed on the mercury. Taking into account the relative amount of materials, it would seem that the silver, not the mercury, was to blame. Just to clear up the matter and show that mercury was a willing solvent, test numbers (93) and (94) were made during two and four hours, giving, respectively, 80.7% and 87.6% extraction. These amalgamation tests now harmonize perfectly with those made on the Arizona ore. The lesson, then, to be emphasized in connection with Table X is evident: do not try to amalgamate after calcining the acid-treated ore, though the temperature be kept low. There seems to be an incipient fusion of the silver or gangue, or both, which prevents amalgamation.

Ordinarily it would be possible to recapitulate after such a series of tests and to draw accurate conclusions, but in this case, if one conforms to the statements in books on chemistry and metallurgy, he must concoct some unheard of compound. However, after correcting an erroneous impression in regard to ammonia, everything except the peculiar conduct toward acetic acid and extreme solubility in cyanide points to *x*—elemental, artificial, or precipitated silver. Now, any millman would view with disgust the statement that precipitated silver is readily soluble in cyanide and cite good authority for his belief. Though I would not disagree with him in regard to silver precipitated from cyanide solutions, I believe that the rule is not of general application,[2] and submit Table XI. The

[2]Louis Janin, *Eng. & Min. Jour.*, Dec. 29, 1888, showed that cement silver is quite soluble in dilute standing cyanide solutions, but less soluble in a concentrated solution. He does not say how the cement silver was prepared.

amount of ore taken in each case was 0.2 A. T. The '25 mg. Ag added' was precipitated silver in the form of a very fine powder, precipitated from an ammoniacal solution with ammonium formate. It was added to the sample and given several hours grinding in a jar-mill previous to the preliminary treatment in sulphurous acid.

The table is intended to show the relative solubility of precipitated silver and the silver in the residue remaining after treating the ore in H_2SO_3. Incidentally, it emphasizes a point already made: that of the greater efficiency of the 'extra solution' when compared with thiosulphate—compare (95) and (97). The same thing is noted in (96) and (98) where the precipitated silver is dissolved; (99) and (100) show how readily the precipitated silver and the silver in the residue is chloridized by cupric

TABLE XI.

DIOXIDE TAILING, JALISCO ORE
(Preliminary treatment in H_2SO_3)

No.	Mg. Ag Added	Kind of Solvent.	Hr. Agitated.	% Extracted.
95	..	Thiosulphate 3%	16	40.7
96	25	Thiosulphate 3%	16	45.0
97	..	Extra solution ('hypo' 3%, $CuSO_4$ 1%).	16	97.8
98	25	Extra solution ('hypo' 3%, $CuSO_4$ 1%).	16	80.0
99	..	$CuSO_4$ 3%, NaCl 3%, then NH_4OH	8	76.8
100	25	$CuSO_4$ 3%, NaCl 3%, then NH_4OH	8	89.0
101	..	KCN 1.5%	1	96.3
102	25	KCN 1.5%	5	85.0
103	..	Amalgamation	2	80.7
104	25	Amalgamation	2	90.0
105	..	$Fe_2(SO_4)_3$ 3%, H_2SO_4 0.5% cold	10	11.1
106	25	$Fe_2(SO_4)_3$ 3%, H_2SO_4 0.5% cold	10	46.3

chloride. The ready solubility of the silver in cyanide as shown by (101) has been referred to before and is put in this table so that it can be compared with (102) which shows that precipitated silver has about the same solu-

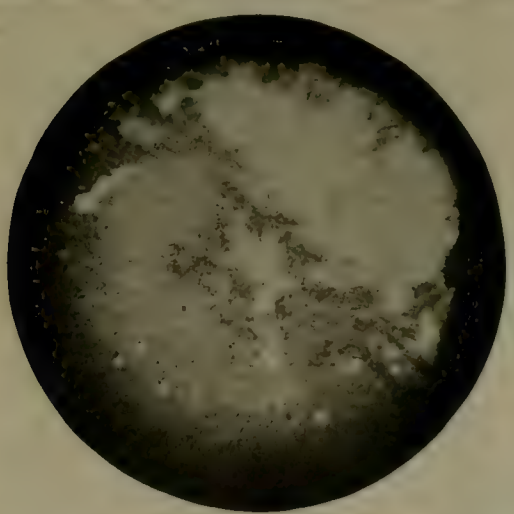


FIG. 1. CONTACT OF QUARTZ (TO THE RIGHT) WITH DIOXIDE OF MANGANESE (TO THE LEFT).

bility as the silver in the residue. The amalgamation tests in (103) and (104) compare favorably. In (105) and (106) there is a lack of the harmony that is not shown in the preceding tests. H. N. Stokes[3] has tested the solubility of silver in ferric sulphate and finds that the reactions involved are reversible, silver being dissolved and in turn precipitated upon change in temperature. Consequently, I am inclined to ignore the tests with ferric sulphate and to conclude that since the silver in the residue dissolves in the other reagents at so nearly the same rate as does the 'Ag added', the silver in the sample belongs to the group *x* and might well be called cement or precipitated silver.

In Table XII the subject is attacked from rather a different viewpoint. After considering the condition of the silver in the dioxide, it seemed desirable to learn in what kind of dioxide grains the silver occurs. The sample was screened and washed as explained in connection with Table V, and six products were made by hand sorting. The calculated assay value is 18.42 ounces.

TABLE XII

JALISCO ORE
(Classification by hand sorting.)

No.	Gm.	% of Total.	Oz. Ag per ton.	% of Total Ag.
Concentrate 107	15.00	7.5	21.70	8.8
Middling 108	44.50	22.1	39.00	46.7
Tailing 109	135.00	67.1	9.60	35.0
Dioxide (botryoidal and stalactitic) 110	1.85	0.9	134.00	6.6
Dioxide (flaky or cleavable) 111	1.60	0.8	18.20	0.8
Iron oxide (red and yellow) 112	3.20	1.6	25.20	2.1
	201.15	100.0		100.0

The middling or 'chatty' grains (108) running high in silver corroborate the statements made in connection with (63) and (64) and the high silver in (110) and low silver in (111) show that the botryoidal and stalactitic pieces of dioxide give a higher assay in silver than does the very flaky and cleavable dioxide. Or, putting it another way, (108) and (110) show that the chatty and stalactitic grains are the richest. The iron oxide (112) assayed higher than was expected. It was not absolutely free from dioxide; this may account for it. In order to follow up this study of types of grains, a number of micro-sections were made; those of the types included in (108) and (110) receiving the most attention. The slides were all examined by an experienced petrographer and nothing of interest noted. Now the study of opaque minerals, such as the oxides of manganese, of course, involves the use of reflected, not transmitted, light. I felt certain that a 'chatty' piece should reveal something characteristic in the dioxide and near the contact with the quartz. I therefore tried reflected light, both natural and artificial, with and without a vertical illuminator. After several hours of such experimenting, I succeeded in getting focused on some dark brown spots in the steel-gray dioxide and near the quartz contact. I say spots instead of mineral grains, because they did not show a definite contact, but blended into the dioxide. The spots were found along the contact and reminded one of the way drift-wood may be strewn along a lake shore. After these things were found, their identification became much easier, they being most easily seen in a moderately bright reflected sunlight. Wishing to secure photographs, I visited the metallographers for the Illinois Steel Co., who spent about two days with me polishing sections and using their metallographer's outfit for magnifying and photographing. This work was a failure. L. H. Weld, who has made a specialty of photographing micro-sections, then came to my rescue. After several hours adjusting and waiting for a light of the proper intensity, a negative (113) was secured. It has been intensified to bring out the dark brown spots which photographed darker than the polished dioxide. Though the dioxide is actually the darker, it does not seem so in the picture, because of the minute flakes which reflect the light and give it the appearance of micaceous hematite. I cannot say positively that the picture shows an unidentified silver mineral, but believe that it does. It seemed to me that a procedure similar to the following should give proof. Remove the cover glass, dissolve the balsam on the upper surface with

[3] *Economic Geology*, Vol. I, 1906, p. 649.

alcohol, then submerge in sulphurous acid and let remain undisturbed until the MnO_2 dissolves. Take from the acid bath and inspect the residue under the microscope and place it in a cyanide bath. Silver would be readily dissolved and its disappearance when noted by means of the microscope would be positive proof of silver. This was tried, but was a failure, possibly on account of the residue of limonite which veiled the silver. However, I think that persistent efforts along this line would be successful. I studied one slide of the stalactitic dioxide (110), but found nothing similar to that noted above.

Resume

1. A screen sizing test, Table I, showed a decided segregation of the silver in the smaller, therefore softer, grains.

2. Treating the cyanide tailing, Table II, in a Thoulet's solution showed a segregation of the silver in the heaviest grains.

3. About 60% of the silver in these ores (3), (44), (64), and (65) could not be dissolved in KCN.

4. Nitric failed absolutely (4) to dissolve the refractory silver. A silver mineral that could not be dissolved by either KCN or HNO_3 was probably unheard of until noted recently by E. M. Hamilton.

5. The silver can be chloridized (5) and (6) by HCl, which dissolves MnO_2 and possibly other oxides, thus indicating that the silver is in an oxide.

6. The silver can be chloridized (7) by sulphuric and salt, a common solvent for MnO_2.

7. Sulphurous acid is a remarkably active solvent (8) and (9) for MnO_2, but does not dissolve the silver.

8. After dissolving the dioxide in H_2SO_3 (10) and (11) the silver can be amalgamated or cyanided, though great care would be necessary to prevent undue consumption of cyanide by the soluble manganese salts resulting from the acid treatment. If carbonates are in the ore the acid treatment must be under pressure.

9. The gold (19) is amenable to cyanidation.

10. Many of the common solvents for silver, Table III, are effective only after the dioxide is dissolved.

11. In (24) the order of increasing efficiency of the thiosulphates was, calcium, sodium, potassium, and ammonium.

12. The Russell 'extra solution' (28) might prove that it has virtue where thiosulphating is practised, but the conduct of the NaCl (31) and (34) must be watched.

13. One pound of S as SO_2 (13) and (45) will dissolve about 1.3 lb. MnO_2.

14. Manganous sulphate (54) does not aid in chloridizing roasting as do iron and copper sulphates.

15. The chloridizing roasting (52) of ores containing MnO_2 is possible and is an absolutely new field as far as published data are concerned, even $CaCl_2$ (58) being operative. Attention has been called to the fact[4] that NaCl and KCl can be mixed in such proportions that they will melt at 135° below the melting point of pure salt. A chloridizing roasting test with this mixture might prove instructive.

16. Comparing (49) and (46) shows that flour has an effect during calcination worthy of investigation. A reduction in a Stetefeldt furnace fired by gas and a deficiency of oxygen might accomplish the same results and obviate the introduction of objectionable constituents.

17. Hand sorting, though ordinarily impossible, can be done with perfect ease, after a wash in dilute H_2SO_3, thus removing the dioxide stain.

18. Table V shows that the silver is largely in the dioxide, and Tables VI and XII show positively that the amount of refractory silver does not vary as the amount of dioxide, as formerly supposed, but as the amount of dioxide in contact with quartz, that is, as the amount of chatty material. This condition makes wet concentration absolutely impossible.

19. I have shown in (70) and (71) that silver does not form a salt with the reagent when these ores are treated with H_2SO_3.

[4] *Eng. & Min. Jour.*, March 2, 1912, p. 439.

20. Table VIII shows what I consider an unheard of condition of silver in the ore, namely: Upon dissolving the dioxide in H_2SO_3 the silver is held in suspension in the solution with the limonite and other slime forming compounds.

21. Acetic acid (77) makes this residual silver refractory toward mercury, but an additional treatment in ammonia (92) removes the obstacle, and it can be easily amalgamated.

22. Table X shows that the residual silver cannot be amalgamated after calcination at a low temperature. Calcining for ½ hour at 321° below the melting point of silver being sufficient to bring about this refractory condition.

23. Many reagents (82) to (89), inclusive, were poor solvents for the residual silver, and Table XI shows a striking similarity of cement silver to the silver in the residue resulting from treating the ore in H_2SO_3. The avidity with which KCN (101) attacks it indicates a unique mode of occurrence of the silver.

24. Now, it has been shown in Tables VIII and XI that the silver in the residue resulting from treating the ore in H_2SO_3 conducts itself unlike the silver in any ore familiar to myself, at least, and in a way nearly identical to the porous precipitated silver with which it was compared; that in (70) and (71) silver does not form a salt with the reagent (H_2SO_3) used in the preliminary treatment; that a micro-section (113) shows dark brown splotches in the part of the dioxide in which it had been previously predicted (64); and (108) that there was a segregation of silver. Therefore it seems evident that the cement silver is the result of a silver mineral being decomposed contemporaneously with MnO_2, this silver mineral being the dark brown splotches above mentioned. To give the composition of this mineral would be mere conjecture. Its association with such a highly oxidized compound would suggest the oxide; if an oxide, then why does it not dissolve in acetic or sulphurous acid?

25. The outlook for investors in mines of this type is not good. Cyaniding without preliminary treatment is absolutely impossible. In the way of preliminary treatments, the one by sulphurous acid must be considered, though it involves purchasing sulphur in amounts of about one pound for every pound of dioxide in the ore, then it would have to be burned, and the resulting fume could not be handled without enough escaping to raise a protest among the millmen. The presence of carbonates such as calcite would increase the consumption of sulphur. The expense of neutralizing after such a treatment preparatory to cyaniding would be considerable. The alternatives of amalgamation and thiosulphating remain. The relative merits of the processes could be determined only by further experiments. If there were a good demand for artificial MnO_2 the market could be supplied by applying electrolytic precipitation to the manganese solutions. The production of a cheap by-product, brimstone, at the smelters would lend favor to the H_2SO_3 treatment. Chloridizing roasting, I understand, has been practised on ores of this type, but cost of fuel and silver losses militate against success. Chloridizing has been mentioned under 15.

26. I submit this problem to both geologist and metallurgist: to the geologist for him to identify this evasive silver mineral and account for the mode of occurrence; and to the metallurgist for him to map the bodies of refractory manganese silver ores so that investors may receive fair warning, and after giving such warning proceed with the investigation of methods of extraction.

Lake ships have been increased rapidly in size. Ten years ago a boat which could carry 5000 tons of coal and would take on a load in from ten to fifteen hours was a marvel of efficiency. Today a boat which occupies the same relative position in lake shipping, will carry 15,000 tons and will receive or discharge her cargo in a maximum of five hours.

Bulgaria produces a fair amount of minerals, the chief being copper and lead ores, of which 18,506 and 3419 tons, respectively, were produced in 1910.

The Common-Wealth Mine

By Llewellyn Humphreys

*The Common-Wealth mine, which is now controlled by the Montana-Tonopah M. Co., is situated at Pearce, Cochise county, Arizona, in the Turquoise mining district, on a branch line of the Southern Pacific railway from Cochise to Gleason and connected by this branch with the El Paso & Southwestern at Courtland, this branch road having Douglas as its terminal point. The distance to Cochise on the main line of the Southern Pacific railroad from Pearce is 16 miles, and to the smelting town of Douglas on the El Paso & Southwestern is 43 miles.

The properties consist of 10 full mining claims, 600 by 1500 ft., seven of which are patented, and two millsites. There is also an additional millsite leased for a term of years, this latter approximating 20 acres in extent, making a total of about 230 acres. The ore was discovered in 1894 by some cowboys by the name of Pearce. In 1896 the property was sold for $275,000, at which time development consisted of workings only 50 ft. deep. The purchasers proceeded with development, shipping their ore to El Paso and Pueblo. In 1896 a pan-amalgamation mill of 200 tons per day capacity was placed in operation, working continually until destroyed by fire in June 1900. The erection of an 80-stamp mill was commenced immediately on the site of the old one, this latter mill remaining continuously in operation until December 1904, when on account of a cave-in at the mine it was closed down indefinitely.

In January 1905 the accumulated tailing was leased to Messrs. Swatling and Smith, who had been superintendents of the mill and mine, respectively, since the purchase of the property. A year later the company leased them the mine, and it is stated that during their first year's operations they paid $200,000 in royalties. These leasing operations continued until November 1909, at which time the lessees asked for a renewal of the contracts. This not being granted, Messrs. Swatling and Smith bought a controlling interest in the mine. After securing control and making a series of tests of the ore, it was decided to remodel and add to the equipment of the mill, when unfortunately the mill was again destroyed by fire through some defect in the electric wiring. The owners having exhausted their resources in buying control of the mine and adding new equipment to their mill, were not prepared to rebuild. During the period the property produced about $10,000,000 and made several owners rich.

There are two distinct systems of fissures which have apparently been the primary cause of the ore deposition. These have a general trend of east and west, and dip to the south about 60° from the horizontal. There is a distance of about 175 ft. between the fissure systems at the main workings, but apparently they come together toward the west end. The andesite is brecciated along their course. This brecciated condition allows the silicification and mineralization of an immense area extending practically from one fissure to the other, but naturally with the heaviest mineral deposition immediately in and adjacent to the fissures.

The principal workings are on the south side of the enriched zone, on what is termed the South vein. The main ore-shoots have been worked along this fissure for a distance of 800 ft., and for a width of 70 ft. into the foot-wall. Numerous small faults, in the main part enriched, are present in the workings. They are, for the most part, parallel to a main fault crossing between shafts B and C. North of the main workings in the east end of the Silver Wave claim, and distant about 250 ft. from the hanging wall, is a very large outcrop of brecciated andesite which is over 70 ft. wide and highly silicified. This forms part of the surface showing on the north vein, contains small amounts of gold and silver, is traceable for over 2500 ft. along its strike, and dips south about 65° from vertical. As depth is gained, a gradual converging of veins would occur, increasing the possibilities for a highly enriched area.

On the North vein no work from the surface has been attempted except a shaft 72 ft. deep on the foot-wall side, with a cross-cut run into the vein at that depth. Assays from this cross-cut gave returns of 40 cents in gold and $1 in silver. The only place this vein has been explored at depth is from the No. 3 level of the No. 4 shaft. A cross-cut was run, cutting a 4-ft. fissure, along which a 60-ft. drift was run, but it is doubtful if this is the North vein proper, as the wall underlying it is a mineralized andesite. The assays from this drift show good improvement over the surface. The North vein has exceedingly good territory for exploration, with a probability of finding new orebodies.

At water-level (No. 7 level) of the mine, 363 ft. from the surface, the workings show the numerous seams and fissures as in the upper workings, so that it is reasonable to assume the water action will redeposit precious metals through cross-fissures in solution on the foot-wall side of the North vein, the South veins showing increased values in gold in proportion to silver on the No. 7 level. No. 10, or Brockman shaft, shows a 5-ft. vein lying south of the main fissurings and dipping 60° north. This vein intersects the main South about 20 ft. above No. 7 level.

Altogether, the geological conditions with the nature of the ore occurrences, strongly indicates that large areas will be found carrying payable ores above water-level, which have hitherto been unexplored, while below water-level additional large orebodies may be expected in a territory practically virgin, but under somewhat different conditions from those found above. The large width, richness, and persistence of the orebodies from the surface down, together with the character of the ore deposition, indicate that at depth an unaltered sulphide ore zone exists.

The mine has been developed by a series of shafts, and nine levels to a total depth of 451 ft. vertically, the principal work having been done above water-level, 363 ft. deep, the seventh level of the mine. The different levels have been extensively worked, and on account of the open manner of working in the past several large caves have resulted. The caved areas on the property have uncovered ores on the foot-wall side of old stopes that will increase the tonnage, the caves in no way proving detrimental to the system of mining it is intended to use.

In virgin ground the cost of mining and development is placed at $1.75 per ton. When the workings are in proper shape it will be possible to mine a large quantity of the low-grade foot-wall ores at a cost not exceeding 75c. per ton. Fuel oil for power purposes is delivered f. o. b. mines at $1.52½ per barrel.

Estimated Ore Reserves

Total ore resources reported August 10, 1911.	$1,783,106.41
Additional ore resources reported March 25, 1912	186,624.52
Gross 314,545 tons	$1,969,730.93
Total net profit, report August 10, 1911	868,292.16
Additional net profit, report March 25, 1912.	87,375.14
Total net profit	$ 955,667.30

In the report of August 10, 1911, silver in ores and tailing was figured on the quotation of that time, 53c. per ounce. The advance in price of silver to present market quotations, 58⅜c. per ounce, will increase the profits to be derived from ores $124,000. In addition, during the month of March an offer was made by the Douglas smelting works of 60c. per ton for the remaining 80,000 tons of class 'A' tailing dump, which offer will doubtless be accepted. Allowing 10c. per ton for loading the tailing, the net additional revenue to be derived from this source will amount to $12,800. Adding the above amounts to estimates previously given, the total net profits from all sources up to the present writing will amount to $1,092,467.

*Abstract from a report made to the Montana-Tonopah Mining Company.

Iron Ore Reserves of Michigan

By C. K. Leith

*In connection with the work of the State Board of Tax Commissioners, the mining properties of Michigan were appraised in 1911, under direction of J. R. Finlay.† The estimates of iron ore reserve were briefly summarized in the report of the Commission. Further details may now be given and are thus summarized.

A significant feature of the table given below is a comparison of fully developed bottom areas of ore by mines and districts. Only areas that give promise of continuity below have been tabulated. Exhausted or nearly exhausted mines are assigned bottom areas of zero. These figures are not strictly comparable throughout; in other words, each area does not have the same promise of continuity in depth. The notably large size of the areas of the Marquette ores is due partly to the low dip and pitch of the soft orebodies, which give them great horizontal and small vertical dimensions. Such orebodies signify future probable development, not below, but laterally, in the direction of pitch or dip.

GEOLOGICAL SKETCH MAP OF THE MICHIGAN IRON REGION.

Area of ore shown by drilling is not directly comparable to area of ore shown in present bottom-developed levels, for the reason that the drills may cut the ore at many levels, whereas the bottom-mine areas cut the ore at a single level. If the mined-out portions of the orebodies lying lateral to the levels estimated were projected to the surface, they would add an amount to the area of the present fully developed bottom levels which would make it more comparable with the area shown by drilling. The aggregate area of ore cut by drilling has been given only to afford a convenient comparison of the exploration in the different districts.

The table assigns no areas or tonnage to high-silica, low phosphorus ores of about 40% grade, which have been mined on both the Gogebic and the Marquette ranges. These lean ores are so abundant and grade so imperceptibly into iron formation that no estimate of their tonnage or area has been attempted. In considering the table, however, they should be taken into account as adding a considerable reserve, which would tend to make the total ascertained reserve nearly equal to the present total shipped from the region.

The probabilities of extension in every district but the Menominee are so strong that it is safe to estimate that for many years the ratio of reserve to total shipment will be maintained—in other words, that as much ore will be discovered yearly as is mined yearly. In fact, today the reserve probably bears a larger ratio to the total shipment than at any time in the past, and the possibilities of developing more ore are so great that ten years from now there will probably be greater reserve in portion to shipments than now. The increasing tendency of the larger interests to make sure of their ore supply for years in advance is leading to the development of increasingly large reserves in proportion to past shipment. Enough facts might be cited in relation to individual mines, explorations, and ranges to show that this forecast of the future is not based on vague surmise. Large extensions, both vertical and areal, are inevitable. Probably not more than 10% of the area of the upper Huronian slates of the Crystal Falls, Menominee, Iron River, and adjacent areas has been explored. Iron formation lenses are likely to be found almost anywhere in these slates. The heavy drift covering will make their discovery a slow and costly process.

The total known area of iron formation is 29,267 acres. In addition, there are fully 20,000 acres of magnetic belt in which exploration has scarcely more than begun. Probably half of this total acreage is iron formation of grade and character that will afford workable bodies of iron ore. The total area of iron ore in Michigan projected vertically to the surface is at present known to be at least 383 acres, or 1.31% of the area of total known iron formation. This area does not include many abandoned mines or worked-out portions of mines that are adjacent to present surfaces of ore. If these were taken into account, the total surface area of vertical projection of all orebodies present and past, would be considerably larger. Future discoveries are certain to increase this area still further. Therefore the average chance of finding ore in iron formation is larger by a considerable, but at present unknown, ratio than the percentage 1.31 given above. This figure does not necessarily indicate that only 1.31% of the 40-acre tracts carry ore, for the ore is so distributed that it includes or touches a much larger proportion of the tracts.

The conclusion therefore is that at no time in the past has the outlook for long life for Michigan iron ores been any better assured than it is now. There are few regions in which expenditure of money for large explorations can yield more certain results. The future size of the reserve will be in more or less direct ratio to the money expended in exploration. There is yet no indication of diminishing returns from exploration. In fact, increased knowledge of the geologic conditions is bringing more certain results for a given expenditure of money. The reserve will cease to grow only when difficulties of exploration or outside economic influences begin to limit the amount of exploration. This table shows the essential relative standing of the different ranges. The Marquette stands easily first in present tonnage and in future promise. The Iron River and the Gogebic are in nearly the same rank so far as

*From Advance Chapter 'Mineral Resources of the United States, 1911,' U. S. Geological Survey.

†*Mining and Scientific Press*, September 9, 16, 23, 1911.

present tonnage is concerned. The Menominee district has evidently seen its best days.

The present estimates of probable ore are limited by certain conventions, described elsewhere, which bring the total reserve to a figure below the total past shipment of iron ore from Michigan. There can be no reasonable doubt, however, that the reserve of iron ore, developed and probably available, approximates the total past shipment. This statement is true for all the ranges except the Menominee, and the shortage in the Menominee is more than offset by the great promise of the adjacent Crystal Falls and Iron River districts.

Most of the estimates received from the mines cover ore actually developed above the bottom levels. Some include, as probable ore, the extensions of partly developed levels. One company adds as probable ore an arbitrary unit of 2000 tons where the breast of the drift is in ore. Others have added as probable ore all the ground from 10 to 200 ft. below the bottom level, where the continuity of the deposits above and the geologic conditions indicate that the ore is likely to have somewhat the same persistence below that it has above. Where drill-holes have shown ore that lies in advance of or below present workings and undoubtedly in the extension of the same deposit, the estimate of probable ore has been extended to include these holes.

District.	Total area of ore, in bottom levels of active mines.	Area of ore developed by drills; vertical projection to surface.[b]	Total area of iron ore in Michigan.	Reserve in mines.
	Sq. feet.	*Sq. feet.*	*Sq. feet.*	*Long tons.*
Menominee	263,465	.....	263,465	11,650,450
Crystal Falls	209,730	167,000	376,730	3,682,142
Iron River	1,065,000	984,000	2,049,000	18,297,700
Gogebic	694,000	None.	694,000	31,605,000
Swanzy	.....	3,298,000	3,298,000	2,712,737
Soft ore or "hematite," Marquette	1,043,060	7,497,740	8,542,740	37,516,800
Hard-ore mines top of Negaunee formation, Marquette	350,000	841,065	1,191,065	17,391,335
Mines west of Michigamme	99,000	211,600	310,600	1,742,000
Total	3,726,195	12,999,405	16,725,600	124,598,164

District.	Reserve in area drilled.	Total reserve.	Total shipment.	Average depth of active mines at lowest developed level.
	Long tons.	*Long tons.*	*Long tons.*	*Feet.*
Menominee	.....	11,650,450	42,616,000	1,160
Crystal Falls	1,925,000	5,607,142	15,609,000	1,070
Iron River	9,719,000	28,016,700	6,179,300	445
Gogebic	None.	31,605,000	55,027,691	1,400
Swanzy	4,138,738	6,851,475	2,420,232	.....
Soft ore or "hematite," Marquette	25,929,090	63,445,890	.....	[c] 690
Hard-ore mines, top of Negaunee formation, Marquette	2,939,290	20,330,535	96,296,717	[c] 1,041
Mines west of Michigamme	332,000	2,074,000	1,080,000	[c] 220
Total	44,982,938	169,581,102	219,228,940	.....

[a] Low-phosphorus, high-silica mines not tabulated.
[b] The phrase "vertical projection to surface" signifies that the area of dipping and pitching ore bodies is stated in terms of horizontal measurement at the surface—that is, that the structure has been flattened out in making computations.
[c] Not rated according to tonnage of outputs.

It is obvious that if the estimates turned in were accepted as they stand, the reserves would not be treated in the same manner throughout, and that companies which used the more liberal methods of estimating would be at a disadvantage as compared with other companies. It has, therefore, been found desirable to formulate a convention to be applied, so far as seems reasonable, to all estimates. The convention is this: Estimates of developed ore are practically accepted as turned in. Estimates of probable ore are modified to include for each mine at least one full level below present workings, with an area equivalent to the average of the lowest fully developed levels. Also, partly developed levels are extended to the dimensions of the nearest fully developed levels. Where drill-holes show ore in advance or below and within reasonable distance of the workings, this ore is added. Where the orebody is actually exhausted or the geologic conditions show a strong probability of the exhaustion or narrowing of the orebody, this convention has been modified accordingly. In applying this convention to each property there have been taken into consideration the total shipment of the mine, the persistence of the orebody, the depth, the comparison of the areas of the lower levels with the average of the levels above, and the geologic conditions. It is possible that this method of estimate gives to a few properties a little more ore than the mining company is willing to concede as a part of its probable reserve, but it is believed that these properties are extremely few; in fact, none are known. For most properties the probability is that the orebody is really much more extensive than has been estimated.

Ore cut by drilling has been treated in a still more varied fashion in the estimates received. Certain companies have merely turned in records of drill-holes without attempting to estimate the ore. Others have turned in a lump estimate—generally moderate. Others have given an estimate of the ore within a radius ranging from 25 to 100 ft. of each hole, and have made no attempt to connect holes. Others have drawn around each hole a circle having a radius of 50 to 100 ft., according to the thickness of the ore cut in the hole, and have then connected by straight lines the peripheries of the circles drawn around adjacent holes on the assumption that ore lies continuously between them. Others have treated the holes as means of showing cross-sections of a continuous orebody and have connected the ore between sections, making no allowance for extensions beyond limiting holes. Still others have allowed extensions of 50 ft. beyond limiting holes. One company estimates its extensions beyond limiting holes to the point of a triangle distant one-third of the thickness of the ore shown in these limiting holes.

The possible variation in reasonable inference from drill-holes is clearly much greater than that from mine workings. It has been found desirable to use the same convention throughout in estimating from drill-holes, but the geologic conditions and the probabilities of connection of ore shown in different areas have been considered in determining a reasonable method of estimate for each property. Where the proximity of the holes to one another and the geologic conditions indicate a reasonable certainty of continuous ore between holes, the limiting holes have been connected by straight lines and the area between them has been rated as showing a thickness of ore equal to the average of that cut by adjoining holes. Allowance is made for irregular spacing of holes in estimating average thickness. Where the orebody has a steep dip or where holes cut it at an angle, due allowance is also made. Where the holes are so scattered that it seems unsafe to connect the holes through so large an area, they have been connected in small groups and the area is estimated in the same fashion. As a rule, no allowance has been made for ore estimated by the companies to extend beyond limiting holes, and these exclusions should counterbalance possible errors made by including too large areas between holes. Where the holes are so distributed in linear fashion as to make it difficult to connect the corresponding areas, the method used by certain companies has generally been followed. This method gives the limiting holes a radius up to 75 ft., according to the thickness of the ore cut in the hole, and then connects by straight lines the peripheries of the circles of the limiting holes so circumscribed.

Of course, no possible method will bring this estimate of drilling to a single standard or degree of probability, for the geologic conditions shown by the different orebodies are extremely diverse. The method used, however, is so conservative that it can do no property substantial injustice, and it is practically certain that in most localities the quantity of ore present is far greater than that shown by the estimates.

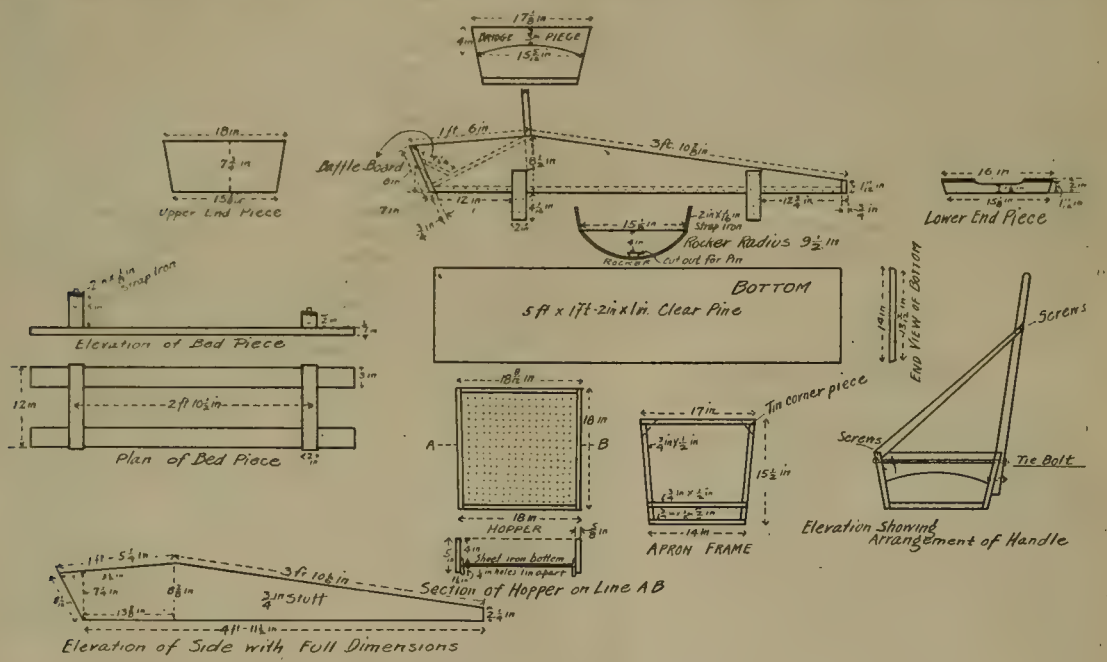
Certain companies have made uniform deductions of 20% for mining loss and waste in their estimates and have reported only the available ore in their reserves. For certain localities, where the nature of or situation at the surface is adverse, still greater deductions have been made. Other companies, and these include the majority, made no

deduction for mining loss and rock. The variation in estimates due to differing treatment of these losses is not so great, especially between similar properties, as the difference in the treatment of these losses by different mining companies would indicate. It is probable that some of the company estimates make allowance for these losses even though it is not so stated. The estimates are made in so many ways and the variations in other features have been so great that in making deductions for mining loss and rock each of the companies has been considered individually. In general, the estimates made from drilling are reduced. The net effect is that the appraisers' estimates increase by 25% those made by the companies.

Rocker for Washing Gravel

By W. H. Radford

The following details represent a worker which in the hands of a fairly careful man will give very clean results. It is a rocker that handles well and can be easily run.



DETAILED PLAN AND SECTIONS OF A ROCKER.

The only new feature about it is the baffle-break used at the upper end which throws any drippings from the upper holes in the hopper on to the apron. A piece of brussels carpet 13½ in. is laid on the floor of the rocker to catch the fine specks of gold. This carpet, which extends for a distance of three feet from the upper end, is held in place by the crosspiece at the foot of the apron frame and by two strips, one on either side of the rocker. These strips are held down by wedges driven under small cleats nailed to the sides of the rocker. Very thin canvas or flour sacking should be used for the apron so that it can bag slightly.

Zinc and Lead Mining

In mining circles there is much interest in the market for lead and zinc. Lead-producing districts, such as Joplin, Webb City, Baxter Springs, and the various fields of Wisconsin are taking on a new lease of life and the continual prospecting that is necessary in all of these districts is being pushed with increased vigor. Under circumstances like the present, with lead and zinc at record prices, the mining industry as it is carried on in these regions makes a rather attractive gamble. In Oklahoma and in Missouri the ore deposits are irregular; it is impossible to tell when the drill will go through a strong breast of ore into the mud. Workings are shallow and the expense is not heavy. The result is a very pretty speculation; if the ore holds out, money can be made rapidly, especially on such a market as the present one. But, in view of the uncertainty of the ore, it has always been the habit of the 'old-timer', in and about these camps, to have good reasons for selling out his mine just when it looked its best. Below Baxter Springs, Kansas, and across the line into the Quapaw reservation, there is a mining district which came into a good deal of notoriety owing to the promotion methods of some Kansas City schemers and some spectacular advertising. The land is owned by the wards of the Government—the Indians of the Quapaw tribe—and all operations are carried on by lessees. The ores of the district are found in somewhat of a blanket formation, at a depth of 90 to 180 ft. The rock is hard and crushing expensive. While there have been some good mills built, there has been a marked tendency to let the tenderfoot do the mining, the older operators confining their efforts to bringing a property, at a minimum expense, up to the point where it shows a maximum of possibilities. Sixty per cent lead ore at $58 per ton will mean a great deal of activity in options and properties in Missouri and Oklahoma, but the activity is not confined to those areas alone. The Consolidated Mining & Smelting Co., of Trail, British Columbia, is expending $100,000 in betterments, including additions to its lead refinery. In New Jersey, the New Jersey Zinc Co. is reopening some mines abandoned twenty years ago.

Dividends

On Tuesday, June 4, the Bunker Hill & Sullivan M. & C. Co. paid dividend No. 177, of $65,400. This makes the total amount of dividends paid $13,519,350.

The International Smelting & Refining Co. has declared a quarterly dividend of 2%, payable June 1.

The Utah Copper Co. has declared its regular dividend of 75c. per share, and Nevada Consolidated declared 37½c. per share.

The Pittsburg Silver Peak has declared a dividend of 16c. per share, payable July 1.

The Tonopah Extension has declared a dividend of 2½c. per share, payable July 1.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Tonopah Milling

The Editor:

Sir—In glancing over the tenth annual report of the Tonopah Mining Co., by W. H. Blackburn, published in your issue of May 25, 1912, the mention of profitable improvements by cyaniding in place of concentrating leads to a reflection on the milling system practised for years. The use of stamps and concentrators with an endless chain of dewatering devices leads to the presumption of hard ore, as such a system has been the one favored by engineers for hard ore during the whole period of modern milling. At the Golden Star mine, Polaris, Yuma county, Arizona, years ago a system of rolls with coarse feed to tandem tube-mills was introduced and operated for years successfully. The ore was the hardest of quartz and the gold in the pure sulphides was as readily extracted as from the oxides. A saving of 95% was accomplished by cyanide process after thoroughly sliming the ore, agitating, and decanting the slime to a consistence proper for 40-lb. pressure filters. It seems that rolls should be preferred in newly designed mills because of the proved increased efficiency when the coarser feed is sent to tube-mills. This system eliminates the excess of water which must be a perpetual menace in cyaniding.

CHAS. E. ANDERSON.

Searles, California, May 29.

Drill-Holes and Patents

The Editor:

Sir—In your department 'Decisions Relating to Mining' I was interested to note that churn-drill holes had been allowed as improvements to apply on patent. If churn-drill holes so apply, is there any reason why diamond-drill work done for the purpose of determining the best place to sink a working shaft should not also apply? I had understood that diamond-drill work could be accepted for patent only when such work was in the nature of development rather than exploration. Can you tell me of an example of diamond-drill work that would be considered development and not exploration? If diamond-drill work can be applied on patent, it is of considerable importance to us, and I am seeking information on the subject rather than trying to emphasize a quibble in the use of words. But it seems to me that most mine work is exploration until ore is actually revealed thereby, when it at once becomes development work, and it appears rather strict to limit patent work to such conditions. Will you kindly tell me also where I can get the published decision on churn-drill holes referred to above and mentioned in your issue of May 18?

PAUL E. LODGE.

Bishop, California, May 23.

[The decision *ex parte*, C. K. McCornick and E. W. Bird, referred to in our issue of May 18, 1912, directly determined that diamond-drill holes were allowable as improvements to apply on patent, even when made for prospecting purposes. The First Assistant Secretary uses the following language: "It cannot be doubted that the drill-hole placed upon the Lake claim was for the purpose of prospecting it in order to secure data upon which the further development work could be based. This expenditure together with the other improvements to which the Commissioner made no objection, is more than sufficient." The decision, which is well worth reading, has not yet been published, but a typewritten copy thereof may be obtained for a nominal sum from the Surveyor General's Office at Reno, by referring to the title and date (March 14, 1912). It was on the basis of the above decision that Commissioner Proudfit held churn-drill holes to be acceptable in the case of the Globe, Globe Fraction, and other lodes.—EDITOR.]

The Prospector and the Mining Law

The Editor:

Sir—T. F. Van Wagenen's article, under the above heading, in the *Mining and Scientific* Press of May 18, discusses the occupation and interests of the prospector from an interesting point of view, and, as he says, "one somewhat different from that usually taken by the mining engineer or investor." While agreeing in his premises, as to the inducements necessary for prospecting, one may reasonably hesitate to agree with him in his apparent view that the occupation of the prospector is one that should be supported by continuing extralateral rights even if they lead to complications in operating mines. It is unquestionably true that the prospector depends, for his financial returns, on the speculative value of the prospects he opens. On turning over the files of the mining journals for the past five years, it will be seen that the trend of nearly all discussion has been toward the protection of the investor and toward discouraging him from purchasing prospects on their speculative value alone. After reading Mr. Van Wagenen's article, therefore, I feel confronted by the question whether the interests of the prospector or those of the investor are more to be considered. No doubt, as Mr. Van Wagenen says, the prospector is encouraged to risk his life on the desert and in the wilderness, by mining laws which permit him to initiate his work without capital. It is, however, also true that, no matter how favorable the mining law, he would not go prospecting if he did not hope to find an investor who would pay him cash for the speculative value of an undeveloped prospect.

It is not at all clear that the mining industry is substantially benefited by the opening of a maximum number of prospects and the sale of the speculative chance of their extralateral rights. In fact, I believe that in Mexico, where the mining industry thrives and where fewer prospects are formally opened, because of the expense involved, more care is exercised in selecting prospects for development. In all mineralized regions, as one travels, he sees dozens of properties on which money has been spent, often in considerable amounts, lying idle and exemplifying, as a rule, the profit of some prospector and the loss of some investor. The subject is too extensive and too involved to be settled off-hand, but it properly raises the question as to whether the prospector is the only one to be considered.

The statement that prospecting is much more extensive an occupation in the United States than in Mexico is also open to argument, for while the Mexican mining law theoretically places restrictions on all mining work and prospecting involves expense to those who do it in a formal way, there are, in Sonora at least, hundreds of native *gambucinos* operating without capital, who open prospects, work placers and abandoned mines, and recover very substantial quantities of precious metal. In short, they work with even more freedom than the prospector can in the United States, for the Government seems to ignore them entirely. The majority of these Mexican *gambucinos* work for revenue only; that is, for the value of the ore or metal they recover, but many of them offer to sell information of their prospects to American mining men and to Mexican capitalists, though their return for the sale of this information is usually small. The main difference between their work and that of the American prospector is that they only follow ore and, so far as I have observed, never drive crosscut adits or sink shafts in barren ground. Without reopening the discussion of the merits and demerits of extralateral rights, I think it must be agreed that in the United States the sale of prospects is at present not nearly as active a business as it used to be, and we may expect, in future, to see the prospector conduct his work on a modified plan.

F. J. H. MERRILL.

Los Angeles, May 24.

Special Correspondence

JOHANNESBURG, TRANSVAAL

MARCH OUTPUT OF THE RAND.—PROSECUTION FOR FALSE RETURNS.—OUTPUT OF BASE MINERALS.

The returns issued by the Government Mining Engineer go to show that the gold output for March was really not as high as for the month of February, the Chamber of Mines output declaration for March being inflated by the inclusion of accumulated gold reserve. The following statement will show the position:

	February		March	
	Output, oz.	Value.	Output, oz.	Value.
Witwatersrand	735,230	£3,123,061	729,492	£3,098,686
Heidelberg	6,848	29,088	7,176	30,481
Klerksdorp	2,743	11,650	2,788	11,846
Ottoshoon	69	293	143	607
Pretoria	....	.....	1	3
Barberton	9,198	39,072	7,345	31,202
Pilgrim's Rest...	12,767	54,234	13,974	59,358
Pietersburg	173	734	292	1,239
	767,028	£3,258,132	761,211	£3,233,422

Sydney Penlerick, the ex-general manager of the East Rand Proprietary Mines, has been fined £100 for a breach of the Transvaal mining regulations in sending to the Government Mining Engineer false returns and figures regarding the gold output each month at various periods between April 1909 and August 1911. All the gold had been accounted for, but as previously pointed out, where the clean-ups were delayed to such an extent it was impossible to file correct returns, and it was proved that cyanide gold had been returned as mill gold to make the statements harmonize with the total gold produced. It was also proved that the gold was not always recovered during the same periods of time shown in the returns, and it was clear that there was no alternative but to institute proceedings in such a glaring case.

Good progress continues to be made in the output of base minerals, which during March, exclusive of diamonds, attained the value of £336,595. Owing to the English coal strike the export and bunkering trade of the Transvaal was lively, and a slight improvement was noticed in Natal, the total coal sold in South Africa during March reaching 680,988 tons, as against 605,034 tons in February. Instead, however, of prices improving they showed a decline of 1d. per ton, the average pit-top price in the Transvaal falling to 4s. 4d. per ton, and if the present tendency continues coal in the Transvaal will soon be as cheap as in any other mining country in the world. The value of the copper ore shipped from the Union of South Africa was during March £117,463, as against £119,954 in February, and the prospect of any marked increase in the amount of shipments south of the Zambesi are not encouraging. The output of tin continues to belie anticipations, for despite the discovery of the Waterburg fields in the Transvaal the output does not materially improve. The production of other miscellaneous base minerals and metals is unchanged. If diamonds are included, the monthly value of the mineral output of South Africa is well over £4,250,000, so that during the current year it is not at all unlikely that it will reach a total of £52,000,000.

Now that unskilled native labor has become more plentiful, it is evident that it is displacing a number of rock drills hitherto used for stoping, because in March the number of drills operating was again reduced, and only totaled 4689, against 4791 in January, despite the fact that during the last twelve months necessity has shown that drills can be substituted for native labor with satisfactory results. It is also satisfactory to find from last month's returns that the number of stamps dropped in the Transvaal and also in Lydenburg, Barberton, and Pietersburg districts along with the Rand continues to increase. Lydenburg is an outside district of some promise, where the gold output in the future may be expected to show a steady increase. The total number of stamps dropped in the Transvaal in March is given as 10,230, as compared with 10,110 in February, but tube mills running show a decrease of one. The outlook for the gold output of the Transvaal is still promising, but the increase can scarcely be expected to be as marked as during the past twelve months. The condition of the market has not lately conduced to the provision of more capital and several developing mines have had to close down on this account. Several of the amalgamated properties and new producers have, however, a reserve of idle plants which can be brought into use as labor and power conditions improve, so that on the Rand, at least, a steady increase in the output ought to be assured for some time.

TORONTO, CANADA

ORGANIZATION OF THE CANADIAN M. & E. CO.—DEVELOPMENT NOTES AT PORCUPINE.—OUTPUT AND DIVIDENDS AT COBALT.

A strong combination of Canadian and American capitalists has organized the Canadian Mining & Exploration Co., Ltd., with a nominal capital of $5,000,000, half of it paid up. The board of directors contains a number of names notable in the financial world of both countries. The Canadians are: Sir Edmund Oster, H. S. Holt, Sir Edmund Walker, Sir Edward Clouston, Sir William Mackenzie, Duncan Coulson, D. Lorne McGibbon, W. Nesbitt, David Fasken, and P. J. McIntosh, and the United States is represented by Wm. E. Corey, E. C. Converse, P. A. Rockefeller, A. H. Wiggin, T. L. Chadbourne, Jr., J. R. De Lamar, Ambrose Monell, C. H. Sabin, R. M. Thompson, and C. L. Denison. The principal promoter of the enterprise is Ambrose Monell, the president, who receives no salary. The object of the company is the investigation and exploitation of American mineral resources, the idea being to secure the influence of men of large affairs, and to make sure at the outset of ample resources to obtain the best engineering talent to investigate opportunities for investment. The $2,500,000 subscribed will be placed in high-class securities as an endowment fund and the income used for the maintenance of a staff and offices. The intention is to have offices at New York in charge of William W. Mein, and at Toronto in charge of A. D. Miles. It is proposed that apparently desirable opportunities will be examined and perhaps prospected, and the subscribers to the endowment fund are to have the privilege of participating proportionately in the promotion of subsidiary companies, in consideration of which they in the meantime waive interest on their contributions, the principal remaining unimpaired.

The country around Porcupine has been almost stripped of timber available for fuel, and many of the mines are beginning to use coal, among them being the McIntyre, which has ordered 2000 tons. This company on May 20, found a quartz vein 27 ft. wide on the 200-ft. level, near the centre of the west end of Pearl Lake. It is supposed to be the Hollinger lode. Another 4-ft. vein parallels it a few feet to the south. An 8-ft. quartz vein has also been found in the cross-cut on the 200-ft. level north from No. 4 shaft. The Pearl Lake property is to be re-opened, a syndicate of New York and Philadelphia capitalists having a controlling interest, liquidated the debts, amounting to about $100,000, and provided a fund to carry on development work. M. J. Ramsay and J. E. Wright, of Philadelphia, have been elected to the board of directors, and R. W. Stevenson, an experienced mining engineer, has been placed in charge of the mine.

Directors of the La Rose mine from Montreal visited Cobalt and made a thorough inspection of the property on May 29. Their visit is supposed to foreshadow the investment of a portion of the accumulated surplus in some other mine, the Chambers Ferland being mentioned. The Trethewey is putting down a sixth shaft, near the mill, which will be sunk to 175 ft., at which depth it is intended to drive east along the line of the property adjoining the

Nipissing. The company has made a 10% distribution of profits. At the annual meeting of the Peterson Lake stockholders on May 27, an attempt was made to oust the directorate, which proved unsuccessful. The balance sheet showed $44,022 cash in the treasury. The operating account showed a loss of $1463. The leases have nearly all been cancelled, the only two leasing companies working on Peterson Lake ground being the Gould and the Seneca Superior. The plant of the Little Nipissing was bought for $2400, and the Peterson Lake is now working the area formerly leased to it. The McKinley-Darragh produced in April 306,000 oz. of silver, and the management forecasts a total output for the first six months of the year of 1,500,000 oz. The two swamp veins, on which work was commenced April 1, yield ore running approximately 4000 oz. per ton, and carry occasional rich pockets of argentite. A 3% dividend plus a 7% bonus has been declared.

The Cobalt Townsite, which is nearly all owned in England and has lately made great strides, will take over the Cobalt Station Grounds mine, which comprises 19 acres of mining rights, under the land reserved for railroad purposes, and two town lots. This will bring the combined area of the two mines up to 57 acres. The Nova Scotia property was sold on May 2 to D. M. Steindler, of New York, a director and one of the largest creditors, for $82,000. The total indebtedness of the company was $245,000. The Coniagas has adopted an extensive plan for the development of the southern portion of the property, which has remained largely unexplored. A cross-cut is being run from the 225-ft. level toward the southern boundary, from which an adit will be driven toward an old disused shaft cut down for 60 ft., which will be reached by a raise. At the Nipissing good ore has been found in a raise from the intermediate level of vein 122, 60 ft. from the surface, where 12 ft. of a shoot has been developed along a drift. There is a 6-in. vein of 5000 oz. ore showing up for 9 ft. of height. A considerable tonnage of low-grade ore has been found on vein No. 73. At the W. S. M. K., formerly the Green Meehan, a vein found on the 200-ft. level has been proved for 125 ft. At first a mere stringer, it has widened to 9½ in. of high-grade, with good milling ore.

NEW YORK

COPPER MARKET LAGGING—TENNESSEE COPPER MERGER—CANADIAN MINING & EXPLORATION COMPANY.

The copper shares are still dull, in spite of much work by press agents. The investors are apparently studying the discrepancies that seem to exist between the reports from the mines and the refinery figures that are given out, and are asking "Where is all the blister copper that figures as mine output?" The market feature, both in New York and London, for some weeks past, has been a specialty that in its future depends almost wholly upon the elimination of copper as a conductor of electricity in telegraphy—the Marconi Wireless Telegraph issues. John Hays Hammond is about to attend the international wireless conference in London, and in the meantime is erecting two wireless telegraph towers on his estate in Connecticut to be used in experimental work in directing dirigible submarines in the waters of Long Island Sound. It seems odd that one of the world's famous mining engineers should act as a delegate to a conference to further a means of communication which will do away with one of the chief uses of copper when the system is fully perfected—which, by the way, seems to be a most distant day. Still, the fact remains that the American Telegraph & Telephone Co. is the owner of more copper metal than any other consumer in the world and one of the largest users of the metal.

Another passing phase of events just as odd is the talk of a proposed merger of the Tennessee Copper Co. with the American Agricultural Chemical Co. Farmers and smelters have always been considered as natural hereditary foes, and that it should be possible to merge anything which had to do with the one into anything which had to do with the other, would seem most anomalous. The American Agricultural Chemical Co. has come forward as one of the successful handlers and dealers in chemical fertilizers, and the Tennessee Copper Co. has become one of the large producers of sulphuric acid. The story of a merger is denied, but nevertheless, chemistry, like politics, makes strange bedfellows when smelting plants that are looked upon as devastators of vegetation and fertilizer companies are spoken of as factors in possible consolidation.

American Smelters Securities are being pushed in the Paris market. The Bank of Paris and the Société Generale are offering the 6% cumulative shares on a basis of 95.

A concern with ambitious plans has recently been incorporated in the Dominion of Canada. The new venture is known as the Canadian Mining & Exploration Co., Ltd., and is made up officially of representatives on each side of the line in equal numbers. The promotors are all prominent either financially or in the mining field. The following are among the directors: Sir William Mackenzie, of Mackenzie & Mann, the great firm of Canadian railroad builders; Sir E. B. Oster, Sir Edmund Walker, Sir Edward Clouston, David Fasken, one of the most prominent attorneys in the Dominion, and who has taken a very large part in the development of Canadian mining industries; D. Lorne McGibbon, of the Nipissing and La Rose boards, and others of equal prominence. Among the American directors are Wm. E. Corey, former president of the United States Steel Corporation and now one of the inner circle in the copper combination headed by John D. Ryan; E. C. Converse, of the Bankers Trust Co. of New York, who is a member of the board of directors of the Dome Mines Co.; Percy A. Rockefeller, one of the most prominent financiers on the board; A. H. Wiggin, of the Chase National Bank of New York; Thomas L. Chadbourne, Jr., whose father was one of the determined and triumphant opponents of the Calumet & Hecla consolidation and who is one of the controlling forces in the Ahmeek; J. R. De Lamar and Ambrose Monell, both of whom are on the board of the Dome Mines, Mr. De Lamar being known all over the country where mining is being carried on, and Mr. Monell being head of the International Nickel Co. The concern is capitalized for $5,000,000, half of which is paid in and is to be invested in high-class securities, the income from which is to be used to maintain an office and a staff of expert engineers who are to pass upon mining and other projects, and if available or worthy of development the stockholders of the company are to have the first privilege of supplying money for further work. The company's announcement is that the prospectors and deserving promoters are to be afforded a market for properties that will pass inspection by trained experts. The establishment of such an "endowment fund," as it is termed by the company's representative, appears at first sight to be tinged with a spirit of benevolence. The formation of a well equipped exploration company is a move in the right direction, and it is not to be disputed that the group of gentlemen mentioned will have at their call unlimited funds to develop anything that may be presented. Another phase of the situation not quite so encouraging is the possibility of the development of what is known as a one-man market. If everything which comes to New York must be presented to the one customer, and if turned down by it will receive a black mark that precludes its being taken elsewhere, so powerful a concern will be enabled to buy at its own price; and while the promoters will always have a market, it may not be a satisfactory one.

Probably of much greater importance to the mining industry in general is the encouraging aspect of affairs in Mexico. Speyer & Co., the international bankers of New York and London, have agreed, with the consent of the State Department at Washington, to lend to the present government of Mexico ten million dollars. It is expected that with this financial support the government of Madero will within a year be enabled to restore tranquility and then get its own financial affairs on a more substantial footing.

There has been a great deal of discussion recently as to the possible increase in dividends by the Nevada Con-

solidated and the Utah Copper Co. The rumors in regard to such increases were unfounded, as the regular dividends have just been declared. There is likely, however, to be an increase in the disbursements made by the Guggenheim Exploration Co., as this stock is expected to be placed on a 12% basis at a very early date. Neither Utah Copper nor Nevada Consolidated have ever been active traders. From the trend of events at the moment it is apparent that an effort is to be made to bring the Guggenheim Exploration Co. into greater popularity, and to this end it is pointed out that should either of the mining companies increase dividends, the Guggenheim Exploration Co. will be the largest sharer in such distribution. The Shannon Copper Co. is about to enter the dividend list, and it is expected that within 60 or 90 days its disbursement will begin.

The outstanding stock of the Inspiration Con. Copper Co. ($14,452,160) has been admitted to trading privileges on the floor of the New York Stock Exchange. The stock will be quoted in dollars and cents. There is a good deal of talk to the effect that the Inspiration Con. Copper Co. is to absorb the new Keystone, which is a Lewisohn property, and J. Parke Channing has been in the Southwest watching some of the churn-drilling that is being done at the Keystone.

The Baltimore refinery of the A. S. & R. Co. is still having trouble with its 'hustlers', who handle copper ingots from refinery to steamer bottoms. Last month some 5,000,000 lb. of copper was on the dock at Baltimore, and it is expected that exports will be delayed when the June figures come out, unless the present deadlock is broken.

SPOKANE, WASHINGTON

IDAHO MEETING OF SPOKANE SECTION OF AMERICAN INSTITUTE OF MINING ENGINEERS.

At the Wallace, Idaho, meeting of the Spokane local section, American Institute of Mining Engineers, May 11 to 13, about 100 members and guests were present. A special car was provided for those going from Spokane by the Oregon-Washington Railroad & Navigation Co., which arrived at Wallace on the evening of the 10th. The meeting opened at 10 a.m. May 11 at the Carnegie library, where an address of welcome by E. R. Denny, president of the Board of Trade, was followed by the formal turning of the keys over to the engineers by J. T. Taylor, Mayor of Wallace. F. A. Thomson, dean of the mining school of the Washington State College at Pullman, made a fitting response. R. S. McCaffrey, head of the department of mining and metallurgy of the Idaho State University, then called for the reading of papers. R. S. Handy, mill superintendent for the Bunker Hill & Sullivan M. & C. Co., at Kellogg, read a paper on the new unit of the Bunker Hill mill, which was illustrated by a flow-sheet. After discussion of this paper, O. B. Hofstrand, ore-dressing expert with the Federal M. & S. Co., at the Morning mill at Mullan, read a paper on the tube concentrator flotation process, with special reference to its installation and operation. As the process was first installed at the Morning mill and is practically new in ore-dressing practice, the discussion was extended and interesting. As a concluding paper, Mr. McCaffrey treated the subject of lead and zinc separation with special reference to conditions in the Coeur d'Alene district.

The afternoon was spent in an inspection of the Hercules mill, near Wallace, where the new Franz concentrating-table is being operated and experiments are being extended. There are one or two new features about this table which may prove valuable in concentration; one being the slots into which the metallic contents drop before reaching the lower edge of the table, and another being a device for classification which is employed on only a few of the newer tables and may yet be discarded. The Hercules M. Co. was the first to introduce ore-sorting from belt conveyors into the Coeur d'Alene district.

Next morning the party went by special train to the Hecla mine at Burke, where the electric hoist is still doing duty as the most satisfactory hoist in the district. With a storage reserve, the hoist continues to operate for two hours after the current has been turned off the main line. Two hundred and fifty dividends are to the credit of this mine. From Burke the party went to Mullan, where the Morning mill with its tube concentrators engaged attention during the forenoon. These tubes are best described in Mr. Hofstrand's paper, which will soon be published. The first installation proved so satisfactory in saving lead and zinc which heretofore went out in the tailing, that the capacity of the tube plant is being greatly enlarged. The Federal M. & S. Co., both here and at its other ore-dressing plants, has introduced many innovations. Some of them in operation elsewhere are new to this district, but nearly all of them have come to stay. After luncheon a trip was made through the two-mile adit of the Morning mine, and the west face of the mine was inspected several hundred feet below, where 40 ft. of ore of all grades is exposed. The station in the adit is one of the largest in the world and contains the compressed-air plant for operating the hoist and car loaders.

Returning to Wallace at evening, the party next morning went to Kellogg, where headquarters was made at the Y. M. C. A., erected by the Bunker Hill & Sullivan M. & C. Co., a monument to better social conditions than formerly existed in this district. Although Mr. Hardy had faithfully described the Bunker Hill new mill, it is only by a visit to the mill itself that the automatic operation and devices which make possible such a high percentage of saving at so low a cost, can be understood. A miner who has worked for several years in the Bunker Hill & Sullivan mine, on being asked what the walls were, said "the walls are ore"; nor was he far wrong. This great property does not show the signs of exhaustion which might be expected from one which has been producing an enormous tonnage for a quarter of a century and which has paid $12,000,000 in dividends. There are now large reserves of ore which may be mined at a profit with reasonable market prices for lead and silver, and new territory is being constantly explored.

KELLOGG PEAK, COEUR D'ALENE.

At Kellogg the party separated, having spent a most profitable three days. Great credit was due the local committee and others for the profitable meeting and the facilities afforded for viewing the mines and mills of the district.

Last year the Coeur d'Alene district produced 30% of all the lead mined in the United States, and 8% of the silver, with large amounts of gold, copper, and zinc. The annual production of the state of Idaho, at the present rate, is about 120,000 short tons of lead, 2000 tons of zinc, 2,000,000 lb. of copper, 7,500,000 oz. of silver, and 60,000 oz. of gold. The rising price of the metals is stimulating prospecting and mining throughout the state.

BOSTON

COPPER MARKET ACTIVE.—WALKER'S ESTIMATE OF BUTTE.—OLD DOMINION WINS SUIT AGAINST BIGELOW.

The movement of the copper metal market at present presages unabated activity through the summer months, and the possibility of 18 or 20-cent copper before the year is over. The statement for May will show a substantial reduction in stocks and bring out conclusively that the normal demand for the metal is well up with, if not ahead of, the supply. The continued rise in the price of the metal will enforce increased dividend payments in all the dividend-paying Boston coppers which have not yet raised their rates, and when these increases have been made and a few new coppers are also settled in the dividend column, the public will surely be in the market and the brokers will be prospering on commissions. The presidential campaign will not disturb the copper market. The final figures tell us that the production of copper has been stationary for the past two years, there being practically no change as between 1910 and 1911, but consumption has been steadily gaining ground, with no prospect of any reaction. Hence there arises a condition in the copper market similar to that which existed six years ago.

George L. Walker, editor of the *Weekly Copper Letter*, here, has been visiting Butte recently, where he went to look into the properties of East Butte, Butte & Superior, Butte Central, and other independents, from a market standpoint. Mr. Walker estimates the gross value of Butte's production to date as $1,160,000,000, saying that only a few entire states in the Union have produced more mineral wealth than the Butte district alone. He quotes those having a comprehensive understanding of the district as saying that it will be a large producer of copper 100 and perhaps 200 years hence. He writes that prominent mining men in Butte declare that the Butte & Superior company has opened the largest known deposit of high-grade zinc ore, its orebodies being so large as to immediately force Butte into prominence as a zinc producer.

The United States Supreme Court, on Monday last, handed down a decision in behalf of the Old Dominion Copper Co, of New Jersey, against Albert S. Bigelow, of Boston, for $2,200,000, plus interest at 6% for two years, making the total $2,464,000. This terminates litigation of ten years standing and probably constitutes a record award as made by the court of last resort against an individual. I have already outlined the history of this extraordinary case. Mr. Bigelow, who is a member of one of the wealthiest 'Back Bay' families, had deposited with the New England Trust Co., as trustee, securities sufficient to settle the judgment against him for this amount which had been secured in the Massachusetts courts. The securities in trust now become the property of the holders of the trust receipts of the Old Dominion Co. of New Jersey. These trust receipts were created on account of this case and have been traded in fitfully from time to time. They have a par value of $10, but have been traded in at all prices, from a dollar or so up to $9 on Monday, the day the decision was handed down. The first sale Monday on the Curb of these receipts was made at 3½. The next sale was 9. A possible value of $14 per share for the receipts is estimated. Richard Olney, Alton B. Parker, C. E. Littlefield, J. C. Spooner, and Louis E. Brandeis, of this city, were legal lights in the case. It is estimated that Mr. Brandeis, who is on the winning side, will receive a fee of $220,000 for his work. It is believed in Boston that Mr. Bigelow has put down a fairly soft pillow to fall upon by 'hedging,' having, it is said, been persistently accumulating trust receipts for the past two or three months in anticipation of an adverse verdict. Mr. Bigelow was associated with the late Leonard Lewisohn in forming the Old Dominion Copper Co., and it was discovered that they, as promoters, had appropriated considerable secret profits. When the discovery was made, Old Dominion stockholders started a movement against them both for restitution. Suits were instituted in New York against Lewisohn and in Massachusetts against Bigelow, the cases otherwise being identical. Lewisohn's estate won the suit, though Bigelow lost. Mr. Bigelow, who is advanced in years, retired from the copper field when the Calumet & Hecla company purchased of him his interest in Tamarack, Osceola, Ahmeek, Laurium, Seneca, and Isle Royale for $8,284,375, three years ago.

SALT LAKE CITY, UTAH

ZINC IN PARK CITY MINES.—BAG-HOUSE AT UNITED STATES SMELTING PLANT.

The strength of zinc in the metal markets is giving an impetus to Utah mines in which zinc is a by-product, where in many instances it was previously a detriment. The greater part of the Utah production of zinc comes from the Park City district, where Daly-Judge and Daly West are the principal shippers of zinc ore, particularly the former. Daly-Judge stopped shipping zinc middling last October, and at the first of the year had 1136 tons piled up awaiting more favorable conditions. Since that time, however, it has resumed shipments, and the zinc middling is now contributing largely to the revenues. The North Tintic district, where the Scranton is the principal shipper, is also looking up for similar reasons, and the holders of property in the new Santaquin district, where zinc occurs largely under conditions similar to those at Park City, are greatly encouraged. The United States S. R. & M. Co., which is using the Huff electrostatic process at its Midvale plant, is engaged in a more active campaign for the purchase of ores containing zinc. In this connection it is interesting to look back a decade to contrast the value of metals and metallurgical methods. At that time the old Anchor mine, which is now a part of the Daly-Judge, had been practically given up by its owners, so far as hope of immediately profitable operations was concerned, because of the large proportion of zinc in the ores. The Daly-Judge, while it includes a vastly increased area and has opened other orebodies, has nevertheless reaped large profits from the Anchor zinc ores, which were previously a serious detriment.

The strike at the American S. & R. Co.'s Murray plant has apparently been broken, and lead ores are being received there the same as ever.

Utah Copper is steadily approaching its maximum production. The Magna and Arthur mills will be in shape next month to handle 20,000 tons of ore per day, and with adequate transportation facilities there will be nothing to prevent maintaining that production, which will bring the annual output of copper close to 150,000,000 lb. One day recently the output from the mine was 24,000 tons, a feat so enormous that its magnitude is not realized at first blush. The work on the Panama canal affords the only comparison.

Frederick Lyon, assistant managing director of the United States company, is authority for the statement that the company has solved the fume problem in its copper smelters as well as in its lead plants. Since the installation of the present bag-house system at the Midvale plant of the United States company, the trouble with farmers has died out. The company is operating its lead plant only, under order of the federal court, but the success of the bag-house at the Kennett copper smelter may presage the renewal of the treatment of copper ores at the Midvale plant.

The most extensive operations in recent years in the old district of Alta are in prospect, the newly organized Michigan-Utah Consolidated company being the active factor. The company includes the Utah Mines Coalition, City Rocks, and other properties, and is well financed. One of its plans is to utilize the old Continental-Alta tramway to a connection with a branch of the Rio Grande railroad in order to maintain shipments all winter. The camp is usually snowbound during the winter months, but the overhead tram will overcome this difficulty.

General Mining News

ALASKA

Fairbanks

The first two clean-ups from the winter dumps on the Bigelow claim on the left limit of Goldstream netted $51,000. Water is available for only one string of sluice-boxes, but it is estimated that one-third of one dump has been washed already and the operators hope to have the two dumps cleaned up within a month.

Juneau

The report of the Alaska United G. M. Co. for April 1912 states that 18,144 tons of ore was crushed from the Ready Bullion claim, and 19,320 tons from the 700 Foot Claim. From the two mills 821 tons of concentrate was saved, with an estimated value of $40,400. The estimated gross value of the free gold was $45,750. The value of the total production was $86,149, with a realizable value of $85,288. The estimated net profit was $26,431. Development to the extent of 607 ft. was carried on, and the stock of broken ore increased 4914 tons.

The report of the Alaska Mexican G. M. Co. for April 1912 gives the amount crushed for the month at 19,152 tons, with 419 tons of concentrate saved. The estimated gross value of the concentrate was $32,550, and of the free gold $25,586. The estimated realizable value of the monthly production amounted to $57,635, with an estimated net profit of $17,525. Development to the extent of 176 ft. was carried on and the stock of broken ore increased 16,956 tons.

The new Nugget Creek power-plant of the Alaska Treadwell company is to be completed this summer, and a large force of men is now at work.

ARIZONA

Cochise County

The steel framework for the new flue-dust chamber at the Calumet & Arizona smelter is about half in place, and will be finished in a few weeks. Additional time will be required for the riveting.

The site for the new Shattuck smelter has been selected south of the Calumet & Arizona property. Plans are being prepared for this new reduction plant, which will have a daily capacity of 400 tons. Arthur Houle, of Douglas, will have charge of the smelter construction work.

Gila County

(Special Correspondence.)—Over 400 men are employed at the Inspiration Con. mines, and the force is being increased. Three development shafts are being sunk to greater depth, and ore from development work is being hoisted through another. The grading is being done on the site of the two concrete, 3-compartment working shafts which will be sunk 50 ft. apart near Inspiration. Ore from the Live Oak mine will be conveyed by underground haulage through the Keystone mine and hoisted through one of these shafts. Grading has not yet been started for the 7500-ton concentrator, as some details remain to be settled. The preliminary surveys for the railroad to the mine and to the concentrator site have been finished, and the dam across Pinal creek will be finished in a few days. W. C. Browning, formerly chief engineer at the Inspiration mine, has been made assistant superintendent and E. G. Deane is now chief engineer. The firm of Repath and McGregor, consulting construction engineers, has charge of all construction work. Associated with them are F. J. Brule, H. J. Wallace, and W. C. Holman, at the head of a corps of 14 engineers.

At the Miami mine diamond-drill hole No. 1 is 125 ft. below the 570-ft. level and has shown ore of commercial grade for the entire distance, which may be taken as indicating that the ore deposit extends to a greater depth than has ever been estimated, all previous estimates having allowed only 50 ft. of ore below this level. The tailing elevator is finished and working satisfactorily. All tailing is now elevated 60 ft. and conveyed by a launder to the gulch, east of the mill, where it is impounded. The total number of men employed about the mine and mill is about 900.

The Copper Hill shaft of the Arizona Commercial company has been retimbered to the fourth level, and a drift is being run on that level to connect with a drift from the Gray shaft of the United Globe mine of the Old Dominion company. At the Copper Reef mine, 15 miles south of San Carlos, the face of the main cross-cut is being advanced, and is now in over 1000 ft. The drift from this adit on the California vein is in 60 ft., and its full width in vein material consists of red hematite and clay gouge. Charles Saxman is superintendent and 11 men are employed.

Globe, May 30.

Mohave County

The Frisco Mines & Power Co. is shipping regularly about $15,000 in bullion from the mill each month. The ore is broken in the stopes by a caving system, and only six or seven miners are required to keep up the supply for the mill.

Pinal County

The American Smelting & Refining Co. has made its initial shipment of blister copper from the Hayden plant. Three cars were sent out consigned to the Perth Amboy refinery in New Jersey.

Santa Cruz County

The Sunnyside and Volcano groups of mines in the Patagonia mountains are reported to have been bonded by L. D. Ricketts, of the Greene-Cananea company. This property is within a few miles of the R. R. R. mine recently purchased by N. L. Amster, of the Shannon. It is also reported that the Calumet & Arizona company has acquired under bond the Chief group of mines in the same district. The Shattuck company of Bisbee also holds options on a large acreage of mining claims near Patagonia. Mr. Amster is prospecting about 30 claims by driving an adit several hundred feet in length. An orebody 47 ft. in width has been cut, and drifts are being driven to develop the ore.

CALIFORNIA

Eldorado County

(Special Correspondence.)—H. Summerfield, of San Francisco, and Oliver Roberts of Alamos, Sonora, Mexico, have bought the Big Chunk and Tropical placer mines in the Kelsey district from the Murphy estate, and a company will be formed to begin work as soon as Mr. Roberts completes the examintion of the properties.

Placerville, June 1.

Inyo County

The old Cerro Gordo property of the Owens River valley has been purchased by F. J. Hagenbarth, L. D. Gordon, and R. J. Shields, Utah mining men. The Cerro Gordo was one of the earliest mines worked in the Southwest. First operated by the Mexicans and then by Haggin & Hearst, it has a recorded production of $20,000,000, the ore being a lead carbonate carrying an ounce of silver to the unit of lead. In late years the mine has had a succession of owners, and the last deal came about through the agency of bankruptcy proceedings and the foreclosure of bonds which the Four Metals company, recently owning it, issued to secure funds. The mine is developed by both adits and shafts to a depth of 1150 ft., and a great amount of zinc carbonate ore is blocked and left in the stopes from former operations. The equipment of the mine is modern, and the underground workings are reported to be in good shape. An aerial tramway connects the mine with the Southern Pacific tracks at Keller, and the present owners hope to ship 1000 tons of ore per day, with a zinc content of 35 to 42%, to Oklahoma.

Plumas County

(Special Correspondence.)—The Lawrence and Hudson placer claims, west of Greenville, have been taken under bond by the Altona syndicate, composed of Seattle and

Alaska people. The property, comprising about 800 acres, will be tested by shafts and drills. The same company has commenced sinking at the Altona quartz mine. A gasoline hoist is in place, and other equipment provided for. J. M. Wiswald is manager for the company. The Anti-Débris Commission has filed complaints against the Neoscene Hydraulic Mining Co., operating at Scales. The company has asked for permission to continue work until a clean-up can be made. The Crescent Hills company is rapidly completing its new cyanide plant, which is intended to treat tailings from the Crescent Hills and Green Mountain mines.

Greenville, June 1.

Sacramento County

The Embaugh Mining Co. has reported the discovery of a rich gravel deposit, yielding $20 per pan. The mine is at Prairie City, one of the oldest placer districts in the state, and all of the land in that vicinity had been thoroughly prospected, yet Sacramento capitalists who compose the Embaugh company have spent considerable money in developing their property.

Shasta County

(Special Correspondence.)—There is renewed interest in the gravel deposits lying west of Redding. The Union Mining & Power Co. has planned to employ a force of 25 men for placer operations on Clear creek. Several small operators are active in the Igo, Muletown, and Shasta districts. The Santa Rosa National Bank has filed a suit claiming the Brush tract, immediately west of Redding. The Hazel G. M. Co., near French Gulch, is sinking the Gladstone shaft an additional 250 ft. to a total depth of 1150 ft. below the adit-level. This adit is 3000 ft. long and taps the vein about 1000 ft. below the outcrop. In the mill 30 stamps are at work, and the average monthly output approximates $30,000, the 1911 yield aggregating $362,000. The company has disbursed $810,000 in dividends. I. O. Jillison is managing director and E. L. Young superintendent of this mine, which employs 120 men. The Milkmaid M. Co. is developing a 2-ft. shoot of ore averaging about $20 per ton, in a drift 100 ft. from the mouth of the adit. H. F. Musser, superintendent of this property, has developed 200 ft. of this orebody in the roof of the drift. The Noble Electric Steel Co. is enlarging the capacity of its electric iron smelter at Heroult.

Redding, May 28.

A company has been organized which will purchase the railroad from Anderson to Bella Vista, and will then extend this railroad to the Afterthought mine and smelter at Ingot, subject to the approval of the State Railway Commission. No doubt the railroad will be extended in the future into the timber and agricultural lands northeast of Ingot, but at present the main idea of the company is to improve the transportation facilities to the Afterthought mine.

The Victor Power & Mining Co. has filed suit against the Midas G. M. Co. in the Superior Court at Redding. The Victor company owns a small mining claim, the Bonanza, adjoining the Midas ground, and alleges that the Midas company is taking ore from the Victor property in the workings on the 1200-ft. level. A restraining order is asked for enjoining the Midas from mining in the disputed territory until a survey under the direction of the court determines the rights of the two companies. The Victor company does not sue for a specific sum in damages, but asks the court to determine the amount. At the Midas 30 stamps have been dropping steadily this spring and fair profits have been claimed.

Sierra County

Many mines in the Alleghany district will resume operations this month. Development is under way at the Rainbow, the El Dorado, and Osceola. The Sixteen to One is planning to place new machinery and deepen the shaft, and a new shaft will be sunk on the Lincoln-Roosevelt vein. In the Independence a drift is being driven north from the bottom of the 350-ft. shaft. The big adit on the Fruitvale is 650 ft. long, and a raise is being made on the vein, which is 12 ft. wide. The Lookout has started an adit after an idleness on the property of fifteen months, and work at the Kenselbach and Red Ledge will be resumed in a few weeks. On the Hardy Kate property an air-compressor, driven by electric power, is being placed, for the purpose of driving a shaft on the northern extension of the Gold King.

A clean-up at the Bear Creek mine, a few miles above Alleghany, resulted in a yield of $157 per ton. The ore came from a stope in a drift about 150 ft. from the surface, where the vein is 3 ft. wide. The mine is worked by John Andrews.

Trinity County

The Trinity Gold Mining & Reduction Co. has reported a production of $207,831 from the Headlight mine for 1911. The expenses of the company were $141,566, leaving a profit of $66,265. Additions to the equipment have been made and an increased output for 1912 is expected. The company claims to have a large amount of $5 ore which can be mined by open-cut methods.

COLORADO

Clear Creek County

(Special Correspondence.)—At the Kelly adit property on Democrat mountain, work has been resumed. As soon as the workings have been cleaned out, the compressor plant will be brought into commission. The 50-ton concentrating plant will be started during the next two weeks. F. Bromley is manager.

Georgetown, May 31.

Ouray County

The Camp Bird mill has resumed operations after a shutdown of several weeks. The new shaft is completed and a sufficient supply of ore for 30 stamps hoisted daily. Development has shown a large body of sulphide ore in the territory which is tributary to the new shaft.

Teller County (Cripple Creek)

The Trilby mine on Bull hill, operated by lessees, is producing about 1000 tons per month from the 1100-ft. level. The properties of the Ophir M. & M. Co., together with machinery thereon, have been advertised for sale on June 25 by the sheriff, under decree of sale from the District Court, to recover the sum of $67,245.03, the amount of a judgment in favor of Colin A. Chisholm, as trustee for the bondholders. The properties are the Carbonate Queen and Dead Pine, both situated on Battle mountain. The Dead Pine has been producing ore under a lease.

The lessees on the Burns property of the Acacia G. M. Co. have shipped about seven cars per week during May, and the royalties for the month are expected to exceed $3000. The ore was mined in the seventh, eighth, and ninth levels, and development has opened up new orebodies, to replace the tonnage hoisted.

The gold production of Cripple Creek for the month of May was $1,263,245, as against $1,216,693 for April. The tonnage was 76,800, compared with 77,281 tons treated the month before. The following is the table of production:

Plant.	Tonnage.	Av. Val.	Total.
Smelters	3,963	$65.00	$ 256,395
Golden Cycle	34,100	21.00	716,100
Portland	9,500	21.00	195,000
Colburn	2,860	2.50	7,150
Stratton's Independence	10,851	3.16	33,436
New Portland	14,400	3.51	50,644
Wild Horse	1,000	3.20	3,200
Kavanagh	300	4.00	1,200
Total	76,800		$1,263,345

The Portland mill at Colorado Springs has been changed from a chlorination mill to a modern plant for the cyanide process. The second unit was started May 8, giving the mill a capacity of 11,000 tons per month. G. M. Taylor, the manager, says that comparisons with the former process are not possible as yet. The Blue Flag cyanide mill, owned by the Blue Flag M. & M. Co., will start operations by July 1 with a daily capacity of 150 tons. The

Isabella mill will also start in June and will re-treat an old tailing dump said to average $1.50 per ton.

IDAHO

Bonner County

The Golden Scepter Mining Co. has awarded a contract for 100 ft. of development work. This will extend the main drift from No. 5 crosscut toward the main ore shoot, which is estimated to be 200 ft. ahead. The workings now have a depth of 700 feet.

Coeur d'Alene

The Federal, Bunker Hill & Sullivan, Hecla, and Hercules mining companies have acquired the overflow valley of the Coeur d'Alene river to Coeur d'Alene lake, in northern Idaho, for $100,000. This eliminates the damage suits instituted by farmers who claim that their property has been ruined by the lead in the water, which has run through the concentrating mills before reaching the river. The Caledonia mine at Kellogg is reported to have found an important body of ore in the raise between the 700 and 800-ft. levels. Charles McKinnis, the manager of the mine, reports that the ore has been followed for 160 ft. and is not yet fully exposed. Samples taken in the raise have assayed as high as 700 oz. in silver, 1.8% lead, and 22.8% copper per ton. Some of the ore in the drift on the 700-ft. level went as high as 863.5 oz. silver and 22.4% copper per ton.

Work has been resumed on Sunset mine, near Wallace, owned by William A. Clark. Loads of machinery and supplies have been sent in and preparations are made for developing the property. The principal work at present is the sinking of a shaft from the end of an adit. This, it is said, will be driven 800 ft. or more, directly on the ore, to determine whether a lower adit is needed for working the mine.

Shoshone County

Earnings for the Federal M. Co. for the first quarter of 1912 amounted to $218,000. Thomas A. Edison is exerimenting on a method to treat the refractory ores from the Morning mine of the company.

MICHIGAN

The Calumet & Hecla is building a new re-grinding mill at Lake Linden. A building some 300 ft. long is to be erected and Huntington re-grinding mills installed.

MONTANA

Silverbow County

(Special Correspondence.)—Butte men interested in the Pilot Butte company have subscribed $100,000 for development and the purchase of new machinery for this property. The shaft is now at a depth of 1100 ft. and will be sunk to a depth of 2000 ft. before any crosscutting is done. At this depth the management hopes to reach the rich orebodies found in the Berlin claim of the North Butte. A shipment of concentrate has been made from the first unit of the Butte & Superior concentrator to the zinc smelter at Bartlesville, Oklahoma. A new electrically driven air-compressor with a capacity of 5000 cu. ft. of free air per minute has been ordered by this company for two weeks' delivery. It will furnish air for 60 drills. The copper production of the Anaconda company for the month of May is estimated at 26,500,000 lb., of which the Washoe smelter turned out 20,000,000 lb. and the Great Falls smelter 6,500,000 lb. Included in the Washoe output was 2,000,000 lb. from the North Butte and 750,000 lb. from the Tuolumne company. The East Butte smelter produced about 1,250,000 lb., and of this amount about 600,000 lb. belonged to the Butte-Alex. Scott. This brings the total output of the district to about 27,800,000 pounds.

BUTTE MINES.

Butte, June 1.

The Butte Miners' Union has rejected, at a mass-meeting, the latest proposal of the Anaconda company to fix the scale of wages at $3.75 per day for all underground men when the price of copper is 15½c. per pound and $4 when the price of the metal is 17c. per pound. The miners demanded a flat increase of 50c. per day, bringing the wage scale of the shoveler in the mines up to the grade of the more experienced miner.

The annual report of the East Butte M. Co. will be presented at the meeting on June 11. In the year ended March 31 the company produced approximately 13,000,000 lb. of copper, more than 400,000 oz. of silver, and 20,000 oz. of gold. The cost of producing copper averaged about 9c. per pound in New York. The first-class ore of the East Butte company during the year averaged over 7% copper and the second-class ore about 3 per cent.

NEVADA

Esmeralda County

(Telegraphic Correspondence.)—The May production of the Goldfield Consolidated is estimated at 30,209 tons. The gross value of this output was approximately $500,000, and the operating expenses of the company $200,000, leaving the net earnings for the month $300,000.

Goldfield, June 3.

The newly discovered orebody in the 250-ft. level of the Florence mine has supplied ore for shipment to the Western Ore Purchasing Co. D. D. Dewey, superintendent of the Florence, states that the vein has been opened for a length of 30 ft., and that both faces show about 3 ft. of high-grade ore, with samples going as high as $2000 per ton, and an average value between $200 and $500 per ton. A body of milling ore about 8 ft. wide forms one wall of the high-grade streak. This vein is about 1000 ft. east of the shaft of the Florence, in virgin ground, and from the work done so far appears to be almost vertical. Mr. Dewey believes that the vein was worked, above the present discovery, by old lessees on the Jumbo claim.

The miners in the employ of the Pittsburg Silver Peak G. M. Co. went on a strike June 1 rather than adopt the reduced wage scale proposed by the company. W. A. Bradley, manager, reports the camp orderly and 60 of the 120 stamps dropping. The mine staff, including foremen and shift-bosses, who were unaffected by the reduction, will continue to work the mine. A new crew is handling the tramway which conveys the ore from the mine to the mill. There is a large tonnage of ore broken in the stopes, and the present force can supply 60 stamps in the mill for some time.

The full report of the Goldfield Consolidated Mines Co. for April shows the operating costs distributed as follows:

Mining:		
Development	$0.87	
Stoping	2.28	$3.15
Transportation		0.10
Milling		2.10
Marketing		0.20
General expenses		0.32
Bullion tax		0.18
Marketing ore shipped		0.12
Construction		0.25
Total cost of operation		$6.53
Miscellaneous earnings		0.10
Net cost per ton		$6.43

The net cost for March was $6.61. Development for April amounted to 3369 ft. In the Combination the 311-P raise, together with the 200 and 205 drifts in the Reilly orebody, produced 295 tons of ore averaging $80 per ton. The 111-M sill of the Mohawk was extended and produced about 50 tons of $26 ore. The 30 drift on the 150-ft. level produced 45 tons of $23 ore. The 3-E sill produced 195 tons of ore averaging $12 per ton, and the 407 sill on the 600-ft. level southwest of the shaft was considerably extended, and produced 250 tons averaging $12.80 per ton. Development in an intermediate below the 250-ft. level, under 111 stope gave promising results. At the Clermont, the sill of the 428 stope, south of the shaft, was extended and produced 350 tons of $75 ore. The 700-M stope, opening between the 1000 and 1200-ft. levels, produced 500 tons of ore averaging $39.60 per ton. In the Laguna the shaft has been completed to the 720-ft. level, where a station and sump are being cut and from which point drifts may be driven both north and south.

Lincoln County

Diamond-drills have been used in prospecting the Golden Prince property of the Pioche Coalition company. The last hole drilled reached a depth of 400 ft. and cut on its way 31 ft. of iron manganese ore. Other drill-holes which have been driven have all penetrated ore, one body being 20 ft. thick.

Lyon County

The Nevada Douglas has increased its output and shipped to the Mason Valley smelter 11,700 tons of ore in May. Development is reported to be keeping the orebody well ahead of shipments.

Nye County

A report recently issued by the White Caps mine at Manhattan, gives the company 10,000 tons of developed milling ore, and 7500 tons additional in what is known as the east ore-shoot, making a total of 17,500 tons.

White Pine County

At the new shaft of the Giroux Con. M. Co. the only work is the handling of about 1200 gal. of water per minute from the 1400-ft. cross-cut and the shaft below that point. The water from the shaft is pumped to the sump in the 1400-ft. station and from there to the big pump in the 1200-ft. station which elevates it to the surface. No work is being done away from the shaft stations. Development is concentrated at present in the Morris and Bunker Hill mines, on the opposite side of the hill from the Giroux shaft, in an attempt to bring the production up to 1000 tons of ore per day. At present only four or five cars of ore are shipped each day to the smelter at McGill, but a large force of men is at work underground putting the mines in shape to produce more rapidly. The surface equipment at the Bunker Hill will not be completed for several weeks, but a force of carpenters and mechanics is at work there.

NEW MEXICO

Grant County

The Chino Copper company mines have been closed by a strike of the steam-shovel crews and the train crews operating the locomotives and ore trains. The men demanded an increase in wages, which the company was not willing to grant.

Socorro County

(Special Correspondence.)—The old ore-bins at the Treasure M. & R. Co. were destroyed by fire on May 25 and the entire mine crew was put to grading for new ones, which will be in commission within a few days. A good ore reserve at the mill will prevent a shut-down. The Ernestine M. Co. reports that two clean-ups for the first 20 days of May yielded 21,725 oz. gold and silver bullion and 22,550 lb. of high-grade concentrate. This is the best 20-day record of the company. The past week's ore treatment was 698 tons. At the Deadwood mines 30 ft. of development was done in the mine. The mill treated 320 tons of ore during the week, producing 18 sacks of concentrate. The Pacific and Johnson mines of the Oaks Co. shipped 30 tons to the Deadwood mill from 21 ft. of development during the week.

Mogollon, May 31.

PENNSYLVANIA

(Special Correspondence.)—The Safe Harbor Iron & Steel Co. has been financed in New York to acquire and operate the Martic iron mines in south central Pennsylvania near Lancaster. This undertaking is notable for the very low grade of the ore which it is proposed to mine and treat. The deposit consists of hornblende schist with magnetite and has an average content of less than 20% iron. About 7,000,000 tons of iron-bearing rock has been proved by drilling, and it is expected that the deposit is much larger. The tests made indicate a satisfactory saving by magnetic concentration, the tailing containing not over ½% magnetite and the product running from about 60% iron with low sulphur and phosphorous content. It is proposed to sinter the concentrate, although experiments now being made indicate the practicability of electric smelting of the product to produce steel. A capacity of 1000 tons of product daily is proposed. A plant is now installed on a spur connecting with the Pennsylvania railroad at Safe Harbor.

Lancaster, May 22.

UTAH

Salt Lake County

The Bingham Mines Co. has resumed work on the Yosemite, and two shifts of miners have started sinking a shaft to connect with the Mascotte adit. A raise has already been driven 280 ft. from the adit, and when the connection is made the shaft will be 2220 ft. in depth on the incline. From the 800-ft. level and above, the old Yosemite company produced about $1,000,000 worth of

ore. No development has been done below the 800-ft. level and the Bingham Mines Co. hopes to find large bodies of lead and copper ore in the ground to be opened by the new shaft.

The International S. & R. Co. has ordered material for the third lead stack at the Tooele smelter, and at the site construction work has already commenced. The fourth reverberatory is in operation at Tooele, and the lead and copper plants are smelting 1000 tons per day.

The Mines Operating Co. has taken a ten years' lease on the property of the Ontario Silver M. Co. and is remodeling the Ontario mill for the treatment of low-grade ores by a cyanide process similar to that which has proved successful at Mercur. The Ontario has a production record of nearly $50,000,000 and a dividend record of almost $15,000,000. In the early operation of the mine, only the high-grade ore was hoisted, and poorer ore was stored in the stopes. It is estimated that the mine has 1,000,000 tons of ore blocked out and stored in the old stopes which will average over $8 per ton. A recovery of 80% is expected from the remodeled mill at a cost of $6 per ton.

Summit County

The annual report of the Silver King Coalition Mines Co. shows cash in the treasury April 30, the end of the fiscal year, to the amount of $410,000, after $100,000 had been spent in electrifying the mine, the purchase of motors, straightening drifts, and replacing old rails with heavier ones. An increased production is planned for the ensuing year. The Mayflower property of the Silver King has been worked by lessees for the past two years. This mine is still producing a small amount of rich ore from a few thin veins and the lessees are encouraged by the company, in the hope of finding a large body of ore.

The John the Revelator property, which is worked by Sam Hair under a lease, has produced rich carbonate ore in May. An incline 60 ft. in depth has been driven in this ore and the vein still shows about two feet wide in the bottom of the shaft. The hanging wall is limestone and the footwall quartzite.

CANADA

British Columbia

The Red Cliff Mining Co. has secured an option on the controlling interest in the stock of the Tyee Copper Co., Ltd., owners of the smelter at Ladysmith, Vancouver Island. One of the most valuable assets of the Tyee Copper company consists of a perpetual coke contract, at a stated price. Since this contract was secured the price of coke has advanced, and should the Red Cliff company complete the deal, it will effect a saving in the cost of reducing the company's ore, as well as allow a handsome margin of profit over cost of treatment at other customs smelters on the coast. About $500,000 is involved in the transaction.

Ontario

(Telegraphic Correspondence.)—The town of Cobalt has been swept by fire, which at last reports was not under control. The Canadian Pacific Railroad Telegraph Co. at Montreal gave out the news early this morning, but since then direct telegraphic communication with Cobalt has been cut off.

Montreal, June 6.

The Hollinger mill in Porcupine has placed an order for 10 additional 1500-lb. stamps for July delivery. This will make a total of 50 stamps for the Hollinger, and will give the Hollinger the largest capacity in the district. At the time construction was started, the cyanide mill was made large enough to take care of a possible addition to the crushing department. The Dome mill is now operating at full capacity. The tube-mill, which has been the principal cause of delay, has been repaired, and the only shut-down now necessary is to clean the plates, and then only one battery out of five is thrown out of gear. The West Dome mine has closed down, on account of shortage of fuel, but is expected to be in operation again by July 1, with either coal or electricity for power. The Nipissing Mining company has started hydraulic operations to remove the overburden from certain claims and make it possible to find any outcropping veins which may exist. The water is raised from Cobalt Lake by an electric pump. About two acres have been washed by this method, and several small cobalt outcrops uncovered. The company intends to prospect several hundred acres by this method.

JAPAN

(Special Correspondence.)—The most serious disaster that has ever occurred in the coal mines of Japan happened about 11 a.m., April 29, in one of the mines of the Tanko Kisen Kaisha (Coal Mine & Steamship Co.) operating in Hokkaido. An explosion of fire-damp in No. 2 incline led to the death of all the men underground at the time, 266, and of 7 men at the surface. A great gust of gas came to the surface, wrecking buildings and blowing out mine-cars. The noise of the explosion was heard for a considerable distance. Following the explosion, fire was found in levels No. 1 and No. 2, and there were finally stopped off with brick walls after great difficulty. No fire was found in the other levels, and rescue parties were able to recover bodies. The mine will be idle for some time, as machinery as well as buildings was destroyed. This will reduce the output of the company, which is a serious matter for it, since, in addition, the widows and orphans of the men killed must be cared for. The company is making generous provision for them. The cause of the explosion has not been ascertained.

Tokyo, May 14.

MEXICO

Chihuahua

The annual report of the Alvarado M. & M. Co. for 1911, together with a supplementary report for the three months ended March 31, 1912, has been issued. The revolution interfered greatly with the operations of the company during 1911, but a profit of $106,468 was earned. The supplementary report shows a profit of $58,961 for the first three months of the present year. Conditions are still unfavorable for the operation of the mine. It has been impossible to move any freight into Parral since early in the month of February, and since the middle of April there have been no banking facilities. Almost all the mines and mills in the Parral district have been closed, and the Alvarado has been enabled to run by having large amounts of supplies on hand when traffic was interrupted. Under normal conditions the Alvarado mine should be able to increase its earnings, as a large body of good ore is blocked out and a constantly increasing tonnage is being hoisted. The water from the mines is handled without difficulty.

Jalisco

(Special Correspondence.)—The El Tajo M. Co., at the suggestion of the manager, Ferdinand McCann, has decided to close the mill until connection has been made between the lower and upper workings, which will materially diminish the cost of mining. While this connection is being made, the lower portion of the vein will be thoroughly explored, and if the results are as anticipated, the mill will be enlarged to a capacity of 100 tons per day, electric power will be introduced, and many other changes made with a view to diminishing the cost and increasing the extraction in treatment. In the meantime, Mr. McCann has severed his connection with the company and intends to go to the City of Mexico, opening an office as a consulting engineer.

San Sebastian, May 28.

Sonora

The Greene-Cananea company has recently acquired a large interest in the Sonora Bonanza, a property situated on the main line of the Southern Pacific in Mexico, south of Nogales, Arizona. The mine is said to have a large amount of gold ore averaging $10 per ton, and carrying a large percentage of silica. The company has been anxious to obtain silicious material to smelt with the basic ores produced in its own mines, and the Bonanza property was regarded as a valuable acquisition and one which would facilitate the desired metallurgical results.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

H. G. PEAKE is in London.

F. W. BRADLEY is at Kellogg, Idaho.

J. R. FINLAY has been in Wisconsin.

JOHN B. FARISH is at the St. Francis.

HENRY P. CHANDLER has gone to Nome.

H. D. MCCASKEY has been in San Francisco this week.

R. H. ELLIOTT has returned from West Africa and London.

J. P. SMITH has gone to Shasta county for geological work.

ALEXANDER MCLEOD is at Orangedale, Cape Briton, Nova Scotia.

J. W. STIMMSON, of Glendale, Oregon, is at Seward, Alaska.

W. H. LANDERS has returned to San Francisco from Nevada.

FREDERICK E. BROWNE, of Salt Lake City, is at Hart, California.

BYRON E. JAMES has returned from Mexico and is at Nevada City.

A. C. VEATCH has gone to Tampico, Mexico, from Washington, D. C.

NORMAN N. BLYE is with the Con. Mercur G. M. Co. at Mercur, Utah.

J. C. NICHOLLS has returned to San Francisco from South Porcupine.

OSCAR H. HERSHEY has returned to Kellogg, Idaho, from southern California.

TADASHIRO INONYE, of the Imperial University of Tokyo, is in Berlin, Germany.

R. C. SPECHT is engaged in examination work in Trinity county, California.

FRED T. WILLIAMS has been in California and Arizona on professional business.

S. L. G. KNOX is vice-president and general manager for the Natomas Consolidated.

F. CUSHING MOORE, formerly of Payette, Idaho, is at Walla Walla, Washington.

SUMNER S. SMITH left Juneau on June 2 for the interior of Alaska, by way of Dawson.

F. G. CLAPP has been in California and has gone to Alberta to examine oil properties.

H. NORTON JOHNSON is general superintendent for the Consolidated Goldfields, Reefton, New Zealand.

F. M. CHAMBERS, of Goldfield, is representative for the International Smelting & Refining Co. in Nevada.

ROLLA E. CLAPP is making a geological examination of the Railroad mining district, Elko county, Nevada.

DAVID MORGAN has gone to Long Beach, California, for the summer and will return to Arizona in September.

H. J. MIESEL has been appointed superintendent for the Independent Lead Silver Mining Co., Keeler, California.

J. B. TYRRELL has arranged with S. N. GRAHAM to carry on his professional work during his absence in the North.

W. R. BASSICK has succeeded S. L. G. KNOX as vice-president and general manager for the Yuba Construction Company.

FERDINAND MCCANN has resigned as manager for the El Tajo Mining Co., and will open an office as consulting engineer in Mexico City.

GEORGE MILLER, formerly with the Mexican Mines Co. at Bolanos, Jalisco, Mexico, is now with the Liberty Bell mine, Telluride, Colorado.

HOWLAND BANCROFT has resigned from the United States Geological Survey and has engaged in consulting geological practice at 730 Symes building, Denver.

W. W. JOHNSON, C. C. WEBSTER, P. D. WINTER, JOHN S. KIMBALL, CHARLES KIMBALL, J. S. JOHNSTON, J. D. CAMPBELL, G. H. RUSSELL, W. M. WITHER, and S. W. BEARDSLEY were among those sailing on June 1 from San Francisco for Nome on the *Umatilla*.

Market Reports

LOCAL METAL PRICES

San Francisco June 6.

Antimony	11—11¾c	Quicksilver (flask)	41
Electrolytic Copper	17¼—17½c	Tin	50—51¼c
Pig Lead	4.45—5.40c	Spelter	7¼—7⅜c
Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50			

METAL PRICES

(By wire from New York.)

NEW YORK, June 5.—Copper strong and advancing; heavy demand, both domestic and export, and considerable decrease in stock expected to be shown by next Producers' Association report. Lead firm. Spelter strong. A large business is now being done in all deliveries.

Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
May 30	Holiday.	No market.		
" 31	16.60	4.20	6.75	61
June 1	16.75	4.20	6.80	60⅞
" 2	Sunday.	No market.		
" 3	16.85	4.20	6.80	60⅞
" 4	16.98	4.20	6.80	60⅞
" 5	17.00	4.20	6.80	60⅞

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	June 6.
Camp Bird Ltd	$ 7⅛
El Oro	4¼
Esperanza	7⅜
Oroville Dredging	1⅛
Santa Gertrudis	6¾
Tomboy	5¾

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, June 6.		Closing Prices June 6.
Adventure	$ 9	Mohawk	$ 66½
Allouez	45½	North Butte	31⅜
Calumet & Arizona	77½	Old Dominion	59
Calumet & Hecla	520	Osceola	124
Centennial	26	Quincy	92
Copper Range	61	Shannon	15½
Daly West	5⅜	Superior & Boston	2⅜
Franklin	13⅜	Tamarack	46
Granby	56½	Trinity	7½
Greene Cananea, ctf.	10⅛	Utah Con	13½
Isle-Royale	30⅜	Victoria	4¼
La Salle	₹	Winona	7⅛
Mass Copper	7½	Wolverine	114

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, June 6.

Atlanta	$ .29	Mayflower	$ .02
Belcher	.39	Mexican	2.72
Belmont	10.00	Midway	50
B. & B.	.14	Montana-Tonopah	2 75
Booth	.10	Nevada Hills	2.15
Chollar	.05	Ophir	1.15
Combination Fraction	.18	Pittsburg Silver Peak	1.25
Con. Virgina	.56	Round Mountain	.42
Florence	.86	Savage	.14
Goldfield Con.	4.40	Tonopah Extension	1.95
Gould & Curry	.04	Tonopah of Nevada	7.25
Jim Butler	.51	Union	.80
Jumbo Extension	.37	Vernal	.14
MacNamara	.25	West End	2.05

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. June 6.		Closing Prices. June 6.
Amalgamated Copper	$ 86⅝	Miami Copper	$ 27
A. S. & R. Co.	86½	Mines Co. of America	8
Braden Copper	7⅛	Nevada Con	22⅛
B. C. Copper Co.	6	Nipissing	7⅞
Chino	34	Ohio Copper	1½
First National	3	Ray Con	21⅛
Giroux	6⅛	Tenn. Copper	45⅝
Goldfield Con.	4½	Tonopah Belmont	10½
Greene-Cananea	10½	Tonopah Ex	1⅞
Hollinger	10⅜	Tonopah Mining	7
Inspiration	19	Trinity	8
Kerr Lake	2⅜	Tuolumne Copper	3⅜
La Rose	3⅜	Utah Copper	65
Mason Valley	12½	West End	1⅞
McKinley-Darragh	1⅜	Yukon Gold	3⅜

Anaconda Copper Mining Company

The report of the Anaconda Copper Mining Co. for the year ended December 31, 1911, is chiefly remarkable as an exhibit of the strong position and wonderful resources of the company, thus enabling it to produce copper at a profit, from the deep orebodies at Butte, even in a year of low prices for copper. The combination of the Butte companies has evidently increased efficiency in each branch and led to economy in the actual working of the mines and smelters. The greatest gain, however, seems to be due to the fact that all of the Anaconda's far-reaching interests are now controlled by a single policy. During the year 1911 the policy of the company dictated a curtailment of the copper output, while reconstruction work and extraordinary repairs were carried on, which left the mines and smelters in better shape than at the beginning of the period and in position to add greatly to their output whenever the market conditions warrant.

Development was carried on at a normal rate throughout the year, and several new orebodies opened in the lower levels of the mines. The total amount of ore developed was in excess of the amount extracted. In the Anaconda department ore was hoisted principally from the Mountain Consolidated, Diamond, Original, Steward, and West Gray Rock shafts. The Anaconda shaft was out of commission for the entire year, and was thoroughly repaired to the 2400-ft. level. The St. Lawrence shaft was also repaired, but sinking and hoisting operations were resumed in May. At the High Ore, Belmont, Diamond, and West Gray Rock new cylinders have been placed in the hoisting engines preparatory to their operation by compressed air. At the Diamond and West Gray Rock the change has been found satisfactory, and the management is confident of complete success in this particular. The Gagnon and East Gray Rock shafts have been closed permanently and are to be used as air shafts. The Never Sweat will also be closed for ore, but still used for lowering men and timber and for ventilation. The shafts of the Anaconda, St. Lawrence, Mountain Consolidated, Belmont, and West Gray Rock will be sunk deeper, and connections made in the lower levels to aid in the ventilation of the underground workings. The water from these mines will all be drained into the High Ore shaft, which will do the greater part of the pumping for the district. The Anaconda is now draining into the 2800-ft. level of the High Ore through diamond-drill holes, and the Diamond and Poulin mines are unwatered through cross-cuts into the High Ore workings. At the High Ore the fire in the stopes threatened serious loss for a time, but after a fight of three months was put out in April. Skips were substituted for cages at this shaft and ore pockets cut on the 1600, 1800, 2200, 2400, and 2800-ft. levels. Three electrically driven quintuplex vertical cylinder pumps were installed on the 1200-ft. level, and three similar ones on the 2200-ft. level, each pump having a capacity of 600 gallons per minute. The power-lines were carried down an auxiliary shaft, and the steam pumps will be maintained in case of accident.

In the Boston & Montana department, development was carried on throughout the year, and the ore reserves were not depleted by hoisting. New air-cylinders were placed in the engines at the Mountain View shaft, and the hoists at the Leonard and Pennsylvania will be changed over in 1912. Cross-cuts were driven to connect the lower workings of the different mines as an aid to ventilation, and the shafts on the Tramway and Buckley mines deepened. All told, the Anaconda company did 30.7 miles of development during the year and sank the shafts an additional depth of 3711 ft. The total amount of ore hoisted during the year was 3,844,070 tons, and in addition 4602 tons of copper precipitate was produced. The Great Falls Power Co. furnished power for the mine operations throughout the year in a satisfactory manner, and the engineers of the company anticipate a great saving in operating cost in the displacement of steam by electric power and in the use of electrically compressed air in the hoists.

The reduction works treated for all companies during the year 3,154,036 dry tons at Anaconda and 1,101,778 tons at Great Falls. Of this amount, 599,578 tons was purchased from other companies. The Washoe production was 191,573,780 lb. of copper, 8,510,122 oz. of silver, and 40,546 oz. of gold, while the Great Falls production was 67,833,313 lb. of copper, 1,221,439 oz. of silver, and 8404 oz. of gold. The total production was 259,407,093 lb. of copper, 9,731,561 oz. of silver, and 48,950 oz. of gold.

At Anaconda tests were carried on with a large centrifugal concentrating unit, which gave promise of good results when certain mechanical imperfections in the machine are overcome, so that it will operate continuously. Experiments which have been carried on for years in the concentrator at Great Falls, tending toward a higher recovery from the ores treated, have finally been successful. One full section has been equipped with new machinery and operated continuously, with such promising results that the whole mill at Anaconda will be changed over, section by section, to conform with the new flow-sheet. The new method will not only increase the saving, but also the capacity of each section.

From the coal mines of the Anaconda company in Montana and Wyoming over 800,000 tons of coal was produced, largely for use in the other departments of the company. The lumber department cut at the mills 90,000,000 ft. of lumber, the greater part of which was sold. These subsidiary departments of the company show profits of $256,301.55.

The Butte, Anaconda & Pacific railway has planned the electrification of the road from the Butte mines to Anaconda, and an extension of the road to the Georgetown district to provide transportation facilities for several low-grade mines in that district. The railroad handled 4,659,696 tons of ore and freight, and 191,797 passengers during the year, earning a profit of $46,944.28.

An analysis of the financial statement of the company shows the cost of mining to have been $3.77 per ton of ore, transportation costs 32c. per ton, and the average cost of reduction $1.82 per ton. The cost of producing, shipping, and selling copper was about 11.77c. per pound, which, after deducting a credit of 2.37c. for gold and silver, leaves 9.4c. per pound as the net cost of the Anaconda production. These costs include all the charges for repairs, development, and construction for the year. The balance sheet shows the fixed assets of the company, including mines, reduction works, townsite property, all buildings and machinery, timber lands, and investments in sundry companies, to be $95,028,477.98. The deferred assets, materials, and supplies for future operations, and insurance paid in advance amount to $2,779,782.91, while the current assets are merchandise and metals held for sale, accounts receivable and cash to the amount of $20,334,528.57. The total assets on January 1, 1912, were $118,142,789.46. The total profits for the year, after deducting interest charges, were $8,043,718.76. The four quarterly dividends amounted to $8,608,750, exceeding the profits by $565,031.24. B. B. Thayer, president of the Anaconda company, states in the report that this difference was more than offset by the item of extraordinary repairs and expenditures, in excess of normal years, which amounted to $583,462.27, all of which was charged directly to operations during the year 1911, and not carried for future proportionate distribution.

James Lewis & Son's Copper Report

Standard copper varied in value £4 per ton during the first 16 days of May. The opening on May 1 was £70 2s. 6d., from which it fell to £69 on May 3. A recovery was made to £69 5s. 0d. on May 6, followed by a decline to £68 18s. 9d. the next day. The American statistics announced on May 9 proved more favorable than expected, bears anxiously covered their previous sales, and speculators bought freely, resulting in an advance to £73 for three months prompt delivery on May 14. On May 15 realization of profits caused a drop to £72 for cash, and

£72 7s. 6d. for three months, warrants for free delivery being offered in limited quantities. On May 16 the publication of favorable statistics advanced the market to £73 cash and £73 10s. 0d. for three months. Sales for the fortnight totaled 27,000 tons. Large sales of electrolytic copper are reported to American consumers at up to 16¼c. per pound, a considerable quantity being also taken for export at £74 to £74 10s. 0d. per ton c. i. f. With continued large deliveries from Europe, the quantity available there in stock is much reduced, and some anxiety is felt as to supplies proving sufficient for future requirements in view of the greatly increased consumption in the United States as well as in Europe.

In the last four months there has been an increased import into the United States of 5532 tons, but a decreased import into Europe from other countries of 9554 tons, or a total diminution in supplies of 4022 tons. The consumption of the United States has increased 19,861 tons and that of Europe 17,738 tons. Exports from the United States have increased 15,990 tons and from Europe have decreased 2717 tons, those from England having fallen off 3564 tons, chiefly due to the coal strike. Stocks in the United States and Europe have together diminished to the extent of 20,803 tons in this period, whereas last year in the same time they increased 14,477 tons, although the total decrease for the year 1911 was 43,082 tons.

In the past fortnight, stocks including Germany and Holland have decreased 3075 tons and the visible supply 4350 tons. The arrivals in England and France have been 6559 tons and the deliveries 8892 tons. The arrivals at Liverpool and Swansea from the United States have been 1077 tons bars, and 435 tons plates, equal to about 1510 tons fine, in London 75, and in France 2100 tons fine. The arrivals of Chile in Liverpool and Swansea have been 1123 tons, and the deliveries 1119 tons, and from other countries 795 and 859 tons fine respectively. The Chile charters for the past fortnight are advised as 650 tons, including 175 tons to the United States.

Total imports to date this year are 6629 tons, and deliveries 4296 tons less than last year. These latter include 3400 tons shipped to the United States, as against 6200 tons last year.

Quotations May 16 were: Standard copper £73 0s. 0d. for cash and £73 10s. 0d. for three months' prompt; electrolytic wire bars, £75 0s. 0d. to £75 10s. 0d. net, c.i.f.; English best selected ingots, £77 0s. to £78 0s. per ton, and tough cake £77 0s. to £77 10s. less 2½%, ore of 20% 12s. 9d. to 13s. 0d., and regulus and matte 13s. 3d. to 13s. 6d. per unit.

Sundries in:

	1912			
Chilean in:	Jan. 1.	Apr. 1.	May 1.	May 16.
Liverpool and Swansea...	4,225	4,807	5,203	5,207
France	714	633	778	821
American in:				
Liverpool and Swansea...12,939		9,825	8,215	6,711
France	4,033	5,248	4,690	4,248
Sundries in:				
Liverpool and Swansea..	786	741	1,148	1,059
London and Newcastle..	6,462	5,377	5,060	5,540
Birmingham	346	767	850	
France	507	537	567	567
English in:				
Liverpool and S. Wales.	17,346	14,215	14,210	14,235
Total in England and France	47,358	42,150	40,721	38,388
Sundries in:				
Germany and Holland...	13,400	10,900	10,121	9,379
Total European stocks...	60,758	53,050	50,842	47,767
Afloat as advised by mail and cable to date:				
From Chile to Europe...	1,575	2,325	2,050	1,375
From Australia	8,350	5,700	7,000	6,400
Total visible supply...	70,683	61,075	59,892	55,542

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

OIL WELLS—INJURY TO ADJOINING REALTY ENJOINED

The pumping of oil and salt water from oil wells, and permitting it to flow on lower adjoining lands so as to accumulate and stand in pools and destroy the crops and timber thereon, and to permanently injure the productiveness of the soil, and cause noxious odors, is an actionable injury, which may be enjoined.

Niagara Oil Company *v.* Ogle, (Indiana) 98 Northeastern 60, April 3, 1912.

MEASURE OF DAMAGES FOR TAKING COAL

Defendant was the owner of coal land adjoining a tract belonging to plaintiff. Having no facilities for mining the coal he executed a lease to other parties on a royalty basis, authorizing them to mine under defendant's land. The lessees unintentionally pushed their workings across the boundary and extracted large quantities of coal from beneath plaintiff's land. Held that the measure of damages for which defendant should be assessed was a reasonable royalty of 7c. on all bituminous and 25c. on all cannel coal wrongfully extracted.

Lyons *v.* Central Coke & Coal Co., (Missouri) 144 Southwestern 503. February 6, 1912.

READJUSTING BOUNDARIES—EFFECT OF EXCLUDING BOUNDARY POINT

Where a placer location was unintentionally made to cover a trifle more than 20 acres, and subsequently the boundary lines were drawn in to correct the error, if the locator in so readjusting his boundaries leaves his only point of discovery outside of the new lines, he thereby invalidates his entire location by leaving it without a mineral discovery. A United States mineral surveyor is, by virtue of his office, disqualified from making mining locations or acquiring any interest therein during his tenure of office.

Waskey *v.* Hammer, (U. S. Supreme Court) 32 Supreme Court Reporter, 187. January 22, 1912.

OIL CONTRACT—RIGHT OF GRANTOR TO RECOVER

Where a contract granted the exclusive right to explore land for gas and oil and provided for the payment by the grantee of 50c. per acre per annum, after the first year, until a well should be completed producing gas in sufficient quantities to justify marketing it, it is not essential to the right of the grantor to recover such sum to show that the grantee ever took or held possession of the land under the contract. As long as said contract was in force the grantee had the right to enter upon said land and prospect for natural gas and oil and he is liable for the compensation fixed in the contract for this privilege until the contract is cancelled.

Kokomo Natural Gas & Oil Co. *v.* Matlock (Indiana) 97 Northeastern 787. March 6, 1912.

ASSOCIATION CLAIM—EFFECT OF PART CONVEYANCE PRIOR TO DISCOVERY

Where eight persons made an association location of 160 acres of oil land, and thereafter conveyed a portion of their claim to a ninth person in consideration of his performing the exploration work necessary to perfect the location, the performance of such work by the grantee upon the portion of the claim conveyed to him or his grantee innures to the benefit of the entire 160 acres. The only difference between such a grantee and one to whom a conveyance of a segregated portion has been promised upon a discovery by him sufficient to perfect the location is that the grantee has been paid his consideration in advance. In both cases the work is being done for the benefit of all the associates and of the whole claim.

Merced Oil Co. *v.* Patterson, (California), 122 Pacific, 950. March 22, 1912.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

TRANSVAAL mines, June 30, 1910, employed 257 air-compressors with a total horse-power of 100,291, while 400 hp. of compressed air was purchased.

ARIZONA, though it has produced no coal on a commercial scale, contains large areas of workable beds, according to the U. S. Geological Survey.

MONTANA, in 1911, according to E. W. Parker, produced 2,975,358 tons of coal, worth $5,339,058. This was a slight increase over the output for 1910.

PHOSPHATE ROCK has been found in central Kentucky and, according to F. B. Van Horn of the U. S. Geological Survey, a considerable production from this area is to be expected.

ZIRCON is used in the manufacture of electric lamps, as an insulator for electricity and heat, in making refractory crucibles, in lining electric furnaces, in making paints, and as an abrasive.

OIL or remarkable purity has been found at Pine Prairie, Louisiana. It contains no asphalt, gasoline, or paraffin wax. The crude product contains a large percentage of illuminating oil.

POTTERY was made and marketed in the United States to a total value of $34,518,560 in 1911, according to Jefferson Middleton of the U. S. Geological Survey. The largest amount came from Ohio.

BEARING and pinions made of manganese steel are used in the tube-mills of the Goldfield Consolidated mill. The gears have been in service for three and a half years now and seem good for two more years. The pinions last two and a half years.

COST of electric power varies enormously, but the following figures may be quoted, they being in cents per kilowatt-hours: Pennsylvania railroad, 0.58; Long Island, 0.697; West Jersey & Seashore, 0.592; Interboro Rapid Transit, 0.543; Twin City Rapid Transit, 0.62.

METAMORPHISM of olivine to serpentine is accompanied by increase in bulk. In the case of one of the South African diamond pipes it is figured that since the surface presented the only free end, the increased bulk necessitated a vertical movement of approximately 800 feet.

SCRAP MICA is ground in large quantities and used for the decoration of wallpaper and in the manufacture of lubricants and fancy paints; it is also molded for electrical insulation. When mixed with grease or oils, finely ground mica free from gritty matter forms an excellent lubricant.

MEERSCHAUM is mined almost exclusively in the vicinity of Eski Shehir in Asia Minor, about one day's journey by rail from Constantinople. It occurs in nodular form in clays, and has been mined for a thousand years. It is sold principally through Vienna merchants, and the annual exports from Turkey are estimated to be worth $260,000.

NITROGLYCERINE begins to decompose at temperatures as low as 50°C. Snelling and Storm, of the Bureau of Mines, have recently conducted experiments on the behavior of nitroglycerine when heated, and were able, by careful work, to decompose it and char the residue without explosion. The experiment is not recommended for amateurs.

IN DRAWING down a superincumbent mass of dirt, as is necessary often when driving beneath caved ground, many operators endorse the system of effecting an opening for the descent 10 or 12 ft. back from the heading, thus leaving the ore face unimpaired. Where repeated pulling of the ground is required they favor pushing the heading on in advance of the openings through which the dirt is drawn down.

BURNING of coal and wood in a mine fire differs in some respects from the ordinary combustion of coal or wood in a boiler furnace; yet, just as periodic analyses of the escaping gases will indicate combustion conditions in the furnace, so periodic analyses of the atmosphere within a burning mine or section of a mine will indicate combustion conditions there, although these indications are less clearly understood, and will be until some features of mine fires have been studied more fully.

HOISTING TIME increases with depth, but not in proportion to the depth. Since the starting and slowing absorbs a constant amount of time whether the hoist be long or short, each additional level is gained with a decreasing added increment of total hoisting time. At Kimberley in South Africa, when hoisting from 1000 ft., 30 sec. per skip was necessary. When hoisting from 2500 ft., the time became 59 sec., and when the skip was sent to 3500 ft., the increase was only 11 sec., or a total of 70 seconds.

WHEN an entire mine, or a section of it, has been sealed to exclude air, the sampling of the atmosphere within the sealed area becomes desirable in order to determine the effectiveness of the stoppings or dams in excluding air. If the stoppages are tight, the fact is shown by a depletion of oxygen in the atmosphere behind them. A period of anxiety always follows sealing, and any aid that tends to allay fears as to whether the fire is spreading or enables the mine officials to act promptly in case conditions get worse, is worthy of consideration. The U. S. Bureau of Mines has been studying the analysis of mine gases, as one means of meeting this situation.

ZINC prices abroad are controlled by a 'Zinc Convention,' formed first in 1909, and which has gradually come to include practically all the leading producers. By this convention the production, within certain limits, was at first allotted in advance to the various members. If the market showed signs of over-production the output was curtailed pro rata. The basis price for metal was fixed at the equivalent for 4.11c. per pound. In 1910 the convention was continued to 1914, but the restriction clause was changed. Under the new rule there was to be no restriction so long as the total stock of spelter did not exceed 50,000 metric tons, or the London price fall below £22, equivalent to 4.8c. per pound. Should either occur, production was to be restricted pro rata on the basis of the output of each smelter for the last preceding quarter.

DIAMONDS are sold all over the world, but approximately 60% of the output is absorbed in the United States. In 1907, when there was a financial crisis here, the demand at Kimberley fell off 75% and many men were thrown out of work. Other countries are much richer than the United States, but their wealth represents accumulations of previous years. Diamonds and jewels have already been bought and are handed down from generation to generation. In the United States the wealthy people have generally made their own fortunes and have their diamonds still to buy. It is also true that here it is possible for even poor men to buy good diamonds because of the system of sale on the installment plan. The stones cost the ultimate consumer more, but it is possible for him to meet small monthly payments when he could not pay out the whole cost at once.

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

THE BASIC OPEN-HEARTH STEEL PROCESS. By Carl Diehlmann. Translated and edited by Alleyne Reynolds. Pp. 329. D. Van Nostrand Co., New York, 1911. For sale by the *Mining and Scientific Press*. Price $3.50.

This book, according to the author's statement, is intended to answer some of the theoretical questions which arise in connection with the manufacture of steel by the basic open-hearth process. The author, in his twenty years experience, has evidently felt the need of a reference text which would not only summarize the knowledge on the open-hearth process, but would also supply several gaps which have existed in previous literature. The translator has confined himself to a literal translation and to the removal of a few inaccuracies in the original text. The first part of the book deals with the fuels available for the manufacture of producer-gas, and the chemical reactions which take place in the furnace and later in the regenerator chambers of the furnace. Stress is laid upon the thermal conditions in the oxidation of the carbon, in contact with steam, and the influence of the individual reactions upon the final temperature produced. The method of judging the work of producers from gas analysis is taken up, and several examples are given to illustrate the possibility of controlling the work of a producer, the admission of steam and air, and the temperature of the distillation chamber from examination of analyses. The effect of the quality of the gas upon the air required for combustion and upon the transferrence of heat to the furnace walls is also taken up from the standpoint of the analytical chemist.

The second part of the book deals with the chemical reactions which take place on the hearth of the furnace. The formation of slag, the removal of impurities, and the influence of temperature of the flame upon the work of the furnace are discussed in detail with a number of illustrative tables and charts taken from tests and from actual practice. The last chapters of the book are taken up with a comparison of the different methods used in working the basic open-hearth process, and in urging the advantages of the process from a commercial standpoint. The appendix contains a number of tables and formulæ for the use of a gas analyst in determining the composition and heat values of producer gas. The book as a whole shows the result of careful study, and emphasizes the importance of a thorough understanding of the principles which underlie the basic process. To a furnace superintendent the book will be especially useful, but to all students of the steel industry it will appeal as a valuable contribution to the literature available for reference.

Recent Publications

GAS ANALYSIS AS AN AID IN FIGHTING MINE FIRES. By George A. Burrell and Frank M. Seibert. Technical Paper No. 13, Bureau of Mines. Washington, 1912. In the introduction to this paper the authors say: "The Bureau of Mines is conducting, as an essential part of the mine-accidents investigations entrusted to it, an investigation of the factors involved in the origin and spread of mine fires, and of the means by which such fires may be prevented, limited, or extinguished. The authors, in connection with their work on mine gases, have made gas analyses and recorded observations on the condition of the atmosphere in mines. Some conclusions from their work are presented in this paper in the hope that they will be of service to those who may have to fight fires; for, although analyses of the gases from such fires have been made in the past, the systematic analysis of samples of the atmosphere of a burning mine or section of a mine has not received the attention its usefulness warrants. In the early stages of a mine fire effort is directed toward fighting it at close range by using water from buckets, hose, or portable extinguishers or by loading out the hot coal. Frequently this effort is not successful, and the mine or a section of it is sealed in order to smother the fire. Some fires gain such headway that the entire mine has to be flooded. This expedient, though effective, requires the use of an enormous quantity of water, not always easily obtained, and a subsequent expenditure of much money and time in draining the mine and putting it in working order."

Topographic maps of the U. S. Geological Survey of the quadrangles named below are now ready for distribution:

Gridley, California, embracing parts of Butte and Sutter counties; scale 1:31,680.

Miami Copper Belt, Arizona, in Gila county; scale 1:12,000.

Mount Goddard, California, embracing parts of Fresno, Inyo, and Mono counties; scale 1:125,000.

Randsburg, California, embracing parts of Kern and San Bernardino counties; scale 1:62,500.

BEHAVIOR OF NITROGLYCERIN WHEN HEATED. By W. O. Snelling and C. G. Storm. Technical Paper 12, Bureau of Mines. 14 pp. Washington, 1912. Very little information as to the behavior of nitroglycerin at high temperatures is available, and this investigation accordingly fills a marked gap in technical literature.

Catalogues Received

ALBANY LUBRICATING CO., New York. 'Economical Lubrication.' 32 pages. Illustrated. 4½ by 6½ inches.

LUNKENHEIMER CO., Cincinnati, Ohio. Catalogue covering its line of engineering specialties. 654 pages. Illustrated.

FORT WAYNE ELECTRIC WORKS, Fort Wayne, Indiana. Bulletin 1142, 'Fort Wayne Electric Fans.' 30 pages. Illustrated. 8 by 10 inches.

SPRAGUE ELECTRIC WORKS, 527 West 34th St., New York. Catalogue No. 325, 'Sprague Electric Fans.' 40 pages. Illustrated. 8 by 10 inches.

AMERICAN PULVERIZER CO., 410 Mermod-Jaccard Bdg., St. Louis, Missouri. 'American Ring Pulverizer.' 4 pages. Illustrated. 8 by 10 inches.

KEYSTONE PLACER DRILL CO., Beaver Falls, Pennsylvania. Catalogue No. 6, 'Downie Deep Well Pumps.' 86 pages. Illustrated. 8 by 10 inches.

WESTINGHOUSE MACHINE CO., East Pittsburg, Pennsylvania. Circular WM No. 506, 'Westinghouse Turbo-Alternators.' 40 pages. Illustrated. 7 by 10 inches.

ROBINS CONVEYING BELT CO., Park Row Bdg., New York. Bulletin No. 5, 'Robins System of Coal, Coke, and Ash Handling.' 40 pages. Illustrated. 6 by 9 inches.

TAYLOR IRON & STEEL CO., High Bridge, New Jersey. Bulletin No. 114, 'Application of Tisco Manganese Steel to Crushers and Pulverizers.' 4 pages. Illustrated. 6 by 9 inches.

MCKIERNAN-TERRY DRILL CO., 115 Broadway, New York. Bulletin covering 'Wizard' Rock Drill. 12 pages. Illustrated. 6 by 9 inches. Also bulletin on heavy-duty pile hammers. 8 pages. Illustrated. 6 by 9 inches.

SULLIVAN MACHINERY CO., Peoples Gas Bdg., Chicago. Bulletin 63 F, 'Sullivan Continuous Coal Cutter'; 32 pages. Bulletin 58 K, 'Sullivan Duplex Air Compressors'; 16 pages. Bulletin 66 F, 'Sullivan Lightweight Rock Drill'; 12 pages. All illustrated. 6 by 9 inches.

UNION CONSTRUCTION CO., San Francisco. 'Catalogue of Elevator Dredges for Placer Mining.' A well printed and illustrated catalogue of dredges for gold and tin, built by this company. Contains interesting matter on tin-dredging and gives operating costs and discussion as to types and sizes. 52 pages. 7 by 10 inches.

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EDITORIAL

REPORT of the special committee now looking into affairs of the American Institute of Mining Engineers, originally to have been made June 3, has been deferred till October 7.

THAT 'pigs is pigs' has been amply demonstrated, but it remained for Mexican customs officials to maintain that 'shells is shells' when they seized as contraband parts for Chilean mills shipped to a metallurgical company in Lower California.

INVESTMENTS by Mr. J. D. Rockefeller are estimated to have increased in value $100,000,000 since the dissolution of the Standard Oil Company. Possibly the moving-picture firms formed their recent merger with a hopeful eye toward future dissolution.

TERRESTRIAL Wave Detector operators have been busy near Napa and promise the Napa Sunrise Oil Company productive oil-wells at a depth of 1500 feet. Since at Napa the Knoxville beds of the Cretaceous rest directly on the basement complex, and the oil-bearing rocks of southern California are absent, ordinary working geologists remain unconvinced.

MUCH has been said in the past year about poor business conditions in the United States, but the foreign trade of the country for the fiscal year just closed seems to have surpassed all previous records. According to estimates of the Bureau of Statistics of the Department of Commerce and Labor, based upon totals for ten months, the imports approximated 1600 million dollars in value and exports 2200 millions.

PLANS for the Panama-Pacific Exposition at San Francisco in 1915 are coming on rapidly. We print this week, through the courtesy of *Western Engineering*, a supplement showing the block plan of the buildings and grounds at Harbor View. In addition there will be a notable group of buildings at the Civic Centre and others in Golden Gate Park. Construction has begun at Harbor View and a large dredge is busy rectifying the shore line.

PROPOSALS for a geological survey of Arizona as part of the preparation for making a suitable exhibit at the Panama-Pacific Exposition have gone awry. A bill providing for such a survey was passed by both houses of the Legislature, but vetoed by the Governor. In Idaho efforts are being made to secure the creation of a state geological survey, and it is hoped that they may be more successful. To make a suitable exhibit of the mineral resources of any state requires careful study by skilled men, and any Western state that fails to make such an exhibit at San Francisco in 1915 will miss a great opportunity.

MINING men interested in Mexico have all taken heart since the announcement of the completion of the Speyer loan of $10,000,000 to the Madero government. Silver is at its best price since in the latter part of 1907, the market for the month of May in New York averaging about 60½ cents per ounce. At this price there is a

margin of profit for many properties in Mexico that have only paid expenses or have been operated at a loss for many months, and shareholders and managers alike are eagerly awaiting assurances that Mexican highways are safe. With the waning interest in the Canadian mining districts, there is a large public that will welcome an opportunity to become interested in Mexico. If the present Mexican government can get affairs firmly in hand, the next few years should see a real mining boom south of the Rio Grande.

HOME rule for Alaska is receiving serious attention at Washington. A bill providing for local government has passed the House and has been reported favorably in the Senate. As amended by the Senate Committee, only one legislative chamber is provided, an interesting move toward simplification that seems especially appropriate in the government of a territory having a small and widely scattered population. It is further proposed to establish a local Railway Commission to consist of an engineer officer each from the Army and Navy, and a geologist from the Geological Survey. This would seem to assure expert and disinterested officials for a critical part of the work to be done in the Far North.

MINE inspectors now maintain an active and helpful Institute, which is to meet this year at Columbus, Ohio, June 17 to 21, inclusive. One of the encouraging signs of the times is the raising of standards among state mine inspectors. There have always been some able and conscientious officials in the work, but there have been far too many men who held positions because of their political activity and who were far too narrowly trained. The Mine Inspectors' Institute of the United States is now in its fourth year. It was organized by the Inspectors themselves and is a movement from within, to better themselves and their work. It is accomplishing great good, as must always flow from frank interchange of experience and ideas among men of the same profession. The Columbus meeting promises to be a particularly interesting and profitable one.

PANAMA is not the only centre of important canal construction just now. Boston has an important canal enterprise nearing completion after two hundred years of agitation. Mr. August Belmont, president of the Boston & Cape Cod Canal Company and American representative of the Rothschilds, a few days ago entertained a party of a hundred guests, including prominent public men and engineers from Germany, Russia, The Netherlands, and Canada, by taking them to view the canal being cut between the deep waters of Cape Cod and Buzzard's Bays, shortening the New York route. Nearly two-thirds of the Cape Cod canal has been completed, and the work should be opened to the public about the same time as the Panama canal. As all those interested in canal sight-seeing will want to view the work done before the water has been turned on, both the Panama and Cape Cod canals may be expected to attract thousands of visitors this year and next.

POLITICS occupy such a large share of the public attention that matters of finance, and especially mining finance, do not just now get much of a hearing. One day last week despatches were printed in all of the New York morning papers to the effect that the town of Cobalt was being wiped out by fire. Later despatches limited the damage to $150,000, but in the meantime not a trader attempted to make any market capital out of the incident. Not so very long ago any similar event would have furnished a basis for speculation in thousands of shares of stock. Another instance of similar import was the cutting of the dividend by the Goldfield Consolidated. It had long been anticipated that the extra dividend of 20 cents per share that had been paid each quarter would be dropped, and formerly there was always an accelerated movement in the stock just before the date of the declaration. Last week when the regular dividend only was declared, there was hardly any comment made concerning the action of the board nor any general discussion concerning the property and its further possibilities.

STATISTICS of accidents in metal mines are neither so common nor complete as in the case of coal mines. In the latter the occasional great explosion with the resulting death of a hundred or more men at once, long since attracted popular attention to the dangers of mining at the same time that it distorted the public view. The chief danger in coal mines as in others, is not that arising from gas or dust explosions, terrible as they are, but the ever-present danger of minor falls of rock. The majority of the miners killed in coal mines lose their lives because of falls of roof. In metal mines the same danger is present, and it would seem likely that an even larger portion of the deaths would be traceable to this cause. A list recently published records all the deaths from accidents in the mines of Clear Creek county, Colorado, beginning with 1863. The total is 176; not a remarkably large figure when the number of miners and number of years involved, is taken into account. The causes of the deaths may be summarized as follows: misfires, 21; explosions and premature blasts, 40; rock falls and caves, 60; suffocation, 5; miscellaneous, 50. Here it happens that death from accidents due to powder has come to about the same number of men as were killed by rock falls. The miscellaneous causes included such widely varied items as falling down a shaft, fall from a bucket, flood, falling timbers, and electrocution.

Funds for the Bureau of Mines

Congress is now busy with appropriation bills, always a sign of impending adjournment. The Sundry Civil bill as reported to the House fails to make any provision of funds for extending the work of the Bureau of Mines so as to cover metal mining in the West. As the matter now stands, except for a small sum available for administration and general expenses of the Bureau, all the appropriations are for the purpose of analysing and testing coal for the Government itself, mine rescue work in the coal mines, and the study of accidents, mainly in coal mines. The House passed, by a nearly unanimous vote, the newly drafted organic act which makes clear the purpose of extending the investigations of the Bureau to cover all branches of mining, but it has failed to furnish money to the Bureau proportionate to the scope of its work. The Secretary of Interior, Mr. Walter Fisher, has, in response to a Senate resolution, written a strong letter urging that $100,000 be devoted to "inquiries and investigations into the mining and treatment of ores and mineral substances, and for equipment, supplies, travel, and other expenses incident thereto." It is hoped that this increase will be voted on the floor of the House. There will be general disappointment in the West if some provision be not made for work in the metal mines. Problems relating to fire, dust, and caving ground make investigations relating to the health and safety of the men as pertinent as in the Eastern coal mines. With the limited sum available the active director, Mr. J. A. Holmes, has occasionally sent the rescue cars into the metal-mining districts to demonstrate the new methods of fighting fire and giving first aid treatment. A much wider compaign of education is needed. The limited studies of health conditions in Colorado mines made by an officer detailed from the Marine Hospital service have been enough

to indicate that here is a wide field for usefulness. In the investigation of smelter fume troubles the mining industry certainly deserves the aid of the Government quite as much as the farmers. Throughout the field mineral waste is a subject second only in importance to problems of the health and safety of the men. The United States has spent from the proceeds of the sale of government land, $65,000,000 on reclamation work. This is a far-seeing and wise policy which has amply justified itself. During the period in which reclamation work has been under way $7,000,000 has been realized from the sale of mineral lands. Why should not this sum, or some reasonable part of it, be spent to stimulate and protect the great primal industry of the West?

The Copper Situation

Statistics of the American Copper Producers' Association, presented on another page, indicate another reduction of surplus to the amount of 15,450,386 pounds. This resulted, not through any lessened decrease in production, which was in fact a trifle greater than for March or April, but because of increased domestic consumption and exports. The price of the metal continues to climb, and there is much speculation as to the soundness of the apparent demand. It is to be remembered that buyers seldom stock up till convinced that prices are to rise and that they usually come into the market with a rush. At the same time there is widely current a feeling that a tremendous deal is being worked out. The press agent's work is being handled most admirably, the only possible criticism being a tendency to overwhelm with denials when discrepancies are pointed out. The world's surplus has disappeared, but there is something of a mystery as to just where it went, in the face of record production that is not a matter for boasting just at this time. It is indirectly admitted, or stated upon apparently good authority, that the operating pool of producers which took the market in hand last fall bought 50,000,000 pounds of copper. It is only natural to ask: Was this all that was purchased, where is it, has it been sold, is it taken into account in the monthly figures given out, is it in dead storage? Copper prices are going up; spot is quoted at 17¼ cents, but this very fact may mean a pinch for the operators. The real question is, have the operators or the pool been able to market any of the metal which they have accumulated? It is not a particularly hard matter for one with a long purse to engineer a rise in the price of a commodity or a stock; the real work comes in unloading the accumulation at a profit. In broker's parlance, these operations, which go hand in hand, are known as 'running a corner,' which is not primarily such a difficult matter, and 'burying the corpse'; it is in the unsuccessful attempt to accomplish the latter that market manipulators most often come to grief. There is no thought of any financial disaster overtaking the men who are at the moment behind the movement in copper, but the fact remains that mine output is increasing and likely in the next few months to further increase largely, and it would seem to be a not unsafe prophecy that if the copper situation is to be kept in hand, another season of curtailment will become necessary. It is quite true that producers are stating publicly that increased production will be a boon, that otherwise the price cannot be held down and a 'runaway' market will ensue. The manipulator of a corner can never let the market take care of itself; if he cannot sell, he must buy; the moment he fails to maintain the price, his corner crumbles. There may or may not be any corner in copper; every copper authority is up in arms proclaiming loudly that there is not; but there are signs that would justify some activity by bear operators at least a 'feeling out' of the situation were it not for the practically invincible financial strength of the men now in control.

The gist of the whole matter is very well summed up in a paragraph in an interview given by an authority on copper in New York: "Some surprise has been expressed that the copper shares have not responded more to the five-cent rise in the price of the metal during the past eight months. The answer is simple: there never was so much doubt as to the genuineness of a movement in copper as there is concerning the present one. When the public realizes that copper-share earnings are going to be very handsome during the next few years, stock-market quotations will commence more thoroughly to discount them than they have yet done." If the public would only come in and buy copper shares in large quantities, it would show a handsome profit on the entire operation, and losses taken in the metal could be considered negligible. Amalgamated is climbing for a high mark; it sold last week at 87⅛, which is higher than at any time since late in 1909. Dividends are being increased in some instances, and resumption is talked of in other cases, and while speculation in the metal is deprecated, investment in copper shares is encouraged in every way possible. In the meantime, as our New York correspondent shows, the large copper producers are rapidly increasing their outputs. Fundamentally the matter resolves itself into a question of the rate at which new production will follow the increased price.

Bolivian Goldfields

Bolivia has been much in the public eye this spring because of reported discoveries of placer gold, especially in the Tipuani district. A number of prospectors have gone down from San Francisco and in response to numerous requests for information, Mr. Carlos Sanjines, the Bolivian Consul, wrote a general description of the country and routes of travel to it, which we published on March 9. Washington despatches have recently stated that accounts of the discovery in the Tipuani valley were based upon misleading information and that the influx of American prospectors was likely to lead to serious distress. The Bolivian Government has risen to the occasion and is assisting the prospectors to go to other districts in which there are good chances of success. In the Tipuani valley there are numerous placers and much gold has been won, but the land is in private ownership and the difficulties to be overcome are severe. Bolivia, however, is a large country, and gold is widely distributed. The Dirección General de Estadística y Estudios Geográficos has recently issued a general monograph on the mineral industry of Bolivia, written by Sr. Pedro Aniceto Blanco. For those who read Spanish this is the best guide to the country, and to all the mining map accompanying the text will prove valuable. In studying the region it should not be forgotten that ancient records are far from accurate, and that in writing a general report such as this, no mining engineer could do more than sift and compile. It is not to be expected that placers examined and sampled as they would be by a mining engineer with ample time and assistance, await the staking. At the same time, a California prospector who worked in the country last year and returned to the United States this spring, found sufficient encouragement to warrant his return with reinforcements. In every rush, statements emanating from the district must be heavily discounted, and to go to any foreign country a prospector must have adequate financial backing, but with these provisos, the Bolivian field seems decidedly worthy of investigation.

Mining and Civilization

James Ralph Finlay

*On the night of April 14, of this year, the greatest steamship in the world struck an iceberg and foundered, causing the death of 1600 persons and shocking the civilized world. The serious comments of the press, outside of the mere news, centred mainly upon the thought that the accident was a case of failure in man's struggle with the forces of nature. It was so indeed in one sense; but the cause of the disaster was not really inability to master the forces which sent the ship to the bottom. It is not fault finding to say that the cause of the accident lay in human psychology. The men who ran the ship believed the *Titanic* to be unsinkable. Even after she struck, the passengers felt such confidence in her that many thought the getting into life boats was merely a disagreeable tribute to be paid to a sense of caution among the officers.

The salient fact of the whole affair is that a human mastery over some of the forces of nature is now generally taken for granted. To get a point of view, think of the adventures of Robinson Crusoe. On every voyage that hero either met or saw shipwreck. Robinson Crusoe is of course fiction but is better than a mere narration of facts to show what the people of that day thought and felt. In our day we have no more doubt of a good ship weathering a windstorm than we have of being able to read the morning newspaper. The *Titanic* disaster no more shakes our faith in successful navigation than a kick from a mule would disturb our faith in agriculture.

I suppose the three great steps in the progress of the human race to be or to have been the following: (1) The conquest and domestication of animals and plants; (2) the subjugation of weak and disorderly men by organized government, thus permitting the intelligent to pursue their chosen activities without the burden of incessantly defending themselves, and to travel and find out about the whole earth; (3) conquering the elemental forces of nature.

We are just taking the third step now. All our great achievements lie in that one province. In prehistoric times people could ride horses and take care of herds as well as we can today. In the time of the Romans the science of government and jurisprudence was advanced practically to where it is now, and many of the arts which government permitted and lack of government hindered, such as literature, sculpture, and architecture, were likewise developed as well as they are today.

What we have recently done, and are doing still, are things like mastering the properties of light which have given us the telescope, the microscope, and the spectroscope, thus opening up fields of information which would have made the Romans gasp with astonishment. Conquest along this line has shown us something of our place in the universe in a detail inconceivable to our predecessors. It has shown us both how little and how big we are. On the one hand, we can realize that the earth we live on, compared with the rest of the universe, is like a grain of sand to the Sahara, or a drop of water to the ocean; on the other hand, we know of organisms so small that billions live in a glass of liquid. Similarly, we have explored into the properties of heat, energy, and chemical reactions, opening up thereby another world of information. We have explored into the manifestations of life and into its history on this earth. All these conquests are quite new, and the really effective imagination of our generation is employed in them. Here is the special realm of modern thought.

The most evident thing about these great achievements is the effect, not the cause. Scientific understanding of natural forces underlies a prodigious expansion of industry and wealth. What does that wealth consist of? In the main it consists of marvelously improved vehicles of communication and travel, telephones, telegraphs, railroads, automobiles, elevators, and steamships; of comfortable and safe abodes built, perhaps, of steel and concrete; of innumerable factories capable of supplying nearly every luxury or utility we can think of. This describes it inadequately. Our wealth consists of our ability so to use the natural elements of light, heat, gravity, and chemical reactions that each man no longer has at his service merely the muscular effort of his own body and of the bodies of horses and cattle; but such great forces that with their aid one man may do what formerly required ten or twenty men to do.

I wish to draw your attention to the fact that practically all the means for these accomplishments are supplied by our mines. We dig out of the earth not only our materials but our energy. The modern ship is as good an example as any. She is wholly built of and propelled by the products of mines. The energy which makes possible the very process of building is supplied by mines, for almost every lathe and riveter in the world is driven by steam which is furnished by coal.

How shallow, then, is the idea so often entertained, and so casually expressed, that the business of mining is a kind of gambling from which the prudent business man should carefully shy away! On the contrary, mining is the mainspring of our whole industrial system! This, I think, must be so plain to every thinking man, that I shall not dwell on it further.

What I wish to inquire into is how far has this particular effort of civilization been accomplished? Have we gone nearly as far as we shall ever go in finding uses for minerals? Or is there still a vast field for expansion ahead? It is too big a question to be more than partly answered. It is plain enough that the expansion is still in full progress and that it is too big a movement to be stopped suddenly. This can be easily ascertained by the most casual inquiry into the facts. But it is a different and more difficult question when we come to look at it in its larger aspects. A parallel example may be found in the growth of cities and populations. Statistics show a rapid and undiminished rate of growth for our largest cities. A chart prepared by a distinguished engineer to show the probable growth of New York City, using all available indications for the serious purpose of laying out the city transportation lines, shows that by 1950 that centre will have a population of 19,250,000 within its present limits. Personally, I do not believe it, yet there is of course no visible evidence to the contrary. The only way to provide oneself with a good reason to doubt such calculations is to carry them on until they reach an absurdity. Why stop at 1950? The same growth might continue until the year 2000. If so, New York would be provided with a population of over 100,000,000. We may all be sure that there will be no such city. If our reason does not tell us so, our common sense does.

Similarly we must expect some limit to the increasing use of minerals. The main cause for increase is the rising consumption per capita in the great industrial nations. In 1850 each person in the United States used 1028 lb. of coal and about 75 lb. of iron; in 1910 each person used 11,000 lb. of coal and 600 lb. of iron. Now this enormous increase of consumption has taken place since a date when the age of steam and iron was already well started. Even in 1860, steamships went regularly between the principal parts of the world, railroads already connected the principal cities, and steam engines were driving the principal factories. Yet in the fifty following years the use of coal increased tenfold. We have added in that time electric lighting, electric railroads, steel buildings, cement pavements, power elevators, automobiles, power-driven farm machinery, ocean cables, wireless telegraphs, and innumerable other avenues for the consumption of metals and of power.

If such an expansion is to continue for another fifty years we shall be using minerals with a lavishness that staggers the imagination. If it does continue, then each person will use 120,000 lb. of coal and 5000 lb. of iron every year, with other things in proportion. Allowing for the increase of population, such figures would mean a consumption of 10,000,000,000 tons of coal and 400,000,000 or 500,000,000 tons of iron annually in the United States alone. This

*Annual commencement address, Missouri School of Mines, May 31, 1912.

seems incredible and utterly out of the question. In other words, I believe that the enormous expansion in the use of minerals will soon begin to slacken. But I said a little while ago that there is no present evidence of slackening, so that it is necessary to explain.

My idea is that approximately the same causes which are producing the general increase of population, and particularly the growth of enormous cities, are behind the great expansion in the use of minerals. The cities grow because transportation is easy and quick; the largest cities grow especially because the perfection of communication allows certain forms of business which otherwise might be scattered all over the country to be carried on to best advantage in the largest city. New York, for instance, is growing on a multiplicity of small manufactures. Forty-odd per cent in number of the new manufacturing enterprises of the country are situated there, but the average number of employees is only 24. Undoubtedly this goes on because a great centre of population supplies artisans for each specialty, and because the city itself is the greatest single market. The highly improved transportation facilities naturally act to better advantage in carrying articles from big markets to lesser ones, than from lesser markets to big ones, for a variety of reasons that will occur to everyone.

The general increase of population is without doubt due to the same causes. This increase is taking place only in the great industrial nations or in regions controlled by them. The improvements in the means of getting a living, the cessation of useless wars and disorders, the reduction of plagues and famines have all been caused by improvements in transportation and production. These agents have afforded populations which had been brought to a standstill by restricted living conditions another chance to grow.

But in the centre of the world's civilization we find a great nation where the population is not increasing. I mean in France. The census figures show a marked decline in the birth rate also in the United States, and I believe the same facts are beginning to appear in England. I am not going into a discussion of race suicide. I am merely giving these evidences of a change in the swing of events. An enormous and continued increase of population is, I think, generally taken for granted. As a general fact it cannot be disputed, but its unlimited continuance is a manifest absurdity, for a few centuries of increase like that of the past fifty years would multiply the human race until there would not be standing room. A check is inevitable, and I believe it is already perceptible.

Similarly, we can find reason to expect a check in the growth of cities. This will come from the working out of the present cycle of industrial development. Whenever the perfection of transportation shall have brought all the people to the great cities who can profitably go to them in the pursuit of business or pleasure, the disproportionate growth of those cities will cease. Our greatest cities are already becoming so crowded and so excited that many people who once found them pleasant would be glad to leave them.

My idea is that the most highly civilized, or at least most active industrial nations may be already somewhere near their maximum productivity, although they certainly have not reached it. There are forces in action now which are plainly still adding to the industrial activity of the average man. While I do not pretend to have any special knowledge of mechanical matters, I take no risk in stating that not one of the great systems of power utilization has reached its full development. I mean that a given million people is not yet fully supplied with electric lights, telephones, automobiles, and other comforts and luxuries. To illustrate this I will give one or two specific examples. A classmate of mine is connected with the Boston Edison Electric Co. He told me that in 1896 that company had a total of 200,000 lights on its circuit. In 1908 they were adding lights within the same territory at the rate of 200,000 each year and expected to continue doing so for many years to come. Just think of that! Each year they are adding as many as were added in the whole 20 years after the business began, and that in the most mature city in the country.

The practical gas-engine is barely 20 years old, but in that short time it has revolutionized certain forms of industry and is rapidly revolutionizing, through the automobile, what we may conveniently call neighborhood transportation. It has also made real a dream of many ages, the navigation of the air. But it occurs to me that any specific thing accomplished by the gas-engine is of minor consequence compared with the fact that through it high class machinery has become a plaything. It seems to me this may indicate that with us at least the great cycle of industrial development may be approaching its culmination. Let us dwell on this idea for a moment.

Water-wheels have supplied industrial power for thousands of years, but because no means had been invented for transmitting that power that form of machinery was chained down to certain localities. The invention of electric transmission removed that shortcoming and the power from water-wheels is rapidly becoming more usable. But, generally speaking, the manipulation of electric machinery remains in the hands of the specialist; and certainly up to the present the mass of the people have not been accustomed to use machines driven by water-power. The steam-engine has been in use for about 125 years. Its usefulness has been and is stupendous; but the necessity of providing with each unit a cumbersome boiler has always confined its use to trained specialists. Very few of us have ever tried to run any kind of a steam engine. To be sure the use of both steam and electricity has been gaining ground ever since they were made practical, but, after all, it remained for the gas-engine to bring high-class machinery into the hands of the average man. We may say that the age has arrived when it is as customary for the every day citizen to drive an automobile or operate a pump as it has always been to drive a horse. There is an enormous significance in this fact. Heretofore industrial efficiency has been growing because the use of machinery has been spreading from one class of people to another and from one industry to another. It has been growing because it could spread. When the use becomes universal there will be no such chance to spread. I am inclined to think, therefore, that we are within hailing distance of the time when the highly civilized and creative nations will have put as many power-using devices into the hands of their citizens as they can use. Now, since the principal use of minerals is to provide the means of utilizing power, I argue that the consumption of minerals will reach its maximum per capita amount at the same time.

In order to be understood, I will state the case in concrete form. Every person in the United States uses 600 lb. of iron each year, and uses more each year. I would not like to state a figure of how much each person will ultimately use, for that would be mere guesswork; but we may be sure that the amount will increase at least as long as the percentage of people who run automobiles increases. Since that point ought to be reached in a decade or two, I argue that each person will increase his consumption of iron for that long, but not much longer. For curiosity, let us see what this will mean to the steel business. In 1900 each person used 400 lb.; in 1910, 600 lb. At this percentage rate, by 1920 each person would be using 900 lb.; but suppose that the present decade is the culmination of the great power-using cycle, that the percentage rate will not be maintained and that the amount of iron used by each person increases only by the same number of pounds as during the last decade. We should by this calculation allow 800 lb. per person in 1920. The population of the country by that time should be 110,000,000. The amount of iron manufactured by that time should be about 44,000,000 tons, against 26,000,000 in 1910. Allowing that during the following decade the consumption would increase only 100 lb. further per capita and allowing for the increase of population, the output in 1930 would be 60,000,000 tons.

I am called a crank on statistics and I must try to avoid making myself tiresome. What I am driving at is to put before you some ideas about the prospects of the mining business. One question for a young man to consider is what hopes to entertain. There is no use going into a form

of activity which you do not believe in. I have used the figures just stated because I believe that they give a fair idea of the growth which may be expected in the mining business in the immediate future. It is perfectly fair, even conservative, to expect that the consumption of all mining products will double inside of twenty years. I have had in mind thus far the progress of our country only; let us consider the rest of the world a little.

The active industrial nations constitute today only a fifth, or perhaps a quarter of the human race. We may specify only Great Britain and her English-speaking possessions, Germany, Austria, Italy, France, Norway, Sweden, the Netherlands, and the United States as the really active industrial nations. The rest of the world is not altogether without knowledge of power-driven industry, but its knowledge as yet is only borrowed and its application sporadic. If the whole race used iron as fast as the people of this country the annual consumption of the world would be at least seven times what it actually is. Now I conceive that the industrial ideas of Europe and America are sure to be adopted in some form or other by all other peoples until they become universal, just as agriculture in earlier times must have spread from some source until it became universal. One would be bold indeed to say when all this will be accomplished, for nations and races have an obstinate way of working out their own destinies in their own way, but the events of the past few years contain many striking signs of the stirring up of intellectual life in Asia. The most conservative nations of the world, China and Persia, have broken with the traditions of ages and have not only undertaken to create republics, but China at least has succeeded in its establishment. Turkey and India have shown in different ways a capacity and desire for advancement. In India, for instance, a large steel plant has been started with native capital.

When we come to that word capital we reach one of the stumbling blocks of those nations that are industrially backward. According to many of our advanced labor unionists, capital and capitalism are the source of grievous economic injustices. Perhaps that is true, but whatever evils lie in the existence and domination of capital are surely counterbalanced by benefits that cannot exist without capital. I have lived in countries where there was little or no capital. There was likewise little or no industry, and little or no security, little or no labor, and mighty low wages. Capital is the symptom and the product of good morals, good government, and fair dealing, as well as of energy and natural resources. It cannot exist without general confidence in the integrity and ability of other people. Modern industry is most emphatically co-operative. The business or the enterprise owned by an individual is now a rare thing. The industrial unit is now the corporation, and that is created only by joint action and joint capital. People who are afraid to trust each other cannot form corporations and cannot participate very much in the best efforts of modern civilization. The progress of industry, therefore, in some countries may have to wait until the people prepare themselves for owning capital.

But at any rate there is an immense field for the further development of industry throughout the world. It is a fair presumption that the nations that are ahead now will continue to be ahead for some time. Undoubtedly they will find considerable business in furnishing the backward nations the facilities for making a start. The position of mining with reference to the development of civilization and of industry has been steadily growing and must continue to grow. In our own country we may be somewhere near the point where we have as much mineral wealth per capita as we can find use for, but in the world at large that point is still far off.

FORMOSAN mining statistics for the year 1911 are given in a consular report as follows: Number of mines: gold, 9; gold-copper, 1; gold dust, 27; copper, 2; mercury, 1; coal, 270; petroleum, 39; sulphur, 16. Production: gold, $1,065,400; gold dust, $48,882; silver, $32,525; copper, $264,513; coal, $468,317; petroleum, $3243; sulphur, $22,950.

The Bradley Process

*The plant of the Copper Extraction Co., built near the Washoe plant of the Anaconda Copper Mining Co. by A. C. Burrage and others for the operation of the Bradley process in the extraction of copper, gold, and silver from the slime of the Washoe concentrator, is in operation, but is not yet up to what was expected of it, although it may yet be considered in the experimental stage. However, those who are closely watching the plant claim that it is only a question of time when the process will be giving every satisfaction. The plant was erected at a cost of nearly $300,000 and has a capacity of 250 tons of material per day, part of the plant being capable of handling 500 tons per day.

In the operation of the process the ore is subjected to a carefully conducted roasting operation in what is known as an 'amphidizer,' the copper in the ore being roasted to a sulphate and most of the iron converted into ferric oxide. The finely crushed ore is heated in the amphidizer, which is a rotating furnace, to a temperature of between 450 and 550°C., air being blown in the amphidizer to accelerate oxidation. The roasted ore is next brought into contact with an excess of calcium chloride solution in a reaction drum, which is maintained at a temperature of about 100° C. Cupric chloride is produced by the reaction between copper sulphate and calcium chloride, while any ferric sulphate in the ore coming from the amphidizer reacts with calcium chloride to produce ferric chloride, which is soluble. The calcium sulphate resulting from both these reactions is insoluble and is separated by filtration in the succeeding step. The production of ferric chloride at this point is advantageous in that it dissolves any copper oxide, copper sulphate, or metallic copper which was unaffected in the amphidizer, producing copper chloride, and this ferric chloride also maintains the copper chloride in the cupric state. The gold and silver in the ore is brought into solution by making all the copper into cupric chloride and then adding a small amount of chlorine. The chlorides of silver and gold, being soluble in calcium chloride solutions, may afterward be precipitated with the copper and subsequently separated. After leaving the reaction drum the mass of gangue, solution, and precipitate is subjected to filtration. The solid matter forms a cake which consists of the gangue, except a small amount of iron and alumina which have been taken into solution, and the calcium sulphate precipitate already mentioned. The solution contains the dissolved copper, a small amount of iron and alumina, and any zinc which may have been in the ore; the arsenic will have been separated by filtration, as it has been rendered insoluble.

The solution is then in condition for treatment for separation of the dissolved metals. The precipitation of iron and alumina may be made by cupric oxide, or milk of lime, and as this precipitate will carry some copper, it is returned to the amphidizer. In the amphidizer the iron and alumina in the precipitate are rendered insoluble, while the copper is left in a soluble condition and can be recovered. The solution from which the iron and alumina have been removed is run to a second tank in which the copper is precipitated by lime as oxide of copper. This precipitate is filtered from the solution and the copper is recovered.

The zinc contained in the ore passes into the solution as chloride of zinc. It is therefore necessary at stated times to run the solution or part of it, after the final treatment and before returning it to the reaction drum, to a third precipitator in which the zinc is precipitated by means of lime. Then the regenerated solution, from which the gangue and all metallic compounds have been removed and which contains calcium chloride, is returned to the reaction drum for the treatment of additional ore from the amphidizer, thus completing the cycle. There are over one million tons of slime stored up near the Washoe smelter, and it is increasing, though the company is handling some of the material by briquetting it and treating it in the blast-furnaces. The slime carries about 2¼% copper and about $1 per ton gold and silver.

*Abstract from the *Boston Commercial*.

The Three Giant Producers on the Rand in 1911

By Rowland Gascoyne

A good deal of attention in one way and another has been attracted during the year to the doings of the three giant gold producers of the Rand, and it may not be amiss to compare their results in a short article. Each of these giants has in turn, during the year, in different months, occupied the proud position of the biggest gold producer in the world, when based on their monthly outputs, but it seems doubtful to which of the two leading producers that position will ultimately fall. The Randfontein Mines has held that position for the past six months and has still 350 stamps in reserve, while the Crown Mines has just completed a new mill of 160 stamps and crushes higher grade ore than Randfontein, so that it is by no means a foregone conclusion as to which of these two concerns will hold the coveted position in the immediate future. The East Rand Proprietary Mines can scarcely be expected to again aspire to first place in the face of the latent growing powers of the other two companies, but at all events, for many years to come, it should make a creditable third.

Taking the total gold recovered during 1911 as the index to the position of the company, their relations will stand as shown:

	Crown Mines.	East Rand.	Randfontein.
Tons milled	1,618,500	2,194,552	2,159,033
Total value of yield	£2,831,625	£2,784,882	£2,661,280
Value per ton	35s. 0d.	25s. 4½d.	24s. 7d.
Cost per ton	19s. 0d.	16s. 8½d.	16s. 8d.
Total profit	£1,271,106	£956,621	£849,241
Profit per ton	16s. 0d.	8s. 8d.	7s. 11d.

Perhaps the most remarkable feature of the above table is the exceedingly narrow margin in the total value of gold recovered separating the three companies, but it ought in fairness to be pointed out that the Randfontein did not start its mammoth mill of 600 stamps until March.

It will be noticed that with the exception of the total tonnage crushed, the Crown Mines is ahead of its two near competitors in its gold output, costs, and profits. Naturally its higher output of gold and profits are due to the better grade of the ore and high extraction. The consulting engineer explains that the working costs of the year are high on account of capital expenditures incurred during the year. It is difficult in the absence of further explanation to understand why this is so, unless it is meant that these extensions require unskilled labor which otherwise would be used for revenue-producing purposes. At the East Rand Proprietary Mines it transpired that as soon as the extension ceased, the working costs advanced, because then the true position had to be faced. Standing charges could no longer be allocated to capital outlay, as is often done when capital outlay and revenue expenditure run side by side. At the Crown Mines it almost seems as though the reverse effect was claimed. It must be pointed out that generally on the Rand, as elsewhere, high costs usually accompany high-grade ore, but at the Crown Mines, ever since the consolidation and the huge capital expenditure was undertaken, working costs have been steadily rising above the average of the individual companies prior to the amalgamation. When, however, the main 13th level is finished throughout the property, the hoisting and haulage arrangements completed,

CASON G. M. CO., EAST RAND PROPRIETARY MINES.

and the underground and surface operations concentrated, a material reduction in the working costs is expected.

It is difficult to realize the huge scale upon which the Crown Mines will be ultimately worked. It is an amalgamation of half a dozen mines, stretching three miles from east to west, and has, in addition, such a considerable area to the dip, proved and unproved, that the resources are impossible to estimate with any degree of accuracy. Its milling equipment consists of 835 stamps; a new mill of 160 stamps having been recently erected. The profitable ore reserve at the end of the year stood at 10,124,072 tons, of an average assay value of 7.25 dwt. over 62½ in. There were seven main hoisting shafts on the property at one time, but these are being reduced to two; No. 5 with an equipment capable of hoisting 6000 tons per day of single shift, and No. 7, equipped for an output of 5000 tons. These shafts are connected with the different mills by an elaborate system of electric railways. The construction program and extension will probably be finished soon after the middle of the current year, and huge as the ore reserves are, they are none too great when once the hoisting and milling equipment gets into full swing. When compared with the previous year the average working costs show an increase of 1s. 2d. per ton, an increase which the general manager attributes to closer sorting, higher charge for development and sand-filling, and not to the influence of capital outlays as maintained above.

With regard to the East Rand Proprietary Mines, it is difficult to know what to say, as so much has been said regarding the affairs of this concern during the past six months. If the figures shown above are reliable—and they are as trustworthy as the staff can compile—they show a remarkable similarity to the Randfontein figures for 1911 in tonnage milled, grade of ore, costs, profits, and even in the profitable ore reserve. The superintending engineer has made a report on the year and shows that 820 stamps were at work, crushing 2,194,552 tons, representing a duty per stamp per 24 hr. of 8.23 tons, a screen value per ton of 6.579 dwt., and a yield of 6.054 dwt. The actual extraction is quoted as 83.9%. The cost of mining is given at 8s. 3.7d.; development, 3s. 1.5d.; reduction expenses, 4s. 8.8d.; general expenses at mine and head offices, 5.9d.; total working cost for 1911 equalling 16s. 7.9d. per ton, as compared with 15s. 6.4d. in 1910. The working costs have somewhat increased per ton of late, owing to a revision of figures of tonnage treated and the stopping of development and capital outlay, thus throwing all the cost upon revenue. The general superintendent points out "that the method previously adopted by the management to secure cheap tonnage by milling rock of low grade is being changed for a policy of eliminating as far as possible from mining operations all ore of an unprofitable grade. 'This will tend to restrict tonnage and increase working costs, and must ultimately result in increased profits to the company." There can be no two opinions about the general soundness of this new policy, but on the Rand low-grade ore has sometimes to be mined to get at that of a higher and profitable grade, while the raising of costs at the East Rand has thrown 4,000,000 tons out of the profitable ore reserve and also materially increased the cost per ton. There are so many million tons of ore near the profit limit in the East Rand that the mines are not all suited to what is known here as the policy of selective mining. The ore of high grade is limited, and the salvation of the East Rand would seem to be low tonnage-costs coupled with wholesale mining and close sorting. As a proof of this assertion, it may be pointed out that whereas, under the present inflated working costs, the profitable ore reserve on December 31 last was estimated at 6,716,605 tons of an assay value of 6.9 dwt., over a stoping width of 55 in., there is another 11,0000,000 tons of lower grade, one-half of which would be profitable were working costs brought down to a reasonable level. In estimating the profitable ore reserve, the superintending engineer raised the profit limit from 3.1 dwt. to 4.3 dwt., whereas at Randfontein, with almost the same grade of ore and working costs, the profit limit of some of the ore reserves is taken as low as 2.832. While it is generally recognized that all the trouble at the East Rand during the year was due to inept management, its effects have been somewhat exaggerated, and advantage has been taken by the new management of the old position to make the future more easily adapt itself to their estimates.

The Randfontein Mines, although the least in area of the three properties considered, owns over 2600 English acres. During the year 745 stamps were at work, and it is expected that the present year will enable the others to be started, thus bringing the total number of stamps up to a thousand. The estimated ore reserve at the end of the year was taken at 6,637,271 tons, of an average assay value of 6.6 dwt., of which 5,658,859 tons assayed 7.29 dwt., the remainder assaying only 2.8 dwt. per ton. As an instance of the amount of development carried out during the year, the footage totaled 87,541 ft., of which 1747 ft. represented shaft-sinking. Despite this large amount of work, the property as yet is far from being excessively developed. The Randfontein is a compact self-contained property, possesses its own power-station, and seems likely to continue to make a strong bid for the position of premier gold producer of the world; a position, be it noted, it has already held for the past six months.

It may be interesting to notice that these three concerns produced practically a fourth of the whole of the gold output of the Rand last year, although the Randfontein did not start its huge mill until March of that year. These large Rand mergers were expected to materially reduce the costs of working, and especially of administration. At the Crown Mines the costs have gone up by several shillings per ton. The following figures speak for themselves on this matter:

COSTS OF WORKING PER TON MILLED

	Crown Mines.	Rand-fontein.	East Rand Proprietary.
Mining and development.	13s. 0d.	12s. 0d.	11s. 5¼d.
Ore treatment	4s. 3d.	4s. 3d.	4s. 8¾d.
General mine and office..	1s. 9d.	0s. 6d.	0s. 6d.
Total	19s. 0d.	16s. 9d.	16s. 8d.

There can be no doubt, however, that when the whole of the milling plant at the Crown Mines gets to work, the new equipment finished, and the cost divided into a larger tonnage, the costs of administration per ton milled should witness a decline.

THE Crown Reserve M. Co. has become involved in some rather interesting litigation growing out of the transactions occurring when the company was organized. The properties were secured from a syndicate, to each of whom individually certain allotments of stock were made. In addition to the issue of stock to the individuals a block of 570,000 shares of stock was set apart to be used by the directors as working capital, and to be disposed of as might best advance the interests of the company. Out of this amount of stock 390 shares have been sold and the syndicate has now come into court to compel the conclusion of the trust, whereby these shares were held, and the distribution of the residue of 231,000 shares pro rata among the members of the original syndicate, the claim being made that the mine is fully developed and the reason for the original trust agreement no longer exists. The company denies the claim of the syndicate members to this stock, and also contends that the stock so put in trust should be held to meet the possible treasury needs of the company in the future, and that this is true, notwithstanding that just at present the Crown Reserve is in a flourishing condition. It will be somewhat interesting to have a judicial determination upon the point as to when a mining property is fully developed.

CANADIAN exports last year amounted to $303,763,328. Breadstuffs and provisions are the principal items of export, but to the United States the chief exports are minerals and metals and wood for paper pulp.

Genesis of Silver-Lead Ores in Wardner District, Idaho—III

By Oscar H. Hershey

(Concluded from page 786.)

Alhambra Type

In the eighth system I place the Alhambra and Upper Cate faults, great reverse faults that resulted from a strong thrust from the southwest, a repetition of the conditions under which the fourth system was formed. It also includes the Gus fault. The displacement on the Alhambra fault is at least 3600 ft. The fault is accompanied in places by lenses of a peculiar, very fine-grained ore, consisting of finely-sheared quartzite cemented by quartz, siderite, pyrite, very fine-grained galena, and probably sphalerite. One lens is described as 60 ft. long and 6 in. to 3 ft. thick, and another 30 ft. long and 4 to 5 ft. thick. Assays have yielded as high as 30% lead; generally there is 1 oz. silver to each per cent lead. This type of ore is probably confined to the narrow zone of severe shearing accompanying the Alhambra fault.

Bunker Hill Type

The most characteristic feature of the Bunker Hill mineralization is the scarcity of pyrite. The orebodies consist of a breccia of quartzite fragments cemented by siderite and galena, with a small number of white quartz seams, the latter often younger than the galena. Small quantities of chalcopyrite, tetrahedrite, and pyrite present may belong to earlier stages of mineralization; this certainly is true of the rare blende. The Bunker Hill type is genetically connected with the Upper Cate fault. It was the compressive stress that produced the Upper Cate thrust with a displacement of over 2700 ft. that gave rise to the ascending currents of water in this stage. The chief development is in the March ore-shoot. This is clearly and definitely related to several structural features. It occurs chiefly in the roughly triangular block of Upper Burke quartzite that is bounded by the Upper Cate, Sullivan, and Flint faults (the latter, in a faulted condition, extending to the Upper Cate). Its position in this block seems to have been controlled by the locus, on each level, of a certain brittle white quartzite; hence, it wanders about somewhat. It never passes below the Sullivan fault nor above the Upper Cate fault, but on certain levels extends a short distance below the Flint fault. The Lower Cate fault has cut through the ore and dragged some of it down to a lower position; on this account, on certain levels, the shoot is largely in the inter-Cate zone. It has been traced from the surface to Bunker Hill No. 12 level, a distance on the pitch of 3150 ft. It is the greatest ore-shoot in the Wardner district and has produced to date over 1,675,000 tons.

From a point below Bunker Hill No. 8 level to No. 12 level, an arm extending along the Ikey seam southeastward from the March shoot had produced about 248,000 tons up to June 1, 1910. Another Bunker Hill ore-shoot came to the surface in the Scrafford open-cut; the original discovery of lead ore in the district was made on it. Before the Lower Cate faulting it was merely a northwest wing to the March shoot, with which it merges in depth. The total production has been about 378,000 tons. The Stemwinder shoot has probably produced 275,000 tons. The East Tyler is another Bunker Hill shoot. These three shoots I regard as due to branch currents which left the main March current and made their way up between the Upper Cate and Sullivan faults on much steeper courses. As they rose, the solutions spread and made larger ore-shoots. The total production of ore of Bunker Hill type has been over 2,584,000 tons. This is significant, in view of the fact that it represents the latest important ore mineralization in the district, a stage succeeding a complex series of faultings and associated mineralizations. Its ore-shoots converge in depth into a sort of chimney whose site is controlled by the Flint fault because that is the line along which the block being upthrust by the Upper Cate faulting dropped over the edge of hard quartzite on to more easily fractured Upper Burke quartzite. As far down as the structural relations remain the same, we can expect considerable Bunker Hill ore in this vicinity.

Jackass Type

The Jackass, the only reverse fault in the ninth system, with a displacement of at least 3200 ft., has a breccia which, on the Jackass claim, has been largely cemented by seams, and pockets of quartz and limonite that yield

JACKASS FAULT.
(Photo by W. J. Elmendorf.)

a little lead and silver by assay. This is the latest lead mineralization, so far as I can see, in the district. It may have been derived from the bands of disseminated lead and zinc ore that come up under the Jackass fault in the vicinity. The great normal faults of the ninth system are the Osburn with a probable displacement of 10,000 ft., the New Era proper with a displacement of 5000 ft., and the Lower Cate with an apparent displacement of 800 ft., more or less. They cut the earlier faults and veins into fragments which they dragged so far apart that it is difficult to correlate them. Many faults of comparatively small throw belong to the system, including the Taylor, Howard, Omaha, Switchback, Nellie, Dull, Arizona, and Keating, but being post-mineral they are of no importance in this discussion. The age of the Tyler, Flint,

Kellogg, Presley, Schofield, Bee, Hornet, Sandow, Silver, Hoffman, Kirby, and Silver King faults is not known with sufficient definiteness to warrant giving them place in the nine systems, but some of them have played important parts in the mineralization of the district.

Relative Importance of Mineralizations

In the early part of 1911 I estimated the production of the Blue Bird type in the district as over 2,515,000 tons, the Jersey type over 831,000 tons, and the Bunker Hill type over 2,584,000 tons, a total of over 5,930,000 tons of ore. In the future the Bunker Hill type will greatly predominate for a number of years, but if the Hatton, Roberts, and Fan shoots that have been sliced off at depth by the Upper Cate fault be picked up under the Lower Cate fault as I expect, the Blue Bird type will gradually regain its standing. The most notable change will be a great increase in the importance of the Jersey type.

General Discussion

In the Coeur d'Alene district, three things have been necessary in the making of an orebody, namely, a source for the minerals, a fissure, and a cause for the movement of water along the fissure. F. L. Ransome[3] argues that the ores have been derived from considerable depth and precipitated from ascending solutions that were hot and under high pressure. In the Wardner district the distribution of the lead mineralization in at least two stages, the Blue Bird and Bunker Hill, points distinctly to ascending solutions that spread out fanwise as they made their way up through the rocks. For instance, in the Motor system of orebodies, descending solutions would hardly have left the Phil Sheridan mineralization and become confined to small seams under that zone. A lateral movement of the water is out of the question on account of the many fault gouges that it would have to pass through. The occurrence of the ore in shoots that descend to great depths proves that, whatever may have been the initial direction of movement of the water, it was deflected by the faults to a parallel course, either up or down. Deposition from descending water would imply more or less 'secondary enrichment' in the sulphide zone, of which there is absolutely no evidence. Enriched ores due to the influence of proximity to the surface can be found locally in the district, but only in the zone of oxidation, and then only on the sites of the original veins. I have been surprised at the scarcity of lead in crevices of the rock north of the vein zone, the first mile of which must at one time have been overlain by the vein zone containing millions of tons of lead. One would expect the meteoric waters to carry more or less of this lead down into crevices of the underlying crushed quartzite, and it is a remarkable fact that almost nothing of the kind can be found. The Wardner sulphide ores extend unchanged to too great depths to be due to the secondary enrichment process. The Blue Bird type before the Cate faulting had a known vertical range of at least 3250 ft. Before the formation of such great faults as the Osburn and New Era, which are younger than practically all the ore in the Wardner mines, the bottom of the valley of the South Fork of the Coeur d'Alene river was at least as high in the strata as the top of Kellogg peak; in other words, Blue Bird and Jersey ores found on Bunker Hill No. 12 level were, at the time of their formation, at least 5800 ft. below the surface, far too low to be within reach of descending meteoric waters capable of depositing sulphides. Since the ore deposits on the south side of the Osburn fault were formed they have been dropped at least 8600 ft. by the Osburn fault, those south of the New Era fault at least 3200 ft. additional, and the orebodies of the inter-Cate zone at least 225 ft. additional, by the Lower Cate fault. Thus there is evidence that the range was originally over 13,000 ft. The ore in the Murphy stope on Bunker Hill No. 12 level must have been deposited at least 11,000 ft. higher than the ore on the main tunnel level of the Senator Stewart mine. This ought to effectually dispose of all theories of the origin of the minerals involving descending solutions.

Mr. Ransome is disposed to regard the faulting of the Coeur d'Alene district as in some way related to the intrusion of the great quartz-monzonite batholith of central Idaho, whose northern extension he considers may underlie the district with a very irregular surface, permitting some of the higher points to appear at the present surface in small areas extending from Two Mile creek to beyond Prichard creek. It is true, as he argues, that after the monzonite masses, as we see them at the present surface, had solidified, the deeper portions of the magma may have remained fluid for a very long time and may have continued to disturb the overlying strata, but it seems to me unlikely that no dikes of monzonite would have penetrated along some of the faults to the present surface. My impression is that he did not attach sufficient importance to the wonderful complexity in the faulting of the district and how it may be generalized into distinct systems, due to forces of different nature and certainly representing a very long period of time. It seems to me unlikely that the magma continued to be active to as late a period as the formation of the Upper Cate fault. I have the same objection to his idea that the ores were formed by solutions that continued to emanate from the deeper portions of the magma long after the arms that reach the surface had solidified, namely, that the ascending solutions continued too long, as proved by the relation between the orebodies and the structure, to be reasonably referable to the action of the same magma. I attribute the disseminated zinc-lead mineralization in the Wardner district to magmatic waters expelled by the monzonite batholith, and I think the influence of the heat of the batholith may be seen in the Sullivan pyrite dissemination, but all the ore-making mineralization I believe to have originated in a different manner. Without any very important exception, the ores of the Wardner district are genetically connected with the reverse faults. One reason may be that normal faulting made stronger gouges than reverse faulting, and gouges were distinctly inimical to the deposition of mineral; but I think the principal reason is that the compressive stresses necessary to make great thrusts forced the waters universally present in the rocks at great depth to ascend to the surface. No magma is required, for the initial heat of the water, intensified by compression of the rocks, would satisfy the chemical requirements.

Mr. Ransome attributes the origin of the lead and zinc in the Coeur d'Alene district to the monzonite magma. He says: "Some of the sulphides were deposited at once in the contact zone simultaneously with the development of magnetite, pyroxene, garnet, biotite, and other contact minerals. * * * The greater part of the sulphide of lead and all the ferrous carbonate traveled farther through the fissured sediments and under suitable conditions of temperature and pressure attacked and replaced the quartzite rocks." Lack of space will not permit me to fully discuss this subject, but I want to say that I am seriously considering the idea that the source of much, if not all, of the lead and zinc in the district has been in a comparatively thin band near the top of the Prichard slate formation. They may have been precipitated with iron carbonate and pyrite at the time of the deposition of the fine carbonaceous mud that has been altered into the Prichard slate; or the metals may have been derived with the sediments from the land area. It is significant that the lead prospects in Prichard areas are all rather high in the formation. Sphalerite is usually a notable constituent. In the Canyon creek group of mines sphalerite seems to become more abundant as the monzonite area is approached and also as depth is attained, but both of these directions happen to coincide with the approach to the Prichard slate. Though not noticeable as yet in the Wardner mines, throughout the Coeur d'Alene district an increase in the sphalerite content of the ores is supposed to be a function of depth; this does not vitiate the statement that throughout the district sphalerite, as an important con-

[3]Professional Paper No. 62, U. S. Geol. Surv., 1908.

stituent of the commercial ores, is limited to a particular stratigraphic horizon, namely, near the top of the Prichard formation. It seems to me this must be more than a mere coincidence; also, that it is hardly compatible with the idea of a magmatic origin for the deposits. If the upper part of the Prichard were the gathering ground, deposition would not extensively occur until a higher horizon was reached, explaining why 99% of the lead has come from veins in the Burke and Revett formations. When the solutions started at the Prichard slate they were richly laden with the elements necessary to deposit sphalerite, but they lost the zinc faster than they did the lead. The disseminated zinc and lead deposits in the Wardner district are among the few examples of a high zinc ratio

PART OF IDAHO.

in mineral deposits in Revett quartzite. The waters were under such intense pressure and heat that they were able to carry much of the zinc higher than usual. It is to be noted that the Cataldo quartzite areas are notably barren of lead and zinc deposits, though doubtless also underlain by the monzonite batholith.

I do not consider the problem solved beyond any doubt, but I believe that Mr. Ransome's magmatic theory and my theory of the minute dissemination of lead and zinc in the upper portion of the Prichard slate and possibly some of the Lower Burke quartzite, exhaust the possibilities in so far as the Wardner district is concerned. We may, therefore, expect the lead, zinc, and associated silver to continue down to the Prichard formation, or until the sediments are cut off by the presumed monzonite batholith. Without a radical change in the structure with depth, the ore deposits may continue to an almost incredible depth. The great Blue Bird ore-shoots are, with depth, slowly advancing stratigraphically upward in the Lower Revett quartzite. The March ore-shoot, for a distance of 3150 ft. on the pitch, has nowhere departed far from one band of white quartzite near the top of the Upper Burke. The Jersey and 'N' veins are advancing to higher stratigraphic horizons with depth, and the Caledonia vein may remain in Upper Burke rocks to a very great depth. In short, the danger that menaces the mines of the Canyon Creek group, the danger of reaching the Prichard slate, need not be feared at all in the Wardner district. Through studies of the post-mineral faulting I have determined that the danger of the ore-shoots being cut off by the monzonite at a depth attainable by mining is very remote. Furthermore, if my theory of the origin of the lead and zinc minerals be correct, the known disseminated lead and zinc deposits above the Buckeye fault are probably at least 11,000 ft. above their source, the latter being at least 8800 ft. deeper than Bunker Hill No. 12 level. The only apparent serious menace to mining in general lies in the tendency of the ore-shoots to converge with depth. However, I have no fear that the principal company operating in the district will not find commercial orebodies of no mean size at the depth of at least a mile below its present deepest level.

Briefly summarized, I favor the theory that the lead, silver, and zinc minerals of the Wardner district were originally disseminated through certain bands of the Belt sediments; were first concentrated into the visible disseminated zinc and lead deposits through the action of the heat and probably water emanating from a monzonite magma; and were then concentrated into commercial orebodies by hot waters that were forced to ascend by the compressive stresses that produced the thrust faults, these thrusts opening the fissures in connection with which the ores have been deposited. The ores of each successive stage have probably been derived in part from those of earlier ore-forming stages, in part from the visible disseminated deposits, and in part from the original minute disseminations in the sediments.

The Silver Market

There is a noticeable tendency among the followers of the metal markets in Eastern financial centres toward silver as a medium of speculation. The situation in copper is such that, while the market is looked upon as fundamentally sound, it is at the same time admitted to be in the hands of producers and held with so much strength as to overcome for a time the law of supply and demand. The markets in other metals are receiving more than their usual share of attention. Silver is higher now than it has been at any time during the past several years, and the situation in the Far East furnishes a basis for speculative action. The large loan that is to be made to the new Chinese Government is one of the features receiving attention, and if the negotiations are carried to a favorable conclusion the result will be a largely increased demand for silver. For some months the leaders in the market for silver bullion have been paying a great deal of attention to the condition of the treasury in India, and the approaching necessity of the Indian Government to resume the purchase of silver for coinage. In addition to the increase in demand from these sources tending to make for higher prices, there is liable to be some curtailment of output. The production from Cobalt is decreasing, rather than increasing, and may be expected to decline in a greater ratio as the various properties near the limit of production. The Mexican situation makes also for curtailment. The labor situation in Mexico is as bad as the political situation; in fact, the two are so intermingled that it is sometimes hard to tell which element predominates. There has been a great deal of discussion concerning the imports of gold into British India, and not a little emphasis has been laid upon the tendency of people in India to convert their savings into bullion, in a form that will admit of its being carried about on the person and the possibility of an enormous amount of yellow metal being withdrawn from the monetary supplies of the Western nations by this means. The most recent reports indicate, however, that there has been a lessening of the demand from India, but it is still considered by some of the best authorities a very important question when considering the industrial needs and the requirements for circulation by American and European countries.

VLADIVOSTOK is 7443 miles from London, and the distance can be covered by the Siberian railway route in 11 days. The trip from Peking to London is made in 12, but when the proposed cut-off from Kalgan to Khiakta is constructed the time will be reduced to 9½ days.

Small Concentrating Mills in the Wisconsin Zinc District

By W. F. Boericke

The economic conditions in a mining district will largely control the means used for concentrating the ore. Many of the small zinc mines of Wisconsin are worked on a small scale by lessees with limited capital, and milling methods are the outcome of experience. Lack of capital, as well as lack of the technical knowledge necessary to build and operate a mill of large capacity, have held back the lessees, and the mills, therefore, are of nearly uniform type: small, light, low in first cost, low in operating cost, and capable of being run successfully by ordinary labor. The fact, moreover, that the lessees do not actually own the land, and hence are obliged to pay a royalty to the owner, tends to make them wary of sinking a large amount of money into a plant that, once their mine plays out, is usually only so much junk. Leasing seldom makes for the best development of the mine, as the tendency is usually to look only for high-grade ore, and prospecting and working of low-grade ore is either neglected or minimized. In Wisconsin a mill of 50 to 75-ton capacity per 10-hour shift usually satisfies the operator.

The ore mined is mostly sphalerite, or 'jack,' as it is universally known, and occurs in a peculiar pitch and flat formation which I believe is unique. The geology of the field cannot be discussed here; an excellent description is given in Bull. 9 of the Wisconsin Geol. Nat. Hist. Surv., and Bull. 294 of the U. S. Geol. Surv. Along with the jack is found

for Wisconsin, as given by the United States Geological Survey, are below, in percentages:

	1909.	1910.
Total concentrate in crude ore	10.8	9.7
Lead	0.7	0.5
Zinc	10.1	9.2
Metallic content	4.3	3.6
Lead	0.5	0.4
Zinc	3.8	3.2
Average zinc content of sphalerite concentrate	37.6	34.8
Average lead content of lead concentrate	79.3	78.7

It will be noted that the metallic content is considerably higher than that reported from Joplin, in both the soft and the sheet-ground. The lead is non-argentiferous, and the zinc is free from cadmium. Zinc concentrates usually carry a little lead, which the jigs are not able to clean entirely. No doubt were tables used generally in the district, a cleaner product would result, but they are rarely seen. A typical assay of the concentrate of a well known mine is:

	Per cent.
ZnS	61.6
FeS_2	28.3
PbS	0.7
$CaCO_3$	4.4

The remainder, 5.0%, includes silica, magnesium carbonate, and alumina, in varying amounts.

The ore occurs in the so-called galena limestone, a granular crystalline dolomite of varying hardness. In general, it

District.	Ore.						Metal content.			
	Lead concentrates.		Zinc concentrates.							
	Galena.		Sphalerite.		Carbonate.		Lead.		Zinc.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Benton	991	$52,985	32,453	$546,872	131	$2,454	779	$70,110	7,346	$837,444
Cuba City-Elmo	601	32,375	2,185	52,909			483	43,470	773	88,122
Dodgeville	70	3,880	263	7,084	60	1,080	60	5,400	126	14,364
Hazel Green	547	25,405	20,632	417,098			380	34,200	6,300	718,200
Highland	206	11,108	81	3,013	4,784	69,235	150	13,500	1,273	145,122
Linden	205	10,286	8,317	124,487			154	13,860	1,923	219,222
Livingstone	181	8,365	7,987	155,497			129	11,610	2,410	274,740
Mifflin	477	27,507	6,720	181,882			378	34,020	2,569	292,866
Mineral Point	40	2,000	684	9,614			30	2,700	167	19,038
Montfort	155	8,228	1,567	28,528			118	10,620	452	51,528
Platteville	268	13,288	12,748	395,425			200	18,000	5,338	608,532
Shullsburg	618	34,038	326	6,714	60	1,374	492	44,280	97	11,058
State, total	4,359	229,465	93,963	1,929,123	5,035	74,143	3,353	301,770	28,774	3,280,236
1910	5,608	286,493	89,232	1,750,574	5,269	69,588	4,413	388,344	25,927	2,800,116
1909	4,659	254,514	65,421	1,505,752	5,130	63,603	3,694	317,684	23,152	2,500,416

PRODUCTION OF LEAD AND ZINC IN WISCONSIN IN 1911, BY DISTRICTS, IN SHORT TONS.

closely associated considerable marcasite and calcite, or as the miners put it locally, 'sulphur and tiff.' Above the jack, in the so-called 'top flat,' is found 'dry bone' (smithsonite) and galena, which were extensively worked in the early days. It is, of course, the object of the millman to keep these products separate; a mixed concentrate of dry bone and jack being objectionable to the smelter. In some mines of the district this is nearly an impossibility, and this naturally interferes greatly with successful work. Fortunately, the 'jack' deposits are usually considerably below the 'bone,' and they can thus be mined separately.

The district, speaking generally, does not produce high-grade ore, nor does the mine-run rock, even after sorting, make a high-grade concentrate. Very few mines ship a product assaying more than 50% zinc. Even 40% is usually considered high grade, unless the ore has been roasted. Here at once is seen a striking difference between the Wisconsin field and Joplin, where 60% ore is the rule rather than the exception. The average of the Wisconsin field would probably be between 35 and 40%. The official figures

breaks clean from the mineral. This important point makes coarse crushing possible and reduces the sliming materially, as the rolls and crusher may be set wider. There is, of course, a maximum size where the limestone is not broken from the jack, but the usual tendency is to go to the other extreme, and crush finer than necessary, with heavy loss in slime. The marcasite and jack are often so closely associated that they are not separated by the rolls, but stay together as one piece, even in the finer sizes. This makes little difference, as, if the former is there, it will come out with the jack in any case on the jigs. Of course, if the ore is to be subsequently roasted, it is important that the two should be separate.

The mills are usually spoken of as having a capacity of so many tons per 10-hour shift—50, 75, or 100 tons. The figure is somewhat misleading. It is possible to crowd the ore through a mill so as to almost double a stated capacity, the limiting factor being where the loss in tailing exceeds the increased economies of operation, or to put it otherwise, where the loss of zinc per ton of tailing is greater

than the decrease in cost per ton of ore milled. The practical limit is a matter of experience, and must be decided by the operator. If the ore is rich—and by richness is meant high in percentage of concentrate in the ore, regardless of whether the concentrate be zinc or iron—a smaller tonnage can be put through than of an ore carrying only a low percentage of concentrate. The ideal ore from a milling standpoint is one in which the entire metallic content is a valuable mineral, but such an ore is rare in Wisconsin, where the marcasite and jack are so closely associated.

Speaking generally, the tendency in the field is to put too little rather than too much through the mill. Millmen usually have preconceived ideas of how much a mill can take, and to educate them out of the rut takes time. It is needless to remark that they invariably minimize a mill's capacity. Larger tonnage with the same crew—which should be the case—means more work and close attention all around—elimination of the little stops and hitches that hold up a mill, and in the total these amount to a surprising proportion of the shift. It is only natural that they prefer the easier course. For an operator who wants to increase the

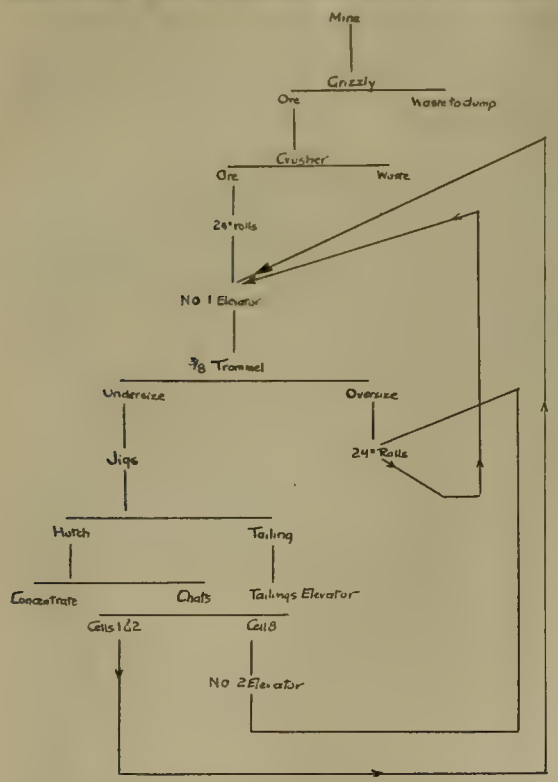


FIG. 1. FLOW-SHEET, 50-TON MILL, 8-COMPARTMENT JIG.

tonnage through his mill there is only one thing to do—go ahead and try it, watching for free mineral in the tailing, and checking by assays. Only in this way can he get independent data. It may be said that the dirt may vary from day to day, one shift's run being much richer than the next. This is true, but it is probably better to risk a little undue loss in the tailing for a day or two and 'clean up the hopper,' than to disrupt the whole system and disorganize the work. Once such disorganization is started, it is easy to find excuses to continue it, and the irregularity will affect not only the mill, but the mine as well.

The labor needed for an ordinary zinc mill in Wisconsin will be about the same regardless of the tonnage milled. The following are usually employed, at the wages stated, per 10-hour shift:

1 millman, or jigman	$3.00
1 helper, or mill 'backer'	2.25
1 crusher-man	2.25
1 grizzly-man	2.25

The millman is held responsible for the successful running of the mill and has authority over the others. He should be a fairly good mechanic, able to make minor repairs and adjustments to the machinery, line shafts, repair jigs, and, in short, he must keep the mill running. He must understand how to treat the ore and get the largest economical extraction. While the mill is in operation, he watches the jigs, sees that the beds are right, attends to drawing off the concentrate, and generally keeps a watchful eye on the entire operations. His helper does the heavy manual work—shoveling concentrate into the car or barrow and working on repairs under his direction. The crusher-man works only on the rock-breaker. In one case I have seen him sort waste from the feed as it comes from the bin and throw

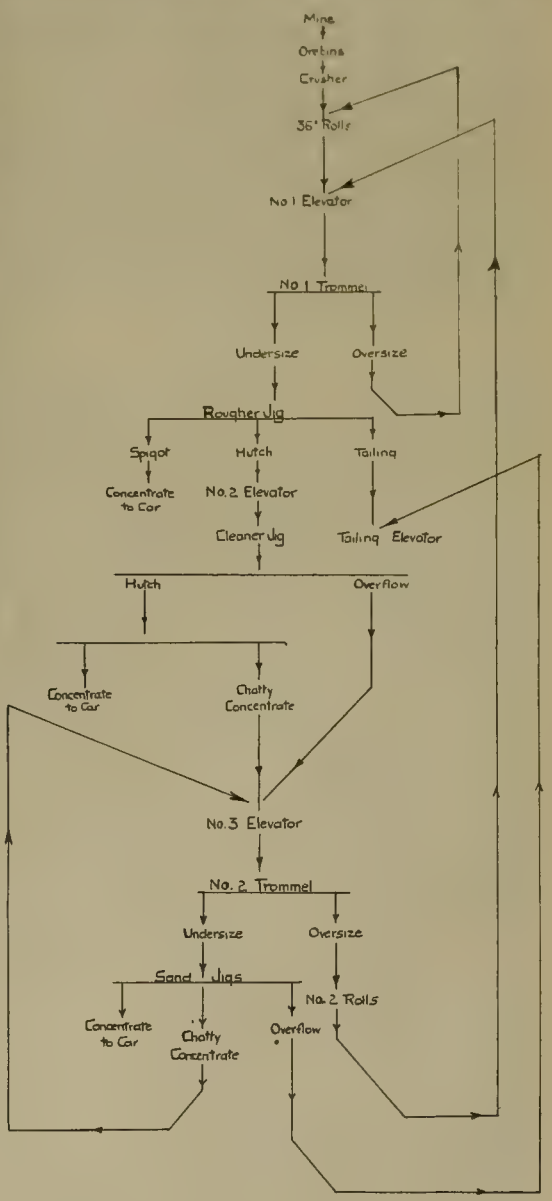


FIG. 2. FLOW-SHEET, 150-TON MILL.

it into a car, but this is not usually expected of him, and is doubtful practice. The grizzly-man breaks the larger lumps of rock to breaker size, and usually throws aside the waste into a car, which he runs over a dump. If only a small tonnage is hoisted, and the rock is pretty well broken underground, he can attend to both duties without trouble. Otherwise a carman helps him.

The equipment of an ordinary 50-ton mill consists of grizzly, crusher, rolls, trommel, elevators, and jigs (see Fig. 1). On account of the general flatness of the country, gravity mills are rarely seen. Bucket elevators are used to

lift the mill-feed from one point to another. A mill of the above description, with one set of 8-cell jigs, costs approximately $10,000 to build, and takes about 90 days.

Tables are not commonly found. They have not thus far proved successful in making a clean separation of the limestone and jack in the finer sizes, but experimental data are lacking. No doubt tables could be devised to treat the finer sizes successfully, but this would mean closer sizing and more careful work generally throughout the mill. It is questionable if this would pay, considering the small size of the mills and the low grade of the resulting product. Instead of tables, sand-jigs are used in some mills to save the fine (see Fig. 2). These take the re-crushed product from the finishing jigs which might otherwise be carried over and sent to the tailing elevator. By adjusting the spigot taps, the concentrate may be drawn out as fast as desired, and either sent to the bin, or, if not sufficiently clean, back to the rolls, and so over the jigs once more.

The jigs are of the familiar Harz type, such as are common at Joplin. Sieves are either round-punched or slotted. Those with round holes are more common, but one operator reports that the slotted sieves last longer. The sizes vary according to the general scheme of crushing, whether coarse or fine. The sand-jigs usually have several 1 16-in. cells. A general arrangement in a mill crushing to medium size, stated in fractions of an inch, is:

	Cell No.					
Jig.	1.	2.	3.	4.	5.	6.
Roughing	¼	⅜	⅜	5/16	5/16	3/16
Cleaning	⅛	3/16	¼	3/16	3/16	⅛

The lead is drawn from the first cell of the roughing jig when there is but one set of jigs, or the first cell of the cleaning jig when there is more than one set. The scheme of treatment of a larger mill is shown in Fig. 2. A variation of treatment, common in the smaller mills, is to draw off fine iron sulphide, known locally as 'sulphur sludge,' from the third cell, from a 5/32-in. sieve. This product is sold subsequently to an acid works, and brings a few dollars per ton. Payment is made only for the sulphur content. It is believed that by this the grade of the zinc concentrate is raised. This so-called sludge carries 8 to 12% zinc, which, of course, is lost. The practice is of doubtful value, but where the mine is not equipped with a roaster, and is distant from a railroad, it may pay. It is also generally easier to sell high-grade than low-grade ore, and storing concentrate while waiting for buyers is an expensive operation.

The concentrate is drawn off from the jig cells through the hutches and also from above the sieves, through ordinary molasses spigots. In the latter case, the millman watches the product closely, to see that it has been properly cleaned before being run into the car. This plan provides for the larger sizes that might not pass readily through the sieves, and saves the trouble of regrinding the coarse concentrate, with attendant loss. Where the dirt is rich and easily cleaned, the millman will sometimes shovel directly from the top of the jigs to the concentrate car.

The water needed for the jigs, elevators, and rolls about the mill is considerable. Usually the mine-water pumped is utilized, but it seldom is sufficient, and must be re-used, after having been through the mill. Most mills have a pond or reservoir near by, for storing the water pumped during the night, and serving as well for a settling pond. Centrifugal pumps are used for pumping from the pond to the jigs, a common size being the 4 inch. The amount of water needed for a 50-ton mill varies with a number of conditions. For ordinary ore, through a ⅛-in. trommel screen, perhaps 300 gal. per minute would be sufficient for an 8-cell jig. The amount increases with the number of jigs. Clean water is highly desirable, as water carrying slime invariably increases the amount of lime in the concentrate, coating it with a thin film. If 10 tons of water is used for every ton of rock milled, the amount will not be far wrong.

Water is also used on the grizzly for cleaning the mine rock as it comes up, thus enabling the grizzly-man to determine, by inspection, the ore from the waste. It is fed into the rock-breaker in a steady stream, performing the double purpose of carrying down the fine material through the jaws and so preventing useless work on the breaker, with consequent sliming, and, second, of clearing the crusher of sticky and clayey dirt, which is frequently present.

Before being sent to the tailing elevator, the tailing is partly dewatered in a settling box, the excess water being sent back to the millpond as noted. The amount of water needed to carry off the tailing varies with the grade of the tailing trough, and with the size of the material. The water needed increases enormously as the grade decreases, and considerably more is needed to get rid of ½ than ⅜-in. material. Tailing is usually elevated 50 ft. or so, and then conducted out by troughs to the tailing pile. As the pile grows larger, more sections are added until there is no longer sufficient fall, and the trough chokes. In such a case, either the elevator is made higher, or another elevator, known as a 'booster,' is built on the tailing pile, and the dirt re-elevated. Cast-iron troughing, in half-moon shape, has been used to line the boxes in which the tailing flows, and has given excellent satisfaction. The friction is much reduced, and hence the distance the tailing may be conducted is increased. With such an arrangement, the minimum grade for ½-in. dirt is 1⅜ in. per foot for a distance of 250 ft. This is about 11% grade. Wherever possible, it is better to make the grade considerably steeper than this, as there will be a substantial saving in the water necessary.

The crushers used in the district are usually of the Blake type, made by local foundries. The usual size is 7 by 14 in. The jaws are set for a 1½-in. opening in the smaller mills, to 2-inch in the larger. The capacities are somewhat greater than usually found, due perhaps to the fact that the limestone breaks easily along well defined cleavage planes, and the principal formation in which the ore is found, the so-called 'oil-rock,' is quite soft. Repairs are at a comparatively low figure.

Rolls 24-in. diameter, with 14-in. face, are most commonly seen in the district. Usually there are at least two sets. Some of the larger mills use one set of 36-in. rolls, returning the oversize to the same rolls (see Fig. 2). These large rolls are set to ½-in. opening, and, having a larger angle of nip than the smaller size, can easily handle the product from the crushers. Their peripheral speed is lower, about 220 ft. per minute. The shells last a long time, under ordinary conditions. The relative efficiency of 36 and 24-in. rolls is an interesting question, but my opinion, for the conditions here, strongly favors the larger size. For coarse crushing there can be no doubt which is the better. The general condition always holds good, that the more the machinery is simplified, other things being equal, the greater the efficiency, and one roll is less bother than two. An interesting feature is the universal use of star-wheels on the first set of rolls. This dispenses with gearing the two rolls —always a dangerous practice—and permits the rolls to be set as far apart as needed, thus enabling the fine rock to drop through without further crushing, and largely preventing sliming. I have seen rolls run without stars in the district, but the choking nearly drove the millmen frantic. Scrapers are sometimes used on the rolls to take off the clayey dirt that sticks persistently.

The power required in these small zinc mills is not large. Exact figures are lacking, and few companies go by anything but rule of thumb. The mill shown in Fig. 1, and treating 60 tons in 9 hours, has a 50-hp. engine. The mill in Fig. 2 has a 75-hp. engine. Until recently power has been supplied by steam, but with the advent of an electric power company into the field, transmitting current at high tension and stepping down at the mines, induction motors are rapidly taking the place of the old engines. A noticeable point is that the power consumption, figured in kilowatt hours, varies more in accordance with the time the mill is run, than with the tonnage put through. In other words, if 150 tons is crowded through a mill in 9 hours, the kilowatts used will be less than if 125 tons is put through in 11 hours. This can be easily understood when the enormous friction of shafting and countershafting, slip in belting, etc., is remembered. The pumping and jigging

power requirements are practically proportional to the time, not to the tonnage. Actual figures for a mill having two sets of jigs, crusher, 36-in. rolls, trommel, two elevators, and a centrifugal pump, show a consumption of 9440 kw. for mill running time of 237 hours. In this period it handled 3900 tons. This shows a consumption of 2.42 kw. per ton. The net kilowatt consumption per hour of mill-run was 39.8, or 53 hp. The mill is provided with a 75-hp., 3-phase, 60-cycle, 220-volt, induction motor.

Consideration of the fact that the time of running affects the power consumption more directly than the tonnage put through, is a powerful argument for crowding a mill to the limit of economical extraction. Especially is this the case if the proportional cost of power labor is included along with the cost of power consumed. This will be shown later in the résumé of cost data for such a mill.

The cost of repairs in a small zinc mill depends largely on the care of the millmen and the watchfulness of the management. The chief items of expense are sieves, screens, belting, and jaw-plates and toggles on the crusher. Elevator belts are an important item of expense. It pays to get the best and most durable belting, and stick to it. The life of screens and sieves varies with the character of the milling. Sieves should be cleaned and the holes freed from clogging particles every day or two—the beds being completely removed, and then shoveled back—the process called locally 'spanking jigs.' Star-wheels and gears on the rolls cost more in repairs and renewals than do the shells, which frequently last two years. Cost of repairs, taken for a year's time on a mill treating 125 tons per 10-hour shift, were $0.039 per ton. In another mill of inferior design and ancient structure, treating about 200 tons in two shifts, the cost per ton was $0.064. In a third mill, where the superintendent and millmen were both extraordinarily careful to keep down expense, the cost was only $0.020 per ton. Repairs no doubt vary more in proportion to tonnage than either power or labor, though the inevitable depreciation of plant and machinery must go on largely independent of the tonnage put through.

The costs of milling in the Wisconsin field may now be briefly summarized. They may be divided into labor, power, and repairs. Depreciation should be included separately. Only actual mill labor is included. Power is figured at $0.025 per kilowatt, with no allowance for engineer's wages. For a mill treating 75 tons of 10% ore per 9-hour shift the result is as below:

	Total.	Per ton milled.	Per ton concentrate.
Labor:			
Millman $3.00			
Helper 2.25			
Crusher-man .. 2.25			
Grizzly-man .. 2.25	$11.75	$0.156	$1.56
Power, 40 kw. (9 hr. = 360 kw.-hr.)	9.00	0.120	1.20
Repairs	2.25	0.03	0.30
Total	$23.00	$0.306	$3.06

It will be noted at once that labor forms over 50% of the cost. As stated before, the same crew will be needed for a 75-ton as for a 125-ton mill unless the ore should get overwhelmingly richer. Suppose it is decided to put 100 tons through the same mill. The ore will probably make but 9% concentrate, as lower-grade stuff can and will be mined. The milling costs will then be as below:

	Total.	Per ton milled.	Per ton concentrate.
Labor	$11.75	$0.117	$1.30
Power, 50 kw. (9 hr. = 450 kw-hr.)	11.25	0.112	1.12
Repairs	3.00	0.030	0.33
Total	$26.00	$0.259	$2.75

Such a change as this—a saving of 4.6c. for every ton of rock milled—may mean that a mine can be run at a profit instead of a loss.

JOPLIN ZINC ore shipments for the week ended June 1 were 4899 tons of blende, at $53.95 per ton, and 200 tons of calamine at $28.81 per ton. The estimated surplus stocks in producers' bins were 900 tons, as against 7500 in 1911.

Free Use of Timber From Public Lands

By T. D. WOODBURY

The Acts of March 3, 1891, and June 3, 1878, permit the free use of timber from unreserved land not within national forests under certain restrictions and conditions. The first of these acts as amended provides that residents of Colorado, Idaho, Montana, North Dakota, South Dakota, Wyoming, New Mexico, Arizona, and the District Alaska, the gold and silver regions of Nevada, California, Oregon, and Washington, and the territory of Utah may cut timber from the public domain, free of charge, for agricultural, mining, manufacturing, or domestic purposes under rules and regulations made and prescribed by the Secretary of the Interior. To justify the cutting of timber under this act, the person claiming its benefit must be a resident of the state or territory in which the timber is cut and the timber must be used for a purpose named in the act and within the state or territory where it is cut and must not be disposed of by sale or otherwise. There are two exceptions to the requirement that the person claiming the benefit of the act must be a resident of and the timber must be used in the state or territory where it is cut, as follows:

The Amendatory Act of March 3, 1901 (31 Stat. 1439) provides that residents of the states of Wyoming and Montana may cut timber for use in either state from the south slope of the Pryor mountains in Montana lying south of the Crow Reservation, west of the Big Horn river, and east of Sage creek.

The Act of July 1, 1908, (30 Stat. 619) provides:

"That it shall be lawful for the Secretary of the Interior to grant permits, under the provisions of the eighth section of the Act of March third, eighteen hundred and ninety-one, to citizens of Idaho and Wyoming to cut timber in the state of Wyoming west of the continental divide, on the Snake river and its tributaries, to the boundary line of Idaho for agricultural, mining, or other domestic purposes, and to remove the timber so cut to the state of Idaho."

Persons who desire to avail themselves of the privileges of the Act of July 1, 1898, must make application to the Secretary of the Interior for a special permit.

The Act of March 3, 1891, provides specially that it shall not operate to enlarge the right of any railroad company to cut timber on the public domain. Under the regulations of the Secretary of the Interior (29 L. D. 572), the amount of timber which may be so obtained without special permit from the Secretary of the Interior is limited to the stumpage value of $50 in one year.

These regulations provide that persons who are entitled to its provisions but are not in a position to procure the timber themselves may employ another as agent to do the cutting, removing, and sawing, provided the agent is paid only for time, labor, and other legitimate expenses exclusive of any charge for the timber. The agent, furthermore, cannot be paid with a share of the timber, but no person, whether acting for himself or as agent for another or otherwise, can cut more than the stumpage value of $50 in one year without permit. Persons wishing to avail themselves of the free use privilege of this act should apply to the Chief of Field Division having jurisdiction over the land, who will supply them with application forms. The applications should set forth the names and legal residences of persons applying for timber, the names and residences of persons who are to use the material, the amount of timber required for each person, and the use to be made of it; also the date upon which cutting will begin and the description of the land from which the material is to be derived. Any cutting done before the permits have been finally approved by the Commissioner of the General Land Office is done at the applicant's risk, subject to such approval.

The Act of June 3, 1878 (20 Stat. 88), which applies only to unreserved land not within national forests, pro-

vides that all citizens of the United States and other persons residents of the states of Colorado, Nevada, New Mexico, Arizona, Utah, Wyoming, Dakota, Idaho, Montana, and all other mineral districts of the United States may acquire for building, agricultural, mining, or other domestic purposes such timber as they may have need of from mineral public lands not subject to entry under existing laws of the United States, except for mineral entry. The timber can only be acquired subject to rules and regulations prescribed by the Secretary of the Interior, which provide for the protection of timber and of undergrowth growing upon such lands. The provisions of this act do not extend to railroad corporations. The regulations of the Secretary of the Interior mentioned above require that persons felling or removing timber under the provision of this act must utilize completely each tree cut that can be profitably used and must dispose of the refuse from cutting so as to prevent the spread of forest fires.

The other Act of June 3, 1878 (20 Stat. 89) prohibits the cutting of timber on any lands of the United States in any public land states; provided that any miner or agriculturist shall not be prevented from clearing his land in the ordinary working of his mining claim or preparing his farm for tillage, or from making timber necessary to support his improvements. These two acts are to be construed together. The first applies to mineral lands only in the states mentioned; the latter prohibits the cutting on nonmineral in all public land states, with the exceptions noted above. The Act of March 3, 1891, provides a defense for criminal prosecutions and civil actions for timber trespass in the states mentioned in this act and its amendments.

Homestead.—A homesteader who has made bona fide settlement upon public land and is living upon, cultivating, and improving his claim in accordance with the law, with the intention of acquiring title, has the right to cut such timber as is necessary for improvements on his claim, and also for fuel. If in clearing the land in good faith for cultivation there is a surplus of timber over the amount needed for improvements, the claimant may sell or otherwise dispose of such surplus. He cannot, however, denude the land of its timber for the purpose of sale or speculation before he has acquired title. The cultivation of the land must keep pace with the clearing step by step.

A homesteader who has never had possession of the land included in his claim, and whose entry has been cancelled, cannot by a subsequent purchase of the land from the Government acquire title to the timber cut prior to his purchase and thereby relieve himself of liability in a civil suit for the value of the timber. Except where it is necessary, in order to clear his land, a homesteader has no right to cut trees for the purpose of sale or profit. Entrymen under the Act of June 11, 1906 (33 Stat. 233) have the same rights as other homesteaders.

Settlers.—With respect to cutting timber from his claim the rights of a bona fide settler upon unsurveyed public land are precisely the same as the rights of a homestead entryman upon surveyed land.

Mining Claims.—The owner of an unperfected mining claim upon public land may cut such timber as is necessary for use in or to permit the development of the claim. (Act of June 3, 1878, 20 Stat. 89.) The burden of proof is on the claimant to show that the use of the timber on a claim other than that on which it is cut will tend to develop the claim on which the cutting was done. In no case can such use of timber be justified on a claim not within the same group as the claim from which the timber was cut. The owner of a patented claim may, of course, dispose of the timber as he may desire.

The cutting of timber for sale in advance of mining operations under the pretext that the stumps would rot and therefore be more easily removed is not necessary to mining operations and is therefore unlawful. An occupant of a mineral claim who has applied for a patent has no right, before the purchase price is paid and he receives a certificate, to cut the timber on such claim with intent to export or remove the same, and a license from him to so cut the timber is no protection to the licensee, as against the Government. The exclusive right to occupy and work a mineral claim, given to the locator by mining laws during his occupancy, does not segregate such claims from the public domain so as to exclude such land from the operation of Rev. Stat. 2461, 20 Stat. 89, and 27 Stat. 348, making it a misdemeanor for any person to cut timber on the public lands. The use of timber from any unpatented claim for the construction of a mill or other reduction works, or for the roasting or reduction of ores, will not be permitted, and all timber cut for such purpose will be held to be cut in trespass.

Free Use from National Forest Land.—The Act of June 4, 1897, as amended by the Act of February 1, 1905, provides that the Secretary of Agriculture may permit, under regulations to be prescribed by him, the use of timber and stone found upon forest reservations, free of charge, by settlers, miners, residents, and prospectors for minerals for firewood, fencing, building, mining, prospecting, and other domestic purposes as may be needed by such persons for such purposes, such timber to be used within the state or territory, respectively, where such reservations may be situated.

Forest rangers are authorized to grant permits for free use on national forests up to $20 in value, Supervisors up to $100 in value, and the Forester up to $500 in value. All requests for permits for an amount of material exceeding $500 in value are acted upon by the Secretary of Agriculture. Free use of permits under this regulation are granted to the various classes of citizens enumerated in the Act of June 4, 1897. In the application of this Act, it is the object of the Forest Service to assist prospectors in their work and to encourage and aid settlers who have not on their own lands or claims or on land controlled by them a sufficient and accessible supply of material for their work. Applications for free use should be made to the local forest officials. Each case is thoroughly considered on its merits and in applications not clearly covered by laws and regulations, it is the policy to grant free material to all local residents who because of their financial condition may not reasonably be required to purchase timber. A distinction is drawn between public or personal and commercial use. Residents of towns and villages engaged in business are expected to purchase building material for town dwellings and other home structure and for fuel. Settlers under the homestead laws who have not yet improved their tracts of land sufficiently to derive a livelihood from them are given a liberal allowance of material for their own use.

Wherever dead or defective timber will serve the applicant's purpose, free use is restricted to such material. Such timber is not only a fire menace and for this reason should be removed, but its cutting improves the condition of the forest and increases the growth of the remaining stand. When it can be conveniently done, free use areas are laid off adjacent to villages, from which applicants can readily derive their material. In the enforcement of the free use regulations, all unnecessary restrictions are waived and an effort is made to serve the public in this respect as promptly as possible. In order to guard against damage by fire, it is necessary to require the applicant to pile the limbs and tops or other débris resulting from cutting in such a manner that it can be readily burned and thus got rid of at the proper season of the year.

In Cripple Creek the Miners' Protective Association has been issuing cards to all employees and owners for the last two months. Since April 3, 2470 cards have been given out, and 37 applicants have been refused. A number of miners have felt that it would be folly to ask for cards at the Cripple Creek office, and have left the district. In this number are men who in the past have worked other men's cards. It was largely to eliminate this practice that the new association was formed among the miners. Not only the laborers and miners are required to have cards, but it is equally necessary for the mine owners and officials to take them out, under the rules of the association. The men working in the Isabella, Stratton Estate, and El Paso, are yet to be examined and given cards.

Prospecting Drill Records

By Charles H. Waters

Drills used for prospecting gravel deposits having dredging possibilities can give data covering the four following conditions: (1) the value per cubic yard and the distribution of gold; (2) the character of the gravel; (3) the bedrock contour and its character; (4) the water-levels, including maximum and minimum heights of the surface above and the extreme depths below the water-level. All facts which a drill can give when carefully and properly handled must be recorded with care, in order to secure accurate samples as well as other important data from which the final estimates must be made. Below is shown a form for making such a record.

At the top of the form is found the 'Kind of prospecting,' the form being available for either drill or shaft prospecting. The name and size of the drill or the size of

KIND OF PROSPECTING | DRILL *Empire*
SIZE OF CASING, 4 IN.
SHAFT | SIZE / DEPTH

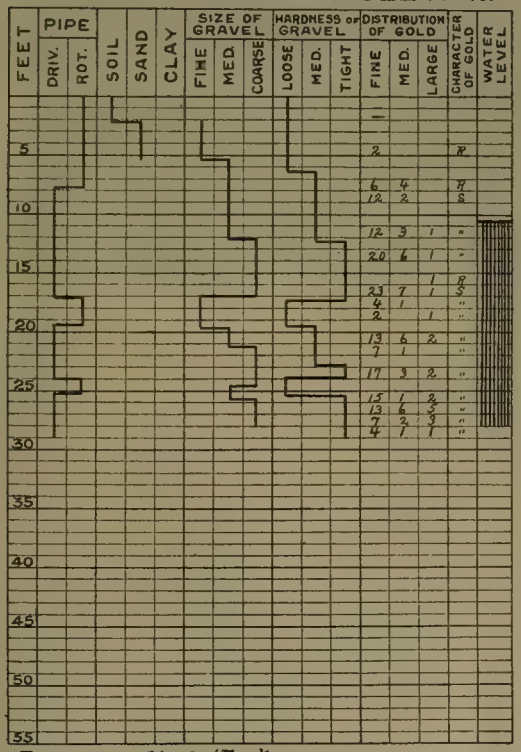
TIME LOG — WORKING CONDITIONS

BEGUN	FINISHED	HOURS DRILLING	HOURS PULLING	HOURS MOVING	TIME LOST	CAUSE	FEET DRILLED PER DAY
8[00]	4[45]	4[30]	1[15]	45	30	Broken chain-tongs	29

VALUES

WEIGHT IN MILLIGRAMS	DEPTH TO BED ROCK	DEPTH DRILLED IN BED ROCK	LENGTH OF CORE	CHARACTER OF BED ROCK	VALUE PER CUBIC YARD
46	28'	1'	1'	Slate	23[¢]

FIELD LOG — Hole No 21



REMARKS: 21 - 300' E of No. 20.
Rain - 2 hrs

CONVENIENT FORM OF DRILL RECORD.

the shaft should be noted. In the accompanying example a drill is assumed to be used. Under the heading of 'Time Log' is found hour when drilling began. The next space is for hour when all work is finished. Under 'Hours Drilling' is put the net time used in drilling. The next space is used to show the time used in pulling the casing from the hole; following this is a space to record time used in moving from hole to hole. Under 'Time Lost' come any unusual happenings which delay the work, and the next space is used to explain the cause of the delay. In the last space is kept a record of the total number of feet drilled during the day. Under 'Values' is found a brief summary of the most important facts. The form is self explanatory.

About the only change that I have made from the more common forms is in the 'Field Log,' which is a graphic record of the following conditions: rotation or driving of the casing; location and amount of soil, sand, and clay; size and hardness of the gravel; size of the gold and number of the colors and where they occur. In the column under head of 'Character of Gold' is recorded such characteristics of the gold, as whether smooth or rusty. In the last column is shown the water-level, by lines drawn, as shown, from the bedrock to the surface of the water; in this case 11 ft. 6 in. from the surface. Under 'Remarks' many things can be added, such as location of the hole, kinds of gravel, amount of black sand, anything, in fact, that may be considered of importance. If in driving the casing I find a smaller core than should have been obtained, I note this fact under 'Remarks,' stating at what point it occurred and the amount the core lacked. A record is also made when too much is obtained. I consider the amount of core very important, and I always mark it on a rod on which the drill wrenches are kept, thus having marks which indicate how much core is in the casing at any time whether drilling or pumping.

Ore Reserves of the Rand

In connection with the interesting description of the largest producers on the Rand, elsewhere in this issue, a summary of the ore reserves of the principal operating companies will be of interest. During the first quarter of 1912, according to the monthly statements of the Chamber of Mines, the companies at work on the Rand milled 6,211,555 tons of ore which yielded 29s. 8d. per ton at a working cost of 19s. per ton. The known ore reserve of the Rand therefore is approximately four years supply.

The tables below, prepared by the *South African Mining Journal*, classify the ore reserves of Rand mines according to the various controlling houses or groups, and deal only with profitable, fully exposed, and fully valued ore, except in one or two special instances. The group aggregates are:

	Tons.
Central Mining & Investment Corporation	36,999,442
Affiliated companies with head offices in Natal	1,358,800
Consolidated Gold Fields of South Africa	9,199,000
East Rand Proprietary	6,716,605
Anglo-French group	1,753,370
General Mining & Finance Corporation	5,842,556
S. Neumann & Co.	4,183,962
Johannesburg Con. Investment Co.	5,814,231
Randfontein-Langlaagte group	6,940,166
A. Goerz & Co.	1,949,207
Consolidated Mines Selection	1,925,346
Total	82,682,685

If to this total be added ore partly developed or partly valued, the great bulk of which may be assumed to be profitable, and there be also added the tonnage of ore awaiting mining in a few comparatively unimportant mines not included in the above, a grand total of slightly over one hundred million tons is reached.

In these calculations no account has been taken of the many millions of tons of low-grade ore—the accumulations of years of exploitation—which are standing developed in the mines. Much of this low-grade ore verges on the profit line. It needs but a happy swing of the pendulum of the industrial clock to transfer several millions of tons from the unprofitable to the profitable side of the Rand ledger.

Details of gold content and tonnage of the principal groups are as follows:

Central Mining & Investment Corporation:

	Tons.	Dwt. per Ton.
Bantjes Consolidated	896,087	7.3
City Deep	2,078,805	8.1
Crown Mines	10,124,072	7.25
Durban Roodepoort Deep	1,288,071	6.8
Ferreira	324,603	8.13
Ferreira Deep	1,837,808	9.7
Geldenhuis Deep	2,262,840	6.2
Modderfontein B.	2,355,700	7.5
New Modderfontein	3,341,830	7.6
Nourse Mines	2,050,705	6.6
Robinson	1,221,661	..... 11.4
	305,000*	....
	1,307,133	..... 4.2
	2,833,794	
Rose Deep	3,670,160	6.0
Village Deep	2,159,792	6.1
Village Main Reef	1,775,175	9.2
Total	36,999,442	

*Estimated tonnage recoverable from old workings.

Companies with head offices in Natal, managed by the Central Mining & Investment Corporation:

	Tons.	Dwt. per Ton.
City & Suburban	789,084	7.6
New Heriot	569,716	8.4
Total	1,358,800	

Consolidated Gold Fields of South Africa, Ltd.:

	Tons.	Dwt. per Ton.
Jupiter	1,089,000	5.74
Knights Deep	1,650,000	5.2
Luipaardsvlei Estate	432,000	5.2
	142,000*	5.3
Robinson Deep	1,140,000	7.2
Simmer Deep	1,312,000	4.9
Simmer & Jack Prop	2,500,000	6.4
Simmer & Jack East	934,000	5.4
Total	9,199,000	

*Partly developed.

Farrar Group:

East Rand Proprietary	6,716,605	6.9

Anglo-French Group:

Benoni Consolidated	606,839	6.56
New Kleinfontein	1,146,531	7.49
Total	1,753,370	

General Mining & Finance Corporation:

Aurora West	345,578	5.85
Cinderella Consolidated	740,157	6.73
Van Ryn	1,655,910	6.37
Meyer & Charlton	312,336	10.099
New Goch	962,575	5.06
Rand Collieries	374,200	5.375
Roodepoort United	448,800	5.49
West Rand Consolidated	1,003,000	5.25
Total	5,842,556	

S. Neumann & Co.:

Consolidated Main Reef	516,890	6.7
Knight Central	644,300	6.04
Main Reef West	628,260	7.0
Vogelstruis Con. Deep	149,530	5.9
Witwatersrand Deep	1,436,202	6.79
Wolhuter	808,780	6.45
Total	4,183,962	

Johannesburg Con. Investment Co.:

Consolidated Langlaagte	1,619,647	6.7
Ginsberg	367,646	6.8
Glencairn	925,000	3.5
New Primrose	423,311	6.7
New Reitfontein	361,484	6.1
New Unified	288,343	6.73
Van Ryn Deep	603,716	7.17
Witwatersrand	1,225,084	5.65
Total	5,814,231	

The Randfontein-Langlaagte Group:

Langlaagte Estate	1,281,307	..
Randfontein Central	5,658,859	7.24
Total	6,940,166	

A. Goerz & Co.:

Geduld Proprietary	607,300	8.18
Lancaster West	472,700	6.65
May Consolidated	212,707	6.84
Princess Estate	656,500	7.26
Total	1,949,207	

Consolidated Mines Selection:

Brakpan Mines	1,925,346	6.73

Copper Producers' Association Report

The Copper Producers' Association statement, June 8, shows a decrease during the preceding month in accumulation in this country of 15,450,386 lb. The details are as follows:

	Pounds.
Stock of marketable copper of all kinds on hand at all points in the United States, May 1, 1912	65,060,029
Production of marketable copper in the United States from all domestic and foreign sources during May	126,737,836
Deliveries for consumption, May	72,702,237
Deliveries for export, May	69,485,945
Stock of marketable copper of all kinds on hand and at all points in the United States, June 1	49,615,643

The changes in surplus since June 1, 1911, have been as follows, in pounds.

	Increase.	Decrease.
June, 1911	.....	8,561,768
July	.....	19,695,306
August	.....	4,297,357
September	7,453,355	.....
October	.....	5,897,214
November	.....	23,212,454
December	.....	22,330,493
January, 1912	.....	22,173,252
February	.....	3,301,944
March	.....	572,431
April	2,927,829	.....
May	.....	15,450,386

Most of the gold mined in Tasmania comes from Beaconsfield, on the Tamar river, near Launceston. This is an exceedingly rich mine, but on account of the great cost of pumping out water, some of the largest pumps in the world being used, the net profits in recent years have been small, and last year there was a slight loss, suggesting the possibility that unless the mine can be more economically worked it may have to be closed. Osmiridium has lately been discovered and mined in Tasmania, and the output, for which there is a good demand at nearly $35 per ounce, promises to show much increase in the future.

French capitalists have raised $1,030,000 for exploiting Sakhalin oilfields, and have signed an agreement with the Sakhalin Oil Co. An expedition has been sent to examine the fields.

Special Correspondence

NEW YORK

Report of Copper Producers. Ohio Copper Co's Report. Cobalt Shares Inactive.

The report of the Copper Producers' Association shows copper stocks to have decreased 15,450,386 lb. European copper stocks are also reported to show a large decrease, and it is quite evident that higher prices for the metal will rule during the coming month. Copper outputs are increasing in a ratio that a short time ago would have been considered most dangerous. The Anaconda production for May was 25,000,800 lb., as against 21,000,700 a year ago, 24,810,593 in May 1910, and 26,665,951 lb. in May 1909. The entire output of Butte was 29,082,362 lb. in May, which compares with 28,929,040 in April and 20,791,460 in May one year ago. The Phelps-Dodge output in May was 12,009,086 lb., as against 11,911,063 in April. The Calumet & Arizona output was 4,424,000 lb. in May, as compared with 4,104,000 lb. in April. The report is that in regard to the rolls installed by E. A. Wall. The average cost of handling the ore was 26.73c. per dry ton. This is considered a remarkably low mining cost. The vertical rolls installed by Mr. Wall have not yet fulfilled all of his predictions, but the engineers are confident that a complete success can eventually be obtained. Ohio Copper has dragged for many years, and its market has suffered accordingly. The Heinze influence seems to have been a handicap to Ohio as well as to the other properties under that control. A dividend of 25c. per share is expected to be declared by the Greene-Cananea. The management is installing three new converter shells of the Anaconda type which will much enlarge the capacity of the smelter. The usual list of Guggenheim dividends have been announced. These include the disbursements by Nevada Consolidated, Utah Copper, Yukon Gold, and the Guggenheim Exploration Company.

While it is true that the public lacks faith in the present copper market, it is evident that some of the individuals who know copper from long years of experience are full of faith in the future of the metal. Mention has been made many times of the amount of money

GENERAL VIEW OF SMELTER, GREENE-CANANEA COPPER CO.

British Columbia Copper Co. made a record output in May, producing 1,054,000 lb. copper and earning net profits for the month of $58,000. The British Columbia Copper Co. is to resume dividends at the rate of 3% quarterly. Giroux has at last enrolled itself as a regular shipper and is sending 1200 tons of ore daily to the Stepteoe concentrator of the Nevada Consolidated. Tuolumne Copper is another of the smaller independent producers that is about to resume dividends. This company is now shipping 300 tons of ore per day to the Washoe smelter, the ore running about $12.80 per ton. A 15c. dividend will be declared in July, payable August 15, if present plans mature. The Old Dominion Copper Mining & Smelting Co. has declared a quarterly dividend of $1.25. This is an increase of 25c. over the distribution made three months ago. The old Santa Fe Gold & Copper Co. is starting up and expects to handle 120 tons of ore per day at its smelter. Recent reports indicate a copper cost of 11c. It is probable that further furnace capacity will be added as soon as possible. The Ohio Copper Co. has just made a report upon its operations of the past six months and shows a profit of $109,477. The company still has in its treasury $754,000 of its bond issue which it has been unable to market. The interesting part of spent by J. B. Haggin and his associates in developing the Cerro de Pasco Mining Co. in Peru. Now it is stated, on apparently good authority, that Mr. Haggin and his friends are planning the development of another property in Peru which is to equal, if not surpass, the older mine. The ground is said to show a vast body of ore that assays 15% copper and 8 oz. silver, so situated that when the Panama canal is done the product can be laid down in Liverpool as cheaply as metal transported from Arizona or Montana. The property is said to be an immense one that will require a vast amount of money and years of time to bring to a point of full production.

At the recent meeting of the Amalgamated Copper Co., William G. Rockefeller was elected a director of the company in place of John G. Morony, who has long been connected with the legal staff of the company. An active market is being made on the Curb for the El Paso of Cripple Creek. Recently the stock scored an advance of ten points in one day, selling up to 91c. per share. It is stated that El Paso has larger orebodies in sight now than at any time for several years past, and the advance is said to have been made solely upon improved mine conditions.

Cobalt activities are at a minimum. Regular disburse-

ments are being made by the Buffalo, Nipissing, and other properties that are producing. One interesting feature is a revival of the story of the contemplated purchase of the Chambers-Ferland ground by the La Rose. The Chambers-Ferland is a small property which lies between the Nipissing and the La Rose in such a manner that it has long been considered almost inevitable that sooner or later the property would be absorbed by one or the other of the adjoining mines. The stockholders in the Chambers-Ferland have had a long and weary wait for some action and will welcome the deal if consummated on any reasonable basis. It is stated that the Guggenheim interests have exercised their option on the Needles group of properties which lie south of the Southwest Miami in the Globe-Miami district. The price paid is said to be $625,000, and work will begin immediately. There seems to be as much danger of a 'runaway' market in zinc as in copper. New record prices are being established each week. The present market is around $59 per ton. Prices have been jumped at the rate of about $2 each week, and in spite of heavy shipments, further advances are expected. Zincblende sold last week at $61.

BOSTON

LITIGATION AND THE OLD DOMINION.—POSSIBILITIES OF AHMEEK.—BUTTE & SUPERIOR AS A ZINC PRODUCER.

It is said that A. S. Bigelow and G. M. Hyams, the twin copper litigants, despite adverse decisions, will keep on fighting in the courts. Bigelow and Hyams are of litigious propensities and are not at all popular in Boston because of their lawsuit activity. Hyams has appealed from the decision of the United States District Court denying him the permanent injunction he sought to keep Calumet & Hecla from voting its Tamarack and Isle Royale stock in favor of the new milling arrangement, which is believed to promise a great economy in treating the ore. Bigelow is represented as being as full of fight as ever, notwithstanding the United States Supreme Court appears to have effectually disposed of the celebrated case which he has been defending against Old Dominion for the past ten years. Bigelow is no longer active personally in his antagonism to the movements of Calumet & Hecla, but Hyams is represented as having received his mantle in that realm of disturbance. It is said that Bigelow, in case restitution of promotion profits in Old Dominion is enforced against him, will sue the estate of the late Leonard Lewisohn for its share of the disgorgement, Lewisohn having been Bigelow's partner in the original enterprise when the Old Dominion was incorporated.

The Old Dominion company, either of Maine or New Jersey, keeps well to the front in the copper news, whether from the standpoint of dividends or litigation. The Old Dominion Company of Maine, the holding company, has again increased its dividend rate, which is now $1 per share quarterly. A year ago the company paid 50c. per share; six months later it paid 50c. regular and 50c. extra per share, and three months ago 75c. per share. The company is now on a basis of $4 per share annually, which compares with $1.50 annually for 1909, 1910, and 1911. The rate in 1908 was 50c. The remarkable dividend action has been the result of the United Globe Mine, of which the Old Dominion Company of Maine holds the 23,000 shares outstanding, declaring its third dividend this year. In January United Globe paid $5 per share, in April $3, and the current declaration is $4.50 per share. United Globe has not paid any dividends since 1907, when they amounted to $4 per share. In 1906, $6 per share was paid, and in 1905, $6.50. This makes the total to date, $29 per share, or $667,000. The operating Old Dominion company is a New Jersey corporation. This corporation is the one which benefits exclusively by the award of $2,464,000 made in the judgment affirmed by the United States Supreme Court against A. S. Bigelow. There is some talk about the creation of trust receipts by the operating company for the purpose of participating in the possible recovery against Bigelow being unconstitutional and a matter to be fought out in the courts. Some day Old Dominion will be no longer a hydra-headed or bifurcated company, and everything will be consolidated under one head. Then it will be possible for the layman to know which company he is reading about.

Calumet & Arizona's declaration of the usual dividend came somewhat as a surprise here. It had been expected that the company would fall in line under the pressure for an increase of dividends from the copper companies. Copper Range declared the usual dividend. Mohawk is expected to increase its rate for 1912. Wolverine will make no increase. No large dividends may be expected from Copper Range and Wolverine until there is a material change in their mine conditions. Wolverine is not much more than earning $10 per share at present. It formerly paid $10 per share in dividends, but was obliged to reduce its rate.

Ahmeek is attracting attention, not on account of its activity but its constant advance in price. It is now selling around $350 per share, its high point, and an order for a thousand shares would probably send it up even with Calumet & Hecla, around $500 per share. Ahmeek is the richest amygdaloid property in the Lake country. It is the lowest-cost producer in that section and one of the lowest in the world. It is now the most important in point of revenue among the subsidiary assets of Calumet & Hecla. Ahmeek is on a dividend basis of $16 per share, but on a 17¼c. metal market it has a profit of 10c. per pound, amounting to $1,600,000. This is equal to $32 per share, or double its present dividend rate. Ahmeek directors will meet in a few days for dividend action, and there is talk that the rate will be increased, inasmuch as the company is in an excellent position to do so by reason of higher-priced metal and increasing output. Ahmeek has been producing this year from its No. 1 and 2 shafts, plus small contributions from its more recent No. 3 and 4 shafts. Its present mill capacity limit has been reached, treating something over 50,000 tons of rock per month, but on account of the two new shafts coming in with added production the mill equipment will be enlarged accordingly. The company is pledged to spend $600,000 the next two years in new shafts and mill equipment. It is believed that this can be taken care of out of the company's earnings above dividend distributions on the present metal market. Ahmeek is traded in on the Exchange. While on the Curb it was known as 'The Little Calumet & Hecla.' There are many points in common between the two properties—the character of the ore, the ownership, the high price and wide fluctuations of the stock, and the promising outlook. A year or 18 months from date Ahmeek should be producing 30,000,000 lb. of copper per year. It is indeed a remarkable copper property and will probably in the future vie with Calumet & Hecla as a top-notcher in mining stock quotations. Calumet & Hecla once touched an even $1000 per share, in the early part of 1907, and if Ahmeek keeps up the way it is going, it may do likewise. In 1906 it sold at $10 per share. Of its entire issue of 50,000 shares, 24,800 are owned by Calumet & Hecla, which company is believed to be accumulating the stock from time to time as it figures in the transactions of the Exchange.

The mine, metal, and market record of Butte & Superior is exciting Boston traders. After a flat failure in finding profitable copper ore, Butte & Superior has developed into one of the largest zinc deposits in the world. The property is immediately north of North Butte, which in the early years of Butte's career was considered to be outside of the copper zone of that district. But North Butte cut the Edith May vein at a depth of 800 ft., working it from that level down to 2300 ft., making a wonderful record of ore output. Butte & Superior, on the theory that the copper zone continues beyond North Butte, put down a 3-compartment shaft 1600 ft. This shaft started in with copper ore of mediocre tenor, changing to zinc, a metal which was unexpected and unsought. However, the zinc ore is clean in character, practically free from iron, making it—unlike the zinc at Leadville—amenable to concentra-

tion. Butte & Superior now has a supply of almost 1500 tons of zinc ore blocked out. To every pound the percentage runs better than 25%, or over 500 lb. of solid zinc in a ton. On the 900 and 1400 ft. levels the company has opened wide orebodies which more than sustain the average mentioned in zinc recovery. The orebody on the 900 ft. level also carries 135 oz. of silver per ton. Persistence of ore is especially indicated at this point. The company's new mill, which has been operating about three weeks, has attained a saving of over 90%, while the old mill could not extract more than 45 to 50%. The new mill was designed for a capacity of 500 tons per day per unit, but has been crowded to as high as 625 tons per day. Recently Butte & Superior has been selling around $45 per share. Its low point for the year is around $19. So sensational have been the developments of this zinc deposit, so efficient the new mill, and so important the financial and technical interests now identified with the company, that some people suggest a price of $75 per share. Every now and then the Butte geological viewpoint has to be changed. Undoubtedly Butte is going to extend its producing boundaries, not only to the north, but to the south, the original discovery section, where there are such properties as Butte Central and Davis-Daly. The rich find made on the 1900-ft. level of Davis-Daly points to the probability of that property being within the zone of the Rarus fault, which the Butte Central management has traced in its property from the 100 to the 500-ft. level.

SALT LAKE CITY, UTAH

UNITED STATES COMPANY ENGAGES IN COAL BUSINESS.—URANIUM IN UTAH.—COMPANY REPORTS.

The last of the options on coal properties held by the United States Smelting, Refining & Mining Co. has been exercised by that company, which has now added the control of the Consolidated Fuel Co. to its other holdings. Nearly $1,600,000 in cash was paid over for this property and some minor holdings. The development of the mines and the building of a connecting railroad will involve a total expenditure of approximately $10,000,000, which the United States company has already financed. The purchasers had already acquired the Castle Valley and Black Hawk holdings, together with a large area of undeveloped coal land. They are now preparing to develop all the properties extensively on a large scale, expecting to increase the production of coal by 3,000,000 tons annually within the next two years, and eventually to several times that amount. This means practically doubling the entire production of the state immediately. While the United States company is itself a large consumer of coal and coke, this fact has had small bearing on its purchase. The main idea has been to furnish a large supply of cheap coal for manufacturing and domestic purposes in Salt Lake City and vicinity, and to invade the markets of the Pacific coast. The Utah bituminous coal is recognized as of better grade than most of the competing coals in this market, but the Utah producers have been handicapped by freight rates. This situation has been improved, however, and a case now pending before the Interstate Commerce Commission, if won by the shippers, will still further aid the producers. Furthermore, the new Western Pacific railroad is looking for traffic. The United States company is planning to build the Utah Coal railway, to connect the mines with both the Rio Grande and the Salt Lake routes. The survey has already been made, but it is possible the Rio Grande may hold the business by building the road itself, providing suitable arrangements can be made with the mining company. Another market which the new owners are seeking is that of the United States Navy. Previous efforts in this direction have not been successful, but the new owners believe they will be able to secure a contract on the merit of the coal and service.

Rare metals are attracting increasing attention in Utah, especially uranium, vanadium, and tungsten. The value of the carnotite deposits near Green River, in eastern Utah, is no longer a matter of doubt. At present only one property is a regular shipper, but it has become one of the big producers of the world, and there are a number of promising prospects. This property consists of over twenty claims, 14 miles southeast of Green river, and is being operated in the name of 'Angus Cameron, Agent.' The ores are marketed through David Taylor of Salt Lake City, and it is understood that they are shipped to Hamburg, Germany, although a great deal of mystery is maintained about the property, its backers, and the outlet of its ores. It is working 20 men, and is shipping about a carload of ore per week. The ore lies practically on the surface, and is easily handled. As the market value is said to be $100 to $200 per ton, the operations are apparently profitable, despite the freight to Europe. Another property of apparent promise is that of Jesse E. Inman, of Green River, which is preparing to begin regular shipments within about a month. There are a large number of prospects, including some properties of merit and some which are in the hands of men who mine with their lungs. Deep Creek, in the western part of the state, is the centre of interest so far as tungsten is concerned. The Willson brothers have been working some tungsten claims there at intervals for years, without as yet accomplishing great results commercially, and now other discoveries are reported in that vicinity.

Ohio Copper, according to the official report, earned $109,477 for the six months ended March 31, and $159,827 for the fiscal year. This is less than the 'unofficial reports' which have been coming out from time to time, but still shows a profit, which can be greatly increased when the company can adjust its finances so as to provide the needed additions to its equipment. The Silver King Coalition, of Park City, has held its annual meeting and reelected the old board. Thomas Kearns, the general manager, announces an early resumption of dividends. This property has produced approximately $25,000,000 of ore and paid over $11,000,000 in dividends. It suspended dividends during recent litigation, which is still pending on appeal, but, it is now announced, the company has enough in the treasury to pay the big judgment of the Silver King Consolidated and still have sufficient surplus to allow the resumption of dividends.

ELY, NEVADA

OPERATIONS OF THE GIROUX.—POWDER TESTS, NEVADA CONSOLIDATED.—REORGANIZATION OF THE ELY CENTRAL.

The Boston-Ely company is diamond-drilling, by contract, from the bottom of the 1200-ft. level. On this level there is a 30 to 40-ft. vein of soft oxidized iron-stained ore with a little carbonate of copper and occasionally a specimen of native copper. The limestones here are much fractured and soft. On this account the diamond-drill hole was cased as far as possible. Recently a little powder was used in the bottom of the hole; it was then filled with cement and drilled out again. The drill-hole is expected to cut the oxidized vein. Water for steam purposes is hauled from Giroux.

At the Veteran mine of the Nevada Con. there are about 330 men on the payroll, all but 30 of them being foreigners. This mine is shipping an average of 1100 tons per day, of ore assaying above 3% copper. Recently a winze sunk from the lowest level penetrated a body of 6% ore, said to be of sufficient amount to materially extend the life of the mine. The underground workings are claimed by the miners to be dangerous. Americans will not work there except under necessity. They are generally hard-rock miners, not accustomed to the caving system, and on this account it probably appears more dangerous than it really is.

At the Giroux mines the only work being done at the Alpha and Giroux shafts is the pumping of about 600 gal. per minute from the latter, to hold the water-level at 1400 ft., where it comes from a long drift running easterly toward the Alpha shaft. The object is to drain the above area that was flooded at the time of the fire last August. All machinery, tracks, and cars have been taken

out from all the levels. It is not expected that any further work will be done there until such time as shipments from the Morris shaft will warrant. The Alpha shaft-house has been entirely dismantled. The shaft where the cave-in occurred is so dangerous that the miners refuse to work in it. It may be kept open, but only for ventilation. The 1200-ft. level of the Alpha, which is connected with the Giroux shaft, is still in the oxidized zone, the ground being generally soft and difficult to hold. There are extensive bodies of ore of high grade, for this district (5 to 20%), exposed. From the surface indications east and north of the Alpha shaft large bodies of good-grade ore are expected when the sulphides are reached. On the east side of the hill from the Alpha, at the Old Glory, Morris No. 1 and 2, the Bunker Hill shafts and in their vicinity, the disseminated sulphides occur, in places within a few feet of the surface and to 150 ft. in depth over a considerable area and to a depth of 500 ft. in places. While at present ore is being hoisted from Morris No. 2 and Bunker Hill shafts, it is quite feasible to obtain a railroad level below the present Nevada Northern railroad tracks, and extract ore from both the Old Glory and Morris hills with steam-shovels; obtaining at least 200 ft. in depth of ore over a large area. This may be done later. At present an average of four carloads per day is being shipped from Morris No. 2 shaft to the Steptoe smelter. This ore averages about 3% copper. The arrangements at the Morris are only temporary. The ore is raised in mine-cars, run over tracks on surface to one side, and dumped into railroad cars. Consequently the tonnage cannot be materially increased from this shaft immediately. At the Bunker Hill shaft a raise has been made from the first level to the surface and into the old stock pile of ore in the dump said to be of good grade, up to 10%, but more or less oxidized. On May 26 the ore-bins were finished and a small skip placed, and hoisting the dump ore began. It will, from all appearances, be some time before the tonnage reaches 500 tons per day, the mine not being sufficiently prepared. Notwithstanding that the company had four months in which to get ready to fill the contract for 1000 tons per day, the mine and equipment are not yet ready. To draw off the powder-smoke and foul air three of the old churn-drill holes that connect with the Morris workings are being used, exhaust stoves being employed on the surface. There is no question but what the Giroux company has a great property; perhaps greater than the Nevada Con., but its development has been haphazard. With the deep-seated ores in the Alpha still in the oxidized zone on the 1200-ft. level on the porphyry-lime contact, and with over two miles of this contact on the property, it is too early to estimate the final value of the mine. To the north there are some iron gossan bodies radiating from the porphyry ores into the limestone and shale and varying from a few feet to 100 ft. in width. Sulphides may reasonably be expected under these. The Taylor shaft, 409 ft. deep, is about one-half mile north of the Giroux mill on one of the iron masses in the limestone area. The dump is said to average 9% copper. On June 1 the Steptoe smelter commenced to treat Giroux ores. W. G. Hawkins, of the engineering force, is there, representing the Giroux interests.

The Nevada Consolidated is drilling a hole adjoining the Liberty pit, for the Butte & Ely. It is reported that the ore will be mined with steam-shovels from the Liberty pit and treated by the Nevada Consolidated. This company is pursuing its usual systematic course. The 5-ton dippers of the 95-ton steam-shovels load a train of 20 cars, 55 tons each, in one hour. The ore is now coming from the west side of Eureka pit and the east side of Liberty pit, about 2000 ft. apart. The overburden in the latter has been 200 ft. deep and is a blocky silicious limestone. In the old Eureka pit the shovels are as deep as they can go, until such time as connections are made with the Liberty pit, when they will be able to circle and go deeper. It is claimed that there is 275 ft. of commercial ore below the present level of the bottom of Eureka pit. The only chance for a lower railroad level is across Ely Central ground, to the north. An enormous amount of powder, said to be 20 cars per month, is used. It is handled mostly by foreigners. The greater portion of the laborers are of this class and many accidents occur. During last January exhaustive tests were made as to the relative efficiency of dynamite and black powder. The record showed that the average cost of breaking the ground with black powder per cubic yard was about one-half that with dynamite, or 6⅝ and 12⅞c., respectively. The overburden and ore is not hard. Within the past few days shovel No. 2, in the southeast portion of Liberty pit, ran into a nice body of native copper ore of a very good grade. It was not noticed until several carloads had been thrown over the dump; then the Greeks were seen examining it. At the smelter advantage is being taken of the abundant water-supply and high price of copper. Last month 314,137 tons of ore was run down from the mines to smelter. Everything is being run to capacity. The traffic is so heavy on the railroad that the block system will be installed between the mine and smelter. There is a large amount of snow in the mountains, where the water-supply comes from, and with the completion of the new large settling-tanks there will be no further delay on account of shortage of water.. Up to January 1, 1912, and for the 15 months previous, the average monthly production of the company was a little over 5,000,000 lb. of blister copper, at an average cost of a trifle over 7c. per pound, including all costs and depreciation of plant. One month 7,000,000 lb. was produced at a cost of 6c., this constituting the world's record. Only 70% of the value of the ore is saved. The average gold and silver content per ton of crude ore saved was 18c. for the above period. Experiments are being made to find a way of making a closer saving on the slime.

The reorganization of the New Ely Central company has been completed, and the company is going ahead and developing its ground with churn-drills. Sulphide ore is being found on the Chispy claim at about 500 ft., in the drill-hole. James Jacoby, the manager, resigned June 1 to develop his own copper property, in Inyo county, California. R. T. Pierce, from California, succeeded him. Those who know Ely Central ground best are confident that under legitimate mining methods commercial ore will be opened. The Ely Consolidated company, at the Zack shaft, has recently placed new pumps and boiler in order to sink 200 ft. deeper from the 600-ft. level. The Nevada Consolidated on this account has discontinued the pumping of about 250,000 gal. of water per day from the Zack shaft.

The Copper Mines Co. is working a few men and opening some ore said to be 10%. The Smokey Development Co., whose property is just above Lane City near the old Chainman, which was worked for gold 30-odd years ago, intends to start work soon. It is claimed that a short adit can be run in from the gulch to reach sulphide ore. Only a short spur from the Nevada Northern would be necessary to give railroad connection. The stock has recently been listed on the Boston Curb. The Ely Verdi is an old company, and has recently altered its by-laws. It is not intended to commence development, there being no funds in the treasury, further than to do the annual assessment work. George Wingfield is one of the stockholders and a director. The present price of copper has led to inquiry for outside properties.

There are many claims in the district on which patent is held up by rulings of the Land Office. One engineering firm has upward of 60 claims on which receivers' receipts have been issued, but patent held up for want of sufficient mineral showing. The owners were given a short time in which to make this, or entry was to be cancelled. The claims being in the limestone, to make a real discovery means hundreds of feet of work. The ground itself is not worth 25c. per acre for any other purpose. There is no water or timber and but little grass. The old debts of the U. S. Tungsten Co., recently examined for the Tonopah Mining Co. by J. E. Spurr, have been paid, and a contract for 200 ft. of work has been let. Colorado men were recently here examining the old Ward properties 18 miles south. There is a large tonnage of low-grade lead-silver ore blocked.

BUTTE, MONTANA

UNITED MINE WORKERS ORGANIZE. BUTTE MINERS' UNION REFUSES OFFER OF ANACONDA COMPANY. FUNDS FOR BUTTE BALLAKLAVA-ANACONDA SUIT.—STEWART RECEIVERSHIP CASE.

The United Mine Workers of America are organizing throughout the Northwest. A few days ago delegates met in this city and formed the Rocky Mountain association of this organization, taking in the following districts: Montana, Wyoming, Washington, Colorado, Utah, and New Mexico, together with Vancouver Island and British Columbia. A committee appointed to set forth the objects of the association reported. "The most important thing this organization will persistently and insistently advocate will be the negotiation of wage agreements, covering wages, hours of labor, and working conditions, at one and the same time by all the coal producing states belonging to the association." It is pointed out that coal mining is a hazardous occupation in the extreme owing to natural conditions, and there has been lack of attention to life-saving. The efforts of the organization were pledged to secure better conditions for men who work around coal mines. The association will meet annually. Officers were selected and an effort is to be made to enroll in the organization every man engaged in and around coal mines. During the next twelve months steps will be taken to secure the enactment of a law in every state looking to compensation for injuries received while at work.

At the present time the miners in the Butte district are paid $3.50 per day, and a committee of the Butte miners' union was appointed some time ago to ask for an increase to $4. After several conferences with representatives of the Anaconda company they reported that the company was willing to pay $3.75 per day while copper was selling between 15½ and 17c. per pound and when the metal advanced above 17c. the wages would be $4 per day. To the surprise of everyone the miners rejected the proposal, and today they are working for $3.50, while if the offer had been accepted they would be receiving at least $3.75 per day. The common understanding is that the offer of the increase was rejected because the Socialists, who secured possession of the hall, were in the vast majority in the meeting and refused to accept the increase. The Socialists hoped to place the company in an unfavorable position and bring about trouble. In this they will not be successful, for the conservative element is in the great majority in the union, and before any action can be taken looking to a further demand a referendum vote will be called by the new set of officers just elected, and the offer of $3.75 is expected to be accepted. It was clearly demonstrated a few months ago when the full membership got an opportunity to vote, that the Socialist element was in the minority, so that there is no danger of any trouble over the wage question.

None of the Boston stockholders of the Parrot company, who are endeavoring to have set aside the sale of the property to the Anaconda company, were present at the annual meeting held at the offices in this city a few days ago. The only business transacted was the election of the same directors as last year, with the exception that C. F. Kelley takes the place of the late F. P. Addicks. The only asset of the Parrot company is 90,000 shares of Anaconda stock which was received in payment for the property.

The Butte-Ballaklava company has secured $100,000 from John G. Williams, giving a mortgage on the property as security. In a statement it is announced that the money is to be used in fighting the suit brought by the Anaconda company for the recovery of a large amount of money as value for ore alleged to have been extracted from ground claimed by the Anaconda company. The company is carrying on development on the 1600-ft. level and is shipping a small amount of ore each week. The point where the work is now proceeding is outside of the ground in dispute. P. H. Nelson, who recently retired from the presidency of the company and has been succeeded by George C. Swallow of Milwaukee, found that he could not further devote his time to the direction of affairs. Mr. Swallow is expected in the city in a short time to look over the property.

A semi-official statement of the condition of the affairs of the Stewart company has been issued, in view of the application for the appointment of a receiver by one of the directors. It is stated that during the first four months of the year the net earnings were $126,000, after deductions of $10,000 to $20,000 per month for equipment and development. In the application for the receiver it was stated that Mr. Heinze gave to H. U. Hart, of New York, 225,000 shares of stock for which nothing had been received. It is now stated that the stock was given to Mr. Hart for his services in driving the recently completed Fir adit after his efforts to make arrangements with the neighboring Coeur d'Alene Development Co. for the use of one of its adits had failed. Through his influence there was acquired by the Stewart company a one-third interest in the Coeur d'Alene company and he also negotiated the smelting contract with the Guggenheims.

JOHANNESBURG, TRANSVAAL

FAR EAST RAND.—BRAKPAN SHOWS PROFIT.—APEX AND OTHER PROPERTIES ENCOURAGING.

Attention is now being attracted to the improved prospects of the Far East Rand. Despite somewhat discouraging bore-hole results, the Consolidated Mines Selection Co., Ltd., some years ago took the Brakpan property and sunk two 7-compartment shafts to the reef and were rewarded by finding profitable orebodies. Over a million sterling has been spent up to the present in connection with this undertaking and today the mine is earning profits in the neighborhood of £30,000. Another mine which has also assisted to bring about a change of opinion with regard to the prospects of the Far East Rand is the Modderfontein B mine, which is an outcrop mine where an expenditure of three-quarters of a million sterling can point to equally good results as those attained at Brakpan. The working costs may be somewhat higher than the average for the whole of the Rand, while the profits are nearly double those of the Rand average and decidedly higher than the profits per ton at the neighboring mines. The Van Ryn Deep is opening so well that no difficulty seems to have been experienced in obtaining the capital necessary for its equipment. Even Geduld, which in the early days of its history was responsible for the unduly high and inflated opinions formed regarding the prospects of the neighborhood, is at last showing signs of improvement and thereby causing the prospects of other deep-level developing properties to be regarded with increased favor.

There have, however, been several disappointments experienced in the Far East Rand, some, such as the Geduld, for instance, are difficult to understand and explain, while others, such as at Cloverfield and Van Dyk, are due to lack of adequate capital, and an enterprising control. A striking example of enterprise under adverse prospects is afforded by the Apex gold property, where, after twenty years of boring and shaft-sinking in search of a profitable stretch of reef, ore has at last been found. At the end of March nearly 400,000 tons of profitable ore had been developed on the Apex showing a milling value of 6.45 dwt. over a width of 53 in., and with the proposed merging, or rather absorption, of the adjoining unfortunately handled Benoni concern, the mining prospects of the Apex gold section, disregarding the Benoni debt, will be roughly doubled in value. No gold has as yet been recovered from the Apex.

Taken on the whole, the successes on the Far East Rand will far outnumber the failures and the doubt thrown upon the value of this part of the Rand by irresponsible persons has not been justified either on geological grounds or by actual mining results. Today the Far East Rand may be safely regarded as of far more value than any similar stretch of country on the western part of the Rand or of equal value at least to that proved between Germiston and Boksburg. The few disappointments caused have been due to oversanguine expectations or to want of ordinary enterprise and efficient handling.

General Mining News

ALASKA

Alaska Peninsula

(Telegraphic Correspondence.)—A heavy eruption of the Katmai volcano has destroyed the fishing villages on the Alaska peninsula, and on Kodiak island. Several inches of ashes have fallen on the mainland in the neighborhood of the volcano, and on the east side of the island. The United States revenue cutter *Manning* has reported by wireless from Kodiak harbor that there has been no loss of life on the island, but that the inhabitants are destitute, as their homes were destroyed by a storm of ashes and sand which began on June 6 and kept up for two days. Heavy earthquakes are also reported from the neighborhood of the eruption.

Cordova, June 12.

Cook's Inlet

(Special Correspondence.)—The Gold Bullion Mining Co. is working its property on Crazy creek, in the Willow creek district. An adit is being driven to cut an orebody which in an upper level yielded $1600 per day for a five-days run with a 7-stamp mill. The old mill building was torn down and a new building with blacksmith and workshops built. Six ore-bins will be completed by June 15. Cal Johnson has directed the work this spring as superintendent. William Barthoff, manager for the company, is expected from Seattle in June. The Alaska Gold Quartz M. Co. is operating its claims on Fishhook creek. This property has a 3-stamp mill and one new Nissen stamp was freighted in over the snow last winter. Other claims will be developed as soon as pack trains can get into the district. The Alaska Free Gold M. Co. has leased its property to Mr. Martin, who is planning to operate the mine next winter. The wagon-road to Fishhook creek has been repaired, and a Lane mill, with boiler, engine, and complete supplies will be brought in for the Free Gold company.

Knik, May 24.

ARIZONA

Gila County

(Special Correspondence.)—The May production of the Old Dominion smelter amounted to 2,160,000 lb. of fine copper, about the same rate as for the previous month. There will be no attempt to meet the prevailing price of copper with increased production until after the capacity of the concentrator has been increased and other improvements made. An average of 2½ furnaces were in operation during the month. The foundations are in for the new flue and dust-chamber at the converter plant, and the steel has been shipped. Plans are now being worked out for hoisting the ore in skips instead of cages, the change to be made without interfering with hoisting or in any way curtailing production. H. Kenyon Burch is working on the plans for doubling the capacity of the concentrator. An important metallurgical change to be made in the near future is the use of basic instead of acid lining in the converters. An order is placed with the Power & Mining Machinery Co. for a large converter stand and two shells that will take the place of the three small stands now in use. It will be of the Great Falls type and electrically operated. About 1150 men are employed at present.

The Miami company produced in May about 2,700,000 lb. of copper, a slight increase over the April production. A large amount of development is being done, the amount for May totaling 5627 ft. Work is about to start on the construction and equipment of a new machine-shop near No. 4 shaft, and the foundation is in for a second 500,000-gal. mill-water supply tank. The mill is now using nearly 2,000,000 gal. of water per day. About 900 men are employed, of whom 500 work underground.

A petition is being signed by prospectors, claim-owners, and business men of the Globe-Miami district addressed to the Arizona legislature, now in special session, asking that the miners' lien law recently enacted shall be amended. The law as passed provides that persons furnishing labor, or material to be used in mines or on mining claims, under contract with the owners or their agents, or with lessees, or with persons or corporations working the mine or mining claims under option to purchase, shall have a lien upon such mine or mining claims for such sums as are unpaid. In other words, prospectors and claim-owners will have to stand for any debts contracted by individuals or corporations working their claims under option. It is generally believed that the enforcement of such a law would mean stagnation, if not paralysis, to the development of mines and prospects in Arizona. While it is admitted that the law affords admirable protection to miner and laborer, for which purpose it was intended, yet it is believed to be grossly unfair to the small claim-owner and prospector.

Activity is displayed in the old silver camps in the Apache mountains, about 12 miles northeast of Globe. The old McMorris mine in Richmond basin, a producer of rich silver ore in the late seventies and as late as 1882, is being reopened by W. D. Fisk of Globe and associates. A new gasoline hoist has been placed and the 800-ft. shaft has been retimbered for a depth of 160 ft. George Wilson is superintendent. John Mitchell and Ed Casson are working Fred Hefty's group of 12 claims under bond and lease. These claims adjoin those of the McMillen-Stonewall company. The Rice brothers are developing the Buckeye group and Lee Ikenberry is taking high-grade silver ore from his claims in Richmond basin. Ed Simonton is mining high-grade silver ore on the claims of P. W. Gallentine, on which he has a lease. No sensational discoveries are being reported, yet some high-grade silver ore is being mined, and honest efforts are being made to develop this once-famous district.

Charles H. Moyer, president of the Western Federation of Miners, has concluded a two-days visit to Globe and Miami and left for Phoenix, whence he will return to Denver. Mr. Moyer said his visit had no especial significance, but that he was merely paying a visit to the local unions.

After a conference of the managers and superintendents of all the principal mines of the Globe-Miami district, an increase of wages or reduction of hours has been granted to all employees, to take effect June 10. Nearly 3000 men will be affected. The nine-hour day has been abolished for surface men and hereafter all employees on surface and underground will work not more than eight hours per day. All surface men who have been working eight hours per day will receive a 7% increase in wages. Surface men working nine hours will receive the same pay for eight hours work. All men working underground will receive the same pay as heretofore, but will spend a total of only eight hours underground, as provided in the eight-hour law recently passed by the legislature. The men will be hoisted and lowered and will eat their lunch in this eight-hour period, which will consume about an hour; so they will hereafter receive the same pay for seven hours work that they have been getting for eight. The increase is in line with the policy of the large mining companies adopted several years ago of granting an increase in wages when copper shall have advanced in price beyond a certain point, with the understanding that they shall be lowered to the old rate when the price of copper falls below that point. This 'critical point' was fixed at 18c. in Butte and seems to be established at 16c. in Arizona. The companies state in the notices posted at the mines that they regret that the wages of underground men cannot be increased, but the eight-hour law reducing the actual working time to about seven hours prevents this, as it is not possible to reduce working hours and increase wages at the same time.

Globe, June 5.

Pima County

The Pioneer smelter has shipped three carloads of matte valued at $20,000 to the El Paso smelter. The Twin Buttes and Patagonia districts are now supplying the Pioneer with all the ore it can treat.

CALIFORNIA

Amador County

(Special Correspondence.) The Pacific shaft of the Plymouth Consolidated Mining Co. has been unwatered to a depth of 1150 ft., and the timber found to be in fairly good condition. The 950 ft. level has not caved since the mine was shut down twenty years ago. In the 1065 ft. level a cave was found 20 ft. from the shaft. At present the air in the 1140 ft. level is so bad that no attempt has been made to go into this level. About 300,000 gal. of water is hoisted from the mine every day.

Plymouth, June 11.

At the Gold Cliff mine the caving of a bluff on the afternoon of June 9 buried the electric motor, wrecked the hoisting engine, damaged the building, and deposited about 1000 tons of rock and earth in the shaft. No one was injured, as the hoisting engineer was outside the building and the other men were oiling the skips. The damage will amount to several thousand dollars and operations will be suspended for a week, until the shaft is cleared and repairs made.

The concentrator of the Calaveras Copper Co. commenced operations last week. The management expects to blow in its own smelter in August, but in the meantime high-grade ore will be shipped to the Campo Seco plant.

Eldorado County

The Northern Ontario Exploration Co., Ltd., a Bewick-Moreing company, has taken an option on the Beebe property at Georgetown, and has begun active development. This is a new prospect recently discovered and interesting as showing that there are veins of value still to be explored in the Mother Lode region.

Mariposa County

The Original M. & M. Co. at Clearinghouse is just completing the erection of a Joshua Hendy 10-stamp mill. The ore is free milling, and the company expects to make

CHAMPION MILL, GRASS VALLEY.

a good recovery on the amalgam plates. The Original owns its own hydro-electric plant and develops power from the Merced river by the use of low-head turbines and Westinghouse generators.

Modoc County

A test of the persistence of the veins exposed at the surface at High Grade will be made by J. F. Cutler. Mr. Cutler has purchased from the Joshua Hendy company a steam hoist, and has announced that a shaft will be sunk 500 ft. as soon as this hoist can be shipped into the district.

Nevada County

The Champion mill resumed operations June 6 with 20 stamps dropping. Development ore from the 1600-ft. drift of the Merrifield shaft is supplying the ore. The mill has been idle since the North Star Mines Co. took hold of the property, but $200,000 has been spent in the past few months in unwatering the mine and in development. Only 30 ft. of water remains to be raised, and the 2400-ft. shaft will be free of water. Drifts will then be run on the vein at the bottom.

The Bald Mountain Gold Mining Co. filed articles of incorporation in Nevada City recently, with J. E. Hippert, W. H. Hippert, John Hippert, Sr., Samuel Hirsh, and A. C. Travis as incorporators. The company was formed for the purpose of mining quartz and gravel claims above Grantsville. During the past year the owners of these claims have driven a long adit to tap a gravel channel, and this adit cut through several quartz veins. The new company intends to thoroughly prospect its property.

Plumas County

The California-Utah Gold & Copper Co. was recently organized in Salt Lake City for the purpose of operating claims about 11 miles from Doyle, on the Western Pacific railroad. A vein can be traced for 3000 ft. on the surface across the property. In the bottom of a 50-ft. shaft samples have been taken which assayed 4% copper and from $2 to $6 in gold.

Shasta County

The Hazel G. M. Co. has started to sink the shaft on the Gladstone mine 300 ft. deeper from the ninth level. The mine is opened by an adit 3600 ft. long, and the deepened shaft will be about 2000 ft. below the apex of the vein. A 150-hp. double-drum electric hoist raises the ore to the adit, where it is handled by a modern electric haulage system using 220-volt alternating-current motors. At the mill 30 stamps are dropping, crushing an average of 100 tons per day. The company owns a hydro-electric plant for supplying power to the mill and mine.

The Pittsburg & Mt. Shasta G. M. & M. Co. is operating the Little Nettie mine near Keswick. The mine is developed by an adit, and a shaft which has been sunk 300 ft. below the adit-level. At present a 15-stamp mill is in operation, but T. V. Scott, manager for the company, has gone to Pittsburg to attend a stockholders meeting, and to take up the question of additional improvements with a view to increasing the output of the mine.

The electric smelter at Heroult, owned by the Noble Electric Steel Co., is producing pitch, tar, acetic acid, and wood alcohol in quantity. These substances are obtained as by-products, extracted from wood in the manufacture of charcoal for use in the smelter. Recently a carload of pitch, a carload of lime, a carload of tar, and a carload of pig iron were shipped to San Francisco. After a 35-day run the smelter has been shut down and new electrodes will be put in the furnace. This will more than double the capacity of the smelter, as 2600 hp. of electricity will be available, instead of 1200 used in the furnace up to this time. Several carloads of pig iron are stacked up in the yard ready for shipment as soon as cars are available.

COLORADO

Pitkin County

The Smuggler mine has been closed by a refusal of the timbermen to accept a cut in wages from $3.50 to $3 per day. The company works two 8-hour shifts per day and employs 18 timbermen, who work in squads of two each. In order to curtail expenses the management attempted to make one of the two men in each squad a helper and reduce his wages to $3 for 8 hours. Only enough men are working at the mine to keep water out of the workings. The miners' union has been reorganized in this district.

Teller County (Cripple Creek)

At the Portland No. 2 shaft-sinking from the 1500-ft. level was started June 3. The company plans to sink an additional 100 ft., and develop the main orebodies to greater depth. On the 1500-ft. level two machines are breaking ore, but little is being done in the way of development. The Portland stopes are being filled with sand from the mills, and in future mining, instead of short stopes made on individual orebodies, the stopes will take in everything, including the low-grade ore between oreshoots, and all ore will be put through the Victor mill of the company. The Blue Bird shaft, on Bull hill, is now the deepest in Cripple Creek. The sinking has been going on for weeks and is now at a depth of 1714 ft., where it is believed the water-level has been encountered. The output from the Blue Bird is regular and amounts to two or three cars of good ore per week.

The stock of the El Paso Gold Mining Co. has been boomed recently by the sale of 400,000 shares at 90c. per share to a party of Swiss bankers. The El Paso has shipped since March, 37 cars of ore averaging $105 per ton. So far the El Paso mine is the only one in the district which has been helped by the Roosevelt drainage tunnel, as all the ore shipped has been produced below the old water-level. A 400-ton mill to cost $475,000 is contemplated by the management, as there is now about 900,000 tons of $6 ore on the dump and about 200 tons is hoisted every day. The Roosevelt tunnel is now discharging about 12,000 gal. of water per minute. The average drop in the general water-level is from 10 to 15 ft. per month, and the total subsidence since the tunnel reached the El Paso shaft is 152 ft. The cost of lowering the water by pumping is estimated at $5000 per foot, and the eventual saving which will be made by the Roosevelt tunnel is figured at $3,500,000.

IDAHO

Coeur d'Alene

The Iron Mask Mining Co., operating a group of claims at Carter, has issued a report on the development accomplished in the year ended April 30, 1912. The cost of driving an adit 1020 ft. was $7.29 per foot. Deducting the cost of track material, pipe, and fittings, the cost of labor, explosives, candles, and power was $5.53, which the company claims as a record for the district. This adit has cut a wide vein, from which some shipping ore has been taken.

The Federal Mining & Smelting Co. is producing about 4000 tons of lead and 200,000 oz. of silver per month. The chief problem of the company is the handling of the low-grade refractory ores from the Mace and Morning mines. No report has been received from Thomas A. Edison, who has been conducting experiments for the company. The second unit of the tube concentrating plant is ready for operation. The first unit has been making $8000 per month. At the present price of lead and silver the gross sales of the company amount to $440,000 per month, of which about $75 is net profit. The tons of ore mined, the net earnings, and the net earnings per ton of ore mined since 1905 are as follows:

	Tons ore mined.	Net earnings.	Net per ton ore.
1905	664,830	$1,242,679	$1.78
1906	974,332	2,685,300	2.70
1907	888,950	2,532,250	2.85
1908	599,850	1,067,036	1.78
1909	832,568	1,185,946	1.42
1910	741,650	944,706	1.27
1911	784,600	1,280,285	1.63

Shoshone County

The new concentrator of the Snowstorm Mining Co. is reported to be working successfully. The first car of copper concentrate has been loaded, and this shipping product is said to be 20% copper and 30 oz. of silver per ton. The mill has a capacity of 100 tons per day, but units may be added if it is desired at any time to increase the output.

MONTANA

Madison County

The California Placer Mining Co. is having a survey of its claims made. They comprise about 5000 acres northeast of Virginia City. It is thought that the original bed of Alder creek was through this property, and the management is planning to prospect the ground with Keystone drills to a depth of from 100 to 400 ft. W. B. McCubben, of San Francisco, and B. L. McCoy, G. E. Egbert, and B. N. Paxton, of Oroville, are among those interested in the company.

Silverbow County

The annual report of the Amalgamated Copper Co. for the fiscal year ended April 30, gives the net profits of the year as $6,647,006, equal to 4.31% on the outstanding stock, as compared with 3.93% for the preceding year. Dividends to the amount of $3,847,197 were paid, and the surplus increased to $21,252,201. Work is being done at all the important mines in the Anaconda group with a view to increased output at lower costs. At the Leonard mine, the hoist has been changed over for the use of air, and at the Tramway and West Colusa the cylinders are now being changed. Electric haulage will be in operation on all the main levels in a few months, and by September 1 the lower levels of the mines will be connected by crosscuts with the Belmont, which will then be the main hoisting shaft of the group. The central compressed-air plant has been completed, and is operating six compressors, each with a capacity of 7500 cu. ft. of free air per minute. As the power consumed is intermittent, sufficient power is thus generated to operate all the larger hoists. The copper production for May from Butte was 29,082,362 lb., from 433,046 tons of ore.

NEVADA

Nye County

The White Caps mine has completed its first run of 1000 tons of ore at the Associated mill, and has replenished the dump by hoisting every night from the stopes. A new body of low-grade ore has been found in the east drift 400 ft. from the shaft.

The sixth annual report of the Round Mountain Mining Co., for the year ended March 31, gives the ore reserves at 145,820 tons, an increase of 33,892 from the preceding year. The mill treated 54,915 tons with a gross value of $7.09 per ton and recovered 88%, or $6.24 per ton. Operating costs for the year were $4.96 per ton, including a depreciation charge of 31c. per ton and 20c. per ton to cover litigation expense. The net realization was $1.36 per ton, or $74,830. Additions were made to the mill, the mine office, the underground crushing plant, and a complete fire-protection system, at a cost of $34,000. The mining costs were reduced from $6.02 for the preceding year to $4.88, and the report states that a further reduction will be made. New development amounted to 7508 ft., at a cost of $6.60 per foot, equal to 90c. per ton of ore milled, or 56c. per ton of new ore developed. During the year the company received the sum of $4202 in royalties from lessees working placer ground on the company's property. It is expected that the litigation in which the company has been involved will reach a settlement within a short time.

The shaft of the Halifax-Tonopah Mining Co. is now nearly 1300 ft. deep. At a depth of 1275 ft. a contact was found with andesite above and rhyolite below. The bottom of the shaft is now entirely out of the rhyolite, and in quartz which is heavily stained with iron and shows specks of silver sulphide. The sinking of the shaft to this depth has been accomplished at a cost of $47 per foot, and about $90,000 has been expended on this work and surface equipment. A new and more powerful electric hoist has been ordered and plans are being drawn for a 120-ft. steel head-frame.

Storey County

The tax statement for the first three months of 1912, filed by the Mexican Gold & Silver Mining Co., shows an output during that period of 5087 tons of ore. The gross yield on the ore milled was 51,579.78 and the cost of extraction was $40,986.11. The cost of transportation was $2352.88. The cost of reduction and sale was $15,196.78, and $10,393.73 was expended for mill construction. This report brings the total bullion production for the Comstock district for the first three months of 1912 to between $225,000 and $250,000.

White Pine County

A new chimney is to be built at the Steptoe smelter to replace the one now in use. The old stack, 250 ft. high, with an inside diameter of 18 ft., is cracked badly. The wooden trestle over which the ore is brought to the concentrator will be replaced by a steel structure. These are the first important renewals to be made since the Steptoe plant was started in 1907.

May was a record month in the amount of ore handled by the Nevada Northern railroad from the mines of the Steptoe works of McGill. During the month 314,137 tons

of ore was shipped from the big pit and transported over the high line, a daily average of 10,133 tons. The best previous month was July 1911, when 293,551 tons was moved.

NEW MEXICO

Santa Fe County

The Santa Fe Gold & Copper Mining Co., which closed its mine in New Mexico in October 1907 because of inability to continue to work the property on a profitable basis, has resumed active operations, now that the price of copper has made a large advance. The company has built a 20-mile branch from its mine to a connection with the Santa Fé railroad.

Socorro County

The Ernestine M. Co. output for May was 34,920 oz. gold and silver bullion and 36,550 lb. of high-grade concentrate. At the Socorro mines approximately 45,000 oz. gold and silver bullion and 25 tons of concentrate were produced in May.

OREGON

Josephine County

The Tennessee Gulch mine has been sold by Hasselton & Wagner to Portland people for a price said to be $40,000. This is an old mine which was worked by ground sluicing; recently three veins have been found which show promise. J. O. Gunn has shipped the fourth carload of ore from his mine near Takelma to the smelter at Kennett. At the Iron Crown, 11 miles from Grants Pass, copper ore, from 1 to 17% copper and $5.50 to $8 per ton in gold, has been found.

COPPER SMELTING PLANT, INTERNATIONAL S. & R. CO.

UTAH

Juab County

The May Day M. & M. Co. has made a contract to ship zinc ores to smelter at Bartlesville, Oklahoma, and has cleared the chutes in the mine of other ores in preparation for the loading of several carloads of zinc ore. It is estimated that 1000 tons of ore carrying 40% zinc is stored in the stopes.

The Yankee Consolidated Mining Co. has levied an assessment of 2c. per share, in order to continue development. A statement sent out by the directors explains that the shaft has been sunk to a depth of 2000 ft. and that crosscuts driven from the 1800 and 1900-ft. levels found large mineral zones with small seams of ore. A large part of the development to date has been paid for by the sale of a large dump of low-grade ore. This is now practically all shipped, and additional funds for exploration must be raised by assessments.

A tabulation of the ore shipments from the Tintic district shows that between January 1 and May 10, 3265 cars of ore, worth $2,612,000, were shipped from the district.

Salt Lake County

The report of the Ohio copper company for the six months ended March 31 was given out at the annual meeting of the company held at Portland, Maine, on June 5. The ore mined in this period amounted to 311,068 tons, and the copper produced was 3,754,866 lb. The ore averaged 1.176% copper, and apparently the recovery was 50% of the copper content. The average cost of mining was 26.73c. per ton of dry ore and the milling cost was 37.02c. per ton. The total operating expense was $251,050, and the operating profit $184,346. Miscellaneous expenses to the amount of $74,869 brought down the net profit to $109,477. This profit was used to equip the third section of the mill, and the company expects to treat 3000 tons per day by August 1. The report gives the mine 3,200,000 tons of developed ore in sight, and estimates between 9,000,000 and 10,000,000 tons of probable ore. The floating debt of the company has increased from $588,979, two years ago, to $839,489, but the cash on hand has also increased in the same period from $8840 to $120,043. The company has not been successful in marketing its bonds, of which there are in the treasury $754,000.

Summit County

The Daly-Judge mine has opened up the Daly vein on the 500-ft. level, and George W. Lambourne, manager for the company, hopes development will prove this level as productive as lower stopes. The vein was first extensively opened on the 1200-ft. level and later on the 900. On the 700-ft. level the vein has made some big stopes and development at that depth gave indication of the extension of the ore upward in paying quantities. Ore was first found on the 700-ft. level over the No. 2 stope last September, and from that time to January 1, 1912, some 5000 tons of milling ore was taken out. Below this level the vein widened and the stope was found to be 40 ft. wide. Recent development on this level has indicated that good ore will be found above, and when the drift has progressed to the vein, it is believed that it will be found to be ore-bearing from the 500 to the 1200-ft. levels.

The Daly West Mining Co. has announced that milling operations will be resumed June 10. Enough milling ore is stored in the stopes to keep the plant busy for months, but only one shift will be put at work until an increased output seems desirable. During the past months the mill has been down on account of the freezing of the water-supply in the Wasatch range. Shipments of high-grade ore have been kept up, however, and good ore has been developed on six levels, the deepest of which is the 2100-ft. level.

Tooele County

The International Smelting & Refining Co., in the year ended December 31, 1911, earned a gross income of $3,539,-

204, and a net income of $1,219,037. This is equal to 12.19% on the capital stock, as compared with 10.02% in 1910. Dividends to the amount of $800,000 were paid, and the surplus of the company was increased to $1,555,940. These figures are from the annual report published in New York and cover the operations of the company at the Eastern refinery as well as at the Tooele smelter. A recent order has been placed for four additional sintering machines for the Tooele plant. These will take care of the increased amounts of lead ore coming to the smelter for reduction. A bag-house will soon be erected in connection with the converter department.

CANADA

British Columbia

The Windfall group of claims near Hedley has been bonded to the Hedley Gold Mining Co., the owners of the adjoining Nickel Plate group, which has produced about $4,000,000 for this company. The price involved in the purchase of the Windfall is $150,000.

The management of the Granby Con. M. S. & P. Co. will delay the building of the proposed smelter at the Hidden Creek property for three or four months, until it can prove by actual underground working the results of the diamond-drilling, which have indicated a large body of 2% self-fluxing ore. The management expects to build a 2000-ton plant, and the directors have voted $300,000 for preliminary work, including foundation work, and also $200,000 for mine development.

Ontario

From the Cobalt district the bullion shipments for the first five months of 1912 are as follows:

	Ounces.	Value.
Nipissing	1,587,763.75	$920,892.18
Crown Reserve	207,203.00	115,951.19
Temiskaming	56,833.00	33,804.96
O'Brien	88,433.01	50,964.00
Nova Scotia	49,010.00	31,800.00
Buffalo	38,938.00	22,714.54
McKinley-Darragh	10,327.00	6,069.37
Kerr Lake	7,240.25	4,381.21
Trethewey	5,703.66	3,238.00
City of Cobalt	1,618.40	1,000.00
Colonial	1,698.00	1,018.00
Miscellaneous	16,268.81	10,798.64
Totals	2,071,036.88	$1,202,632.09

The May shipments of high-grade ore are given, in pounds, below:

Kerr Lake	101,541
Temiskaming	395,329
Drummond	37,112
Beaver	111,094
Hudson Bay	125,493
Buffalo	182,482
Cobalt Townsite	310,335
McKinley-Darragh	140,753
La Rose	818,091
Coniagas	344,690
Nipissing	393,356
Chambers-Ferland	128,000
Crown Reserve	77,910
O'Brien	127,923
Trethewey	114,737
Colonial	43,200
Cobalt Lake	62,310
Total	3,814,356

A meeting of the Porcupine branch of the Canadian Mining Institute was held at the Pearl Lake Gold Mines bungalow, June 8. Starting of the Vipond mill has been delayed by the non-arrival of an electric motor which went astray. The other machinery is in place and ready for operation. In the mine ore has been broken and stored in the stopes, and it is the intention of the management to keep a reserve of broken ore in the mine. The feed to the mill will be kept as uniform as possible and the underground reserves will be used to grade the ore to about $15 per ton.

The reorganization of the Pearl Lake Mining Co. places the control of the company in the hands of officials of the Pennsylvania railroad, who are also connected with the Tonopah-Belmont in Nevada. The management of the Pearl Lake will be in the hands of the Hargraves Engineering Co. A development fund of $250,000 has been raised and placed in the treasury. A 10-stamp mill will be erected immediately, so designed that additional stamps can be added if necessary. The main shaft, which is now down 400 ft., will be continued to the 800-ft. level, when another station will be cut, and a cross-cut started south to cut an ore-zone, which gave favorable assays from drill-hole samples last fall. At the 400-ft. level a cross-cut, which was started just before the old company made an assignment, will be continued 200 ft. to tap another vein which gave an assay of $58 from the diamond-drill cores.

Yukon

The first steamer of the year left White Horse for Dawson on May 31. The Yukon river was then open for its full length. This is exceptionally early.

MEXICO

Chihuahua

At the El Chocheno mine near Temosachic, a new power plant is being erected, and the mine has supplies on hand to enable a steady output to be maintained.

Durango

(Special Correspondence.)—The Penoles Mining Co. has been granted a sixty-day extension from May 1, on its option on the Paloma mines in Mapami district. The original option was for thirty days, and during that period five engineers representing the Penoles company started an examination of the property. Their report was not ready at the time the first option period expired, and the extension was granted in order that the prospective purchasing company might have information in regard to the propable production of the Paloma mines. The proposed consideration is ₱2,000,000. The Penoles Mining Co. is one of the strongest German mining concerns operating in Mexico. It has a capital stock of ₱4,000,000 and its mines in 1911 paid a dividend of $750,000 to the stockholders. It is expected that the Penoles company will extend development and increase production of the Paloma if the deal is made.

Monterey, June 10.

Sonora

The Greene-Cananea Copper Co. has recently acquired a large interest in a property known as the Sonora Bonanza, situated on the main line of the Southern Pacific in Mexico, south of Nogales, Arizona. The mine is said to produce ore averaging $10 per ton in gold, but the chief value to Greene-Cananea is in the high percentage of silica in the ore. Greene-Cananea has been planning an increased output of approximately 9,000,000 lb. of copper per month, and has already placed three or four large converters. This increased production requires an additional amount of silicious material to treat with its iron ores, and the Sonora Bonanza is regarded as a valuable acquisition which will facilitate the desired metallurgical results.

A new company has been organized to operate the Abundancia property, formerly held under option by the Cananea West company and later by the Copper Queen company. The property is owned by Juan Cabral, Sr., and the new company, which will be known as the Abundancia Mining Co., has been organized by O. L. Neer, of Douglas, Arizona, and Apollis Fuller, of Boston. The property is six miles west of the Greene-Cananea smelter, on the west slope of the Cananea mountains. Some rich ore has been found in the past, and trial shipments were made to the El Paso smelter in 1908 and 1909. A force of men has been put at work, and shipments of ore will be made to the Cananea and Copper Queen smelters as soon as the mine can be reopened.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

LEONARD ORYNSKI is in San Francisco.

T. LANE CARTER is in northern Michigan.

GELASIO CAETANI has returned from Idaho.

PHILIP BRADLEY has gone to Nevada county.

WALTER HARVEY WEED is at Wallace, Idaho.

W. R. CRANE will leave for Alaska June 18.

W. A. WOLF is here from Ecuador for a short stay.

FRANK LAWRENCE is in San Francisco for a short stay.

ROGER BEALS has returned to San Francisco from Butte county.

R. B. NICKERSON has returned to Oakland from Kenora, Ontario.

H. W. YOUNG is leaving for a trip through British Columbia.

ALBERT BURCH was in San Francisco Monday, but left for Nevada Tuesday.

VICTOR G. HILLS is examining properties near White Horse, Yukon Territory.

R. S. BOTSFORD has returned to London from eastern Siberia, near Vladivostok.

WILLIAM H. KINNON is now manager of the 85 Mining Co., Lordsburg, New Mexico.

H. W. HARDINGE is in London and will visit Stockholm before returning to New York.

WILLIAM J. MCGEE has gone to Chicago and New York, expecting to return in about three months.

GEORGE WINGFIELD has been appointed United States Senator from Nevada to fill the unexpired term of GEORGE S. NIXON.

EDWIN J. COLLINS has returned to Duluth, Minnesota, from British Columbia, where he has been examining copper properties.

W. H. ALDRIDGE will make his headquarters after July 1 with WILLIAM B. THOMPSON, Bankers Trust building, 14 Wall street, New York.

E. S. SHEFFIELD has been appointed superintendent of the Empire and Pennsylvania mines at Grass Valley, California. GEORGE W. STARR continues as managing director.

Obituary

JAMES H. KINKEAD, inventor of the Kinkead mill and well known especially for his work on the Comstock Lode, died at Reno, Nevada, June 9, at the age of 69.

ALEXANDER HILL, of Alexander Hill & Stewart, died in London on April 24. According to 'Who's Who in Mining & Metallurgy,' Mr. Hill was educated at St. Andrew's and Glasgow universities. He entered the laboratory of the Tharsis Sulphur & Copper Co., then went to Rio Tinto mines, Spain, and was in charge of nearly half the works there for five years. From there he went to Mexico as manager of silver mines and reduction works at El Chico. Later he served as manager for Archibald Coates, of Paisley, Scotland, of various copper and other mines in Spain and Portugal. He became a partner of G. D. Delprat and in 1895 went to California for Matheson & Co. In 1897 he returned to England and in 1903 took into partnership C. H. Stewart, forming the firm of Alexander Hill & Stewart. Mr. Hill was about 55 years of age. His firm has been consulting engineers for the Le Roi No. 2, Ltd., with a group of mines and small concentrating plant at Rossland, B. C. From the time of the organization of the company in 1900, and in his consulting capacity, Mr. Hill visited Rossland several times, the last having been about five years ago. The firm has acted in like capacity for the Van-Roi Mining Co., with mines and concentrating mill in the Slocan district, British Columbia.

Market Reports

LOCAL METAL PRICES

San Francisco June 14.

Antimony	11—11½c	Quicksilver (flask)	41
Electrolytic Copper	17½—17½c	Tin	60—61½c
Pig Lead	4.70—5.70c	Spelter	7½—7½c
Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50			

METAL PRICES

(By wire from New York.)

NEW YORK, June 13.—In copper a large business is now being done, and there is danger of a shortage through a strike at the refineries. Lead is strong and advancing with good demand. Spelter remains firm.

Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
June 6	17.10	4.20	6.83	60⅛
" 7	17.18	4.20	6.83	—
" 8	17.25	4.20	6.83	—
" 9	Sunday.	No market.		
" 10	17.28	4.20	6.83	61⅛
" 11	17.28	4.20	6.83	61⅛
" 12	17.25	4.60	6.83	61⅛

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	June 12.
Camp Bird Ltd	$ 7
El Oro	4⅛
Esperanza	7½
Oroville Dredging	1½
Santa Gertrudis	7½
Tomboy	6

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, June 13.		Closing Prices June 13.
Adventure	$ 9⅛	Mohawk	$ 67½
Allouez	48	North Butte	31
Calumet & Arizona	76	Old Dominion	58⅛
Calumet & Hecla	523	Osceola	124
Centennial	25½	Quincy	91
Copper Range	58¾	Shannon	15
Daly West	5½	Superior & Boston	2⅛
Franklin	13⅛	Tamarack	45½
Granby	66⅛	Trinity	7
Greene Cananea, ctf.	10	Utah Con	11½
Isle-Royale	32½	Victoria	3 15/16
La Salle	7⅛	Winona	6¾
Mass Copper	7½	Wolverine	111

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, June 13.

Atlanta	$ .26	Mayflower	$ .02
Belcher	.52	Mexican	2.70
Belmont	10.20	Midway	44
B. & B.	.12	Montana-Tonopah	2 55
Booth	.09	Nevada Hills	2.10
Chollar	.04	Ophir	1.17
Combination Fraction	.16	Pittsburg Silver Peak	1.25
Con. Virginia	.57	Round Mountain	.43
Florence	.91	Savage	.13
Goldfield Con.	4.30	Tonopah Extension	1.90
Gould & Curry	.04	Tonopah of Nevada	7.00
Jim Butler	.54	Union	.70
Jumbo Extension	.38	Vernal	.13
MacNamara	.24	West End	1.87

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. June 13.		Closing Prices. June 13.
Amalgamated Copper	$ 85⅞	Miami Copper	$ 28⅛
A. S. & R. Co.	85½	Mines Co. of America	3⅛
Braden Copper	6⅞	Nevada Con	22½
B. C. Copper Co.	6	Nipissing	7⅞
Chino	32⅜	Ohio Copper	1⅜
First National	3	Ray Con	20⅜
Giroux	5⅜	Tenn. Copper	43¾
Goldfield Con.	4½	Tonopah Belmont	10½
Greene-Cananea	10⅛	Tonopah Ex.	1⅞
Hollinger	9⅜	Tonopah Mining	7
Inspiration	19	Trinity	7
Kerr Lake	2⅞	Tuolumne Copper	4⅛
La Rose	3⅜	Utah Copper	63¾
Mason Valley	12⅜	West End	1⅞
McKinley-Darragh	1⅞	Yukon Gold	3⅜

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

A TEXT-BOOK OF RAND METALLURGICAL PRACTICE. Vol. I. By Ralph Stokes, J. E. Thomas, G. O. Smart, W. R. Dowling, H. A. White, E. H. Johnson, W. A. Caldecott, A. McA. Johnston, and C. O. Schmitt. Chas. Griffin & Co., London, 1912. For sale by the *Mining and Scientific Press*. Price $6.50.

This important volume is so full of material that it is quite possible to approach it in review from a variety of standpoints. The authors are all men of prominence in the development of Rand metallurgy (the majority of them being or having been connected with the Consolidated Gold Fields of South Africa), and such a concerted effort could scarcely fail to be of great service and importance. W. A. Caldecott deserves especial prominence in the list of editors, since the production of this volume is largely due to his initiative and energy. The value and importance of such a work is obvious, and it would be easy to fill a large amount of space with commendation of its excellence. On the other hand, anything which is so good upon the whole can easily support criticism of its defects, and even on hasty reading it is evident that the book could have been much improved by the elimination of the obvious. The elementary material included sometimes verges on the absurd; on page 59 for example, "To reset a tappet it is raised on the stem, or the stem lowered through it." Rand metallurgists must be skeptical if they require to be assured that either method would be effective. Several of the co-authors appear to have forgotten the title of the work, and present general discussions rather than descriptions of Rand practice. This is especially so of the chapters on breaking and sorting, and assaying, both of which might have been greatly improved if their authors had chosen to eliminate the elemental and devote a corresponding amount of space to illustrations and records of Rand practice, with an analysis of the reasons for adoption and retention of the methods. Some of the chapters cause the reader to consult the date on the fly-leaf in bewilderment. Especially is this true of the chapter on stamp-milling, which also is disappointing because it is largely confined to a discussion of elementary principles rather than the features that characterize stamp-milling practice on the Rand. An analysis of the results of the recent comparison between individual mortar stamps and 5-stamp units would have been a most desirable feature, but the author has given us nothing on this subject. Apparently the old Challenge ore-feeders are still in use on the Rand, although the Nelson and other types of grip feeders have demonstrated their superiority in every other mining district in the world. The Challenge feeder with the old-style pawl, pawl-shoe, and 'banjo' friction is prominently displayed, while the Tulloch, superseded by the Challenge twenty years ago, is given a generous allotment of space. The reader is referred to Egleston's 'Metallurgy of Gold, Silver, and Mercury,' which has been out of print for nearly two decades, while MacFarren's recent book is not even mentioned. Fig. 27 shows an "Improved" stamp-head, the improvement consisting of a hole cored longitudinally through the centre for the insertion of a drift-pin for the removal of the stem. This method was tried in California many years ago and abandoned because the hole weakened the casting, causing frequent breakages. The description of the new curve for cams, Fig. 23, developed by Hans Behr, is interesting but disappointing, as the author, while giving the radius of the curve, has neglected to show the relative position of the centre. We must disagree with the author's remarks on the order of drop. The salient point to be remembered is not that no two adjacent stamps must drop successively, but that the order of drop should be such that an even distribution of pulp between the shoes and dies should be obtained and the pulp should be prevented from banking in the ends of the mortar. The established drop that most nearly accomplishes this end is 1-5-2-4-3, in which it will be noted that two stamps, 3 and 4, are adjacent and drop successively.

The chapter on assaying is likely to be a source of more astonishment than service to the ordinary assayer in America. The assay of ore containing free gold and assaying $5 to $6 per ton, by crushing the sample through a 60-mesh screen ("should, however, coarse particles of gold be liable to occur the screen must be inverted and any particles failing to pass be rubbed into the sample"), using 1 assay-ton charges, and weighing the gold on a balance sensitive to 0.02 mg., is at least a decade behind current American practice in assaying.

It is perhaps more of a compliment to the vigor of discussion among Rand engineers than criticism of the book that much recent material seems to have escaped inclusion in this volume. Some of the more valuable chapters have already appeared in print elsewhere, and the authors may have lacked opportunity to bring them up to date. The preparation of a volume by a multiplicity of authors, while having obvious advantages, presents no less obvious difficulties, and every such volume should have its lack of homogeneity viewed with toleration.

Those engaged in cyanide practice elsewhere will consult with the greatest interest the chapters on tube-milling, the treatment of sand and slime, and the chemistry of Rand ore-treatment. Considerations of space preclude any extended review of these, and it must suffice to say that they are discussed by men who are leaders in the work and are able, confining themselves to Rand practice, to present their topics lucidly and with authority. Not to attempt to catalogue its excellences, the beginning and end of the volume are especially admirable; namely, the comprehensive summary of the Rand and Rand problems, by Ralph Stokes, and that of the chemistry of Rand ore-treatment, by W. A. Caldecott. The tables which conclude the book, compiled by W. A. Caldecott and H. A. White, are unusual in containing so much of value in addition to the ordinary tabular material that can readily be obtained from any of the numerous handbooks. Altogether this volume is easily the most important of recent works on metallurgy and should be widely read.

MANUAL OF STYLE. The University of Chicago Press. Pp. 140 — 118; ill., index. Third Edition. Chicago, 1911. For sale by the *Mining and Scientific Press*. Price $0.85 paper, $1.12 cloth.

To engineers this useful book may perhaps be most easily described as a volume of specifications for the guidance of proof-readers, compositors, and editors. It is more than this, however, and the explanatory matter concerning the mechanical side of the printer's art will be of interest and service to all who have occasion to write for publication. In matters of detail the style of the Manual differs in many particulars from that of the *Mining and Scientific Press*, and the sentence at the bottom of page 36 was evidently not written by the professor of rhetoric at the University, but a consistent usage is most important, while uniformity can scarcely be expected before the Greek Kalends. The Manual is unusually comprehensive, and should be upon the reference shelf of every editorial room.

NEVADA STATE GAZETTEER AND BUSINESS DIRECTORY. Pp. 460. R. L. Polk & Co., Seattle, 1912. For sale by the *Mining and Scientific Press*. Price $10.

This volume is a useful business directory and its lists of government and county officers, state boards and commissions, postmasters, postoffices, express, telephone, and telegraph offices, justices of the peace, hotels, and daily and weekly newspapers will prove of much service. Valuable data concerning all the principal communities, such as situation, population, distance to different points, the most convenient shipping points, products that are marketed, stage communication, schools, libraries, and societies form a feature of the work, and the classified directory of business houses, mines, and mining companies, and list of land owners compiled by county, giving postoffice address, is especially convenient.

Copper Statistics and the Copper Market

*In 1911 there was a decrease in the world stocks of 45,000 tons, leaving a little more than one month's supply on hand. German consumption increased 10%, and other European countries are using an increasing amount. American needs were less in 1911 than in the preceding year, by 5%, but there is promise of greatly increased demand from American consumers in 1912.

The large new supplies which were promised in fabulous quantities are not yet apparent. The first important consignment of copper from the much-famed Katanga district arrived about the end of the year, and it is manifest that problems have yet to be solved before a large production can be looked for from this source. In America also, a too optimistic view appears to have been taken of the time required to develop the new sources. The long-heralded vast quantities from the porphyry mines are still only futures. Similarly, the Braden Copper Co. in Chile, in spite of years of laborious development and the completion of its large smelters, has not yet entered the ranks of the producers. A further instance is furnished by the Copper River district in Alaska. The district has been spoken of for ten years as one of the richest fields in the world. It has been necessary, however, to construct a railway at great cost, and last year only about 7000 tons of ore found its way to smelters, and of this quantity only a portion could be treated in 1911. The next year should witness the completion of some of these prophecies. The Miami, Ray, and Chino will be large producers. Considerable quantities of copper from the Mason Valley company in Nevada and from the Chilean and Alaskan fields, may also be expected.

The world's copper production, according to the figures for 1911 compiled by Aron Hirsch & Sohn, is given in the following table, in tons of 2240 pounds:

Producing Countries	1903.	1906.	1910.	1911.
Germany	21,200	26,200	28,800	30,500
Austria-Hungary	1,300	1,500	2,250	2,520
Italy	3,100	3,100	3,000	3,000
Russia	10,300	10,000	22,300	25,500
Norway and Sweden	6,000	10,954	7,000	9,500
Spain and Portugal	49,700	51,000	53,000	55,000
Turkey	1,400	1,000	1,500	700
United States	311,500	417,400	482,200	487,300
Mexico	45,300	60,000	58,800	54,050
Canada	19,300	24,000	22,500	24,000
Chile	31,100	30,000	35,800	29,600
Peru	7,800	11,000	26,000	26,000
Bolivia	2,000	2,000	2,500	2,500
Cape Colony	5,200	8,500	7,000	7,000
Australia	29,000	43,000	43,400	44,600
Newfoundland	2,100	2,500	2,100	2,100
Japan	32,600	38,000	50,000	55,000
Miscellaneous	1,100	1,500	9,000	10,500
World's production	580,000	741,654	857,150	869,370

The world's copper consumption of the principal consuming countries, for the corresponding years, is as follows, in tons of 2240 pounds:

Consuming Countries.	1903.	1906.	1910.	1911.
Germany	116,318	163,098	208,826	234,985
France	52,789	68,927	92,838	106,408
England	110,765	121,256	148,187	159,736
Austria-Hungary	21,122	27,976	37,150	41,101
Russia	24,633	24,532	28,237	31,830
Italy	10,987	25,237	32,487	40,949
Belgium and Holland	8,600	12,798	14,000	13,000
Scandinavia	2,200	7,000	9,500	9,500
Rest of Europe	1,400	3,000	2,500	2,500
Europe	348,814	453,824	573,725	640,009
North America	241,071	316,964	334,565	316,791
Rest of America	1,200	2,200	3,000	3,000
Europe and America	591,085	772,988	911,290	959,800
China	4,605	2,576	5,000	4,500
Japan and rest of Asia	9,500	10,000	15,000	20,000
Africa and Australia	1,800	2,000	2,000	2,000
World's consumption	606,990	787,564	933,290	986,300

These figures do not show the exact proportion between the world's production and consumption, as in some cases the imports of manufactures have been included as consumption, although they have already appeared in the consumption total of the country of origin. The quantities of old metal, which are not separated statistically, also prevent an exact comparison.

*From 'Statistical Compilations About Copper,' issued by L. Vogelstein & Co., New York.

The world's stocks of copper on hand December 31 for the last four years is estimated as follows:

World's Stocks.	1908.	1909.	1910	1911
United States	54,624	63,289	54,480	39,947
England	40,961	95,673	66,917	42,104
France	5,266	6,299	6,080	[illegible]
Rotterdam and Hamburg	3,000	2,200	16,300	[illegible]
Total	103,851	167,461	143,777	100,695

The average price of copper since 1900 in the New York and London markets shows a wider range than can be accounted for by production and consumption tables. Evidently speculation, manipulation, and general business conditions have influenced price as much as the amount of stocks.

PRICES OF ELECTROLYTIC AND LAKE COPPER IN N. Y.

	Av. Price in cents per lb.: Electrolytic.	Lake.		Av. Price in cents per lb.: Electrolytic.	Lake.
1900	16.48	16.69	1906	19.39	19.67
1901	16.35	16.78	1907	20.11	20.66
1902	11.82	11.98	1908	13.22	13.38
1903	13.63	13.45	1909	13.02	13.35
1904	13.09	13.12	1910	12.81	13.03
1905	15.82	15.89	1911	12.47	12.64

On the other hand, the outlook is all in favor of an increase in European consumption, especially in Germany. The substitution of electric for steam power in railways is only a matter of time. Certainly a sudden transition is neither possible nor desirable, if only because of the gigantic amount of capital involved, and furthermore, a rapidly increased demand would be beyond the reach of production. American finances are sound, but disturbed by the impending election. After the settlement of this question, the state of industry in the United States should improve.

Copper consumption in America has not increased since 1906, and the natural industrial expansion impeded by the quiet years since then must be resumed with augmented vigor, and a boom period may be anticipated, when consumption gains by leaps and bounds, as in 1899 and 1905.

One further point of importance lies in the fact that no new mines have been exploited in the last two years, and in view of the low metal prices, there has been a suspension of pioneer work in this regard. There are, therefore, no apparent sources of new production, and even with new discoveries stimulated by better market conditions, new mines, as already shown, do not become producers for years, generally too late to profit by the high prices which induced their promoters to seek them. For a healthy development of the copper industry, exaggerated fear of overproduction on the one hand, and fevered activity, on the other, are equally harmful. Granted immunity from restraints of a political nature, the industrial world may look into the immediate future of the copper industry with confidence.

Dividends

The Daly-Judge has declared a dividend of 15c. per share, payable July 1.

Yukon Gold has declared a regular quarterly dividend of 1½%, payable June 29.

Old Dominion M. & S. Co. has declared a quarterly dividend of $1.25 per share.

The Trethewey Silver-Cobalt Mine, Ltd., has declared a dividend of 10%, payable June 15.

The Montana-Tonopah Mining Co. has declared a dividend of 10c. per share, payable June 21.

Calumet & Arizona Mining Co. has declared a quarterly dividend of $1 per share, payable June 24.

The Guggenheim Exploration Co. has declared a regular quarterly dividend of 2½%, payable July 1.

United Verde Copper Co. paid a dividend of 75c. on June 4, the fourth dividend during the current year.

The Hecla Mining Co. has paid its regular monthly dividend of 2c. per share, making a total to date of $2,450,000.

Nipissing Mines Co. has declared a regular quarterly dividend of 5% and an extra dividend of 2½%, payable July 20.

The McKinley-Darragh-Savage Mines, Ltd., has declared a regular quarterly dividend of 3% and an extra dividend of 7%, payable July 1.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

OIL GRANT—RIGHT TO ERECT PUMPING STATION

Where a conveyance of oil and gas, with certain rights as to pipe-lines, conduits, and machinery in or upon the land of the grantor, is ambiguous as to the right to erect on the land pumping stations, the deed will be construed to give such right, where the grantee erected a pumping station on the land and operated it for fourteen years without objection from the grantor.

Collision *v.* Philadelphia Co., (Pennsylvania) 82 Atlantic, 474. Jan. 2, 1912.

GRANT OF MINERAL RIGHTS—TIME FOR COMMENCING WORK

Where a grantor conveys the mineral and timber rights on his land in consideration of certain royalties to be derived from developing such rights, the court will read into the contract the condition that development must be commenced within a reasonable time, if the contract contains no express terms as to the time of commencement. Failure to begin operations within such reasonable time will entitle the grantor to declare the rights abandoned and re-enter.

Eastern Kentucky Mineral, etc., Co. *v.* Swann-Day Lumber Co., (Kentucky) 146 Southwestern, 438. April 30, 1912.

MINER'S LIENS—LESSEE NOT THE LESSOR'S AGENT

Persons who furnished labor and materials for the development of a mine under contracts with a lessee in possession of the mine, with full knowledge that the lessee was operating under a lease, were held to have contracted with such lessee as principal and could not hold the lessor liable so as to charge his property with miner's liens. A mining lease containing the usual covenants does not constitute the lessee the lessor's agent with authority to contract for material and labor so as to charge the property with miner's liens.

Union Trust Co. *v.* Branch Mint Operating Co., (South Dakota) 134 Northwestern, 65. Jan. 17, 1912.

OIL PLACER LOCATION BY CORPORATION—AREA

Where eight persons made an association oil placer location of 160 acres and immediately afterward conveyed the same to a corporation of which several of the eight locators were officers or organizers, it was held that the prior oil discovery by the corporation would only support a claim to the twenty acres on which the well was drilled. A corporation is only one person and cannot lawfully embrace in a single location under the placer mining laws more than twenty acres, either in its own name or through individuals who are manifestly acting in its interest and for its benefit.

Coalinga Hub Oil Co., (Land Department) 40 Land Decisions, 401. Dec. 20, 1911.

ASSOCIATION OIL CLAIM—EFFECT OF CONVEYANCE OF PART

Where eight persons as associates enter upon and locate a tract of 160 acres of vacant unoccupied mineral lands of the United States under the placer-mining laws, and proceed with the work of development to make an oil discovery, but before any discovery is made they all join in conveying a specific portion of the consolidated claim to a third person who prosecutes the work of discovery on the portion so conveyed, and subsequently makes a sufficient discovery of oil, the effect of such a conveyance, in the absence of any contrary understanding, is to surrender to the grantee all of the rights which the grantors formerly enjoyed in the portion conveyed, and to constitute it a separate and independent claim; and such subsequent discovery of oil would not redound to the benefit of the portion not conveyed or suffice to validate and perfect the location of the owners thereof.

Merced Oil Co. *v.* Great Northern Oil Co. (California) 43 California Decisions, 303. March 22, 1912.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

TRUNK-CYLINDER hoists, the so-called Anaconda type, are peculiar in their construction in that the exhaust pipe is placed above the inlet, so that cases have been known of the exhaust being connected to the boiler or air-line. Needless to say, a single-acting cylinder will not act with such an arrangement.

SCREENING tests on mill samples can only be made accurately by the wet method. The slime should be washed through a 200-mesh screen, after which the oversize can be dried and screened with comparative ease. A small amount of material under 200-mesh will be obtained in the final screening, and this should be added and weighed with the dried slime.

TITRATION of potassium cyanide by the $AgNO_3$ method is inaccurate in the presence of ferrocyanide, which dissolves the AgCN. It has been found by Treadwell that if the cyanide is not stronger than one-tenth normal, is rendered slightly alkaline with ammonia and 1 gm. KI added, accurate results are obtained. By this means $K_2S_2O_3$, if present, is prevented from interfering.

ZINC carbonate ore occurs at the Cerro Gordo mines at Keeler, in Inyo county, California. These mines were for many years operated as lead mines, the zinc deposits having been discovered only recently. Zinc occurs in the copper ore of the Mammoth mine at Kennett, in Shasta county, but is not now recovered from the fume, where the zinc is useful in neutralizing the SO_3 formed in copper smelting. Zinc also occurs in the Bully Hill copper ores, and experiments are now under way to develop a process for saving the zinc.

GOLD or platinum wires of small diameter, or the filaments for tungsten or tantalum lamps may be fused by the use of lead-pencil electrodes. Two ordinary pencils should be sharpened and then the wood cut away a short distance above the point, so as to expose the 'lead.' Small copper wires can then be used to connect the lead-pencils with an ordinary lighting circuit, but a suitable resistance must be interposed to prevent short-circuiting. On bringing the tips of the pencils together a small arc will be formed that is hot enough to fuse small wires.

ADVERSE claims may be filed against any kind of a mineral entry by another mineral location, whether of the same class or not; though where the classes of locations are at variance the adverse may take on the nature of a protest, as in the case of a lode claim adversing a millsite and questioning its non-mineral character. Claimants under filings or entries other than mineral, instead of adversing mineral applications, protest against them. A co-owner who has been excluded from the application for patent by the co-owners, may adverse in his own behalf, but his adverse is more in the nature of a protest.

DIRECT air-hoists are simple in action, responding with ideal promptness to valve manipulation for either motion, but their simplicity and promptness sometimes seem to be in excess. They may hoist too quickly and may not stop the load at the precise point desired, while a careless hand may drop the load too sharply. Such a hoist also, when the air is shut off, will not hold its load continuously, slight leakage allowing a slow descent—extremely slow, if everything is all right—but still it cannot hold absolutely. The motor hoist has more than all of the desirable properties and none of these objections. It is entirely responsive to the control of its manipulator. It will hoist at any speed desired; it will stop with precision; it will hold its load absolutely for any length of time; it will lower gently and will not run down to make unnecessary slack to be taken up before the next hoist.

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EDITORIAL

AN error in proof-reading in our issue of June 8 makes us speak of Joplin lead ore as selling on a 60 per cent basis. In fact lead ore there sells on the basis of containing 80 per cent of lead. It was zinc that was meant and which there sells on the 60 per cent basis, as is well known to all familiar with the district.

MINE LA MOTTE has closed again, this time as a result of the demand for higher wages on the part of the miners employed. This famous old estate in southeastern Missouri has fallen upon evil days. All familiar with the beautiful surroundings and the long history of the property will hope that the various difficulties may be resolved and the mines and furnace again become the centre of busy and contented industry.

MEXICAN conditions are still far from satisfactory, but the area under domination of the Madero government is being steadily increased, and it is interesting to note that the smelters of the American Smelters Securities Company are working at maximum capacity. In general the large business enterprises have suffered little interference, except in the case of the railroads in the north. The insurgents in Chihuahua are short of funds and ammunition, while the federals are well supplied.

SINKING a shaft through running water without cribbing sounds like the impossible, but Mr. Leon Perret tells how they manage to do it in Russia. Putting a stove into a test pit in order to freeze the sides is also paradoxical, but it works. Many an effective native method is condemned by visiting engineers because it is crude, when in reality it is simple and excellently adapted to the work in hand. We especially commend Mr. Perret's article on 'Prospecting Frozen Ground' to engineers engaged in placer examinations.

PHOSPHATE lands in the United States seem likely to remain withdrawn from entry for some time. Mr. F. W. Mondell has introduced a bill in the House of Representatives providing that hereafter they shall "when subject to entry" be entered only under the placer laws. The Senate committee has, however, recommended favorably a bill providing that they may be disposed of "as placer or lode claims as may be appropriate." In the meantime the administration is committed to leasing, and apparently public sentiment favors the latter plan.

FINANCING China is likely to have no little effect on the silver market. Terms of the $300,000,000 loan have already been concluded, and $100,000,000 is to be paid over in the course of this year. Some of this will be absorbed in meeting the back payments of interest upon China's present indebtedness, but a large part will enter the country as bar silver. Whether this absorption of silver has already been fully discounted by the advance in the price of that metal since the first of the year is difficult to determine, but it seems likely that the ruling price of silver during the next few years will be higher than during recent years.

MOSQUITOES and flies are to be banished from Oroville, in a general effort to do away with conditions favorable to the spread of disease. Malaria, it is reported, has already been decreased 25 per cent. Conservation is the order of the day, and conservation of health should be first.

GEOLOGISTS are in good repute in the Far North, and it is an interesting tribute to the profession that Mr. J. B. Tyrrell should have been appointed recently to head the expedition charged with the selection of lands on Hudson Bay, given by the Dominion of Canada to Ontario for railway terminals. At Dawson there is now an active protest at the detail of Mr. D. D. Cairnes to work lower on the Yukon, and the demand is made that another geologist be sent to give the expert advice needed this year in the effort to develop quartz mining near that enterprising city, which is itself named after an excellent geologist. In the bill for home rule of Alaska, now being debated at Washington, there is provision that a geologist shall serve with two engineers on the commission charged with the duty of locating and building railroads through the territory. Despite the old gibe, 'one man can see into the ground as far as another,' the ability of the scientists to see into the future seems to have impressed the practical men of the North.

NEW methods are always promising—indeed that is often their chief characteristic. We know of few, however, that promise as much for so little as one called the 'Rational Process'. Concerning it the promoters write: "The exact chemical composition of the ore must be known before the work begins. The reason of this is that all the atoms are held together by electroids, or ironic centres of force, and that these centres of force do not at all times remain constant in their potential, and therefore behave differently at different times although of the same chemical composition, and again altered when the chemical composition is varied. Then when the mass of ore is ready the whole is depolerized, paralyzing these ionoids till molecular cohesion is eliminated. By the application of a simple device the good is easily separated from the bad. In other words the gold from the slimes and the gold that the slimes carry. The time required for an assay of one pound is approximately twenty minutes. The cost thus far averages $1.50 per ton, depending upon the transportation facilities. A plant for handling five units per day would cost about $5000."

EXCEEDINGLY interesting things have been developed in the inquiry carried on by Mr. Samuel Untermyer as counsel for the Congressional committee investigating the 'money trust.' To the unprejudiced observer it is quite apparent that there is no discredit to be thrown upon the bankers of New York, who have steadily grown in power and influence; and the misuse of this power, if misuse it can be called, has been by no means flagrant or altogether selfish. In fact, the chief criticism or comment that can be made is, that the Eastern bankers have overrated their own importance; that they have come to feel a sense of ownership rather than a sense of trusteeship, and have to a somewhat unwarranted degree forgotten that the vast amount of capital piled up in New York, under their own control and guidance, belongs to the country at large, and in reality belongs to the people rather than to themselves. In all justice it should be said that the use of this power has been such as to reflect credit upon the bankers. The facts so far brought to light show rather the necessity of the provision of some check, and of a different system, than for condign punishment of those individuals toward whom the American public has recently assumed a markedly vindictive attitude. Abuse there has been, but not so much as might have been expected where such unlimited authority has been reposed in individuals responsible to no one but themselves. A new system is imperative—as to punishment, there will be none.

KATANGA has hung like a shadow over the copper producers ever since Mr. J. R. Farrell came back from that country with accounts of Brobdingnagian deposits awaiting treatment and transportation. Millions have gone into their development, but so complicated has been the financing of the enterprise that no one has felt sure of the outcome. In the meantime the sleeping sickness has crept down from the north as railways have come slowly up from the south. At last, however, copper has begun to reach the market from Central Africa and the public is now fairly well convinced that there are large amounts of metal there to be won. American opinion has, however, settled down to the comfortable belief that the difficulties in the way are so large as to assure that the influx of new metal will be slow, and that the question of real cost is far from being settled. Now it is stated in London that Mr. Robert Williams is to surrender his control of the project, and who will be his successor is not determined. It is not unlikely that Americans will attempt to fortify their position in the copper market by taking advantage of the opportunity to join in the inevitable reorganization; if, indeed, they do not attempt to dominate it. Coincidently it is announced in Boston that the irrepressible Mr. Thomas W. Lawson has sent an expedition to Africa to spy out the land. Only his campaign for the Senate and his desire to assist Mr. Roosevelt are said to have kept him from heading the caravan. Whatever may prove the final truth regarding Central African copper, there can be no question that the field is one admirably chosen for one of Mr. Lawson's brilliant advertising campaigns. *Scribner's* story of the journey of a 'faunal naturalist' through the lion grounds, will pale into insignificance against the lurid 'literature' we may expect from Boston next year—if the price of copper remains high.

RESIGNATION of Mr. Waldemar Lindgren, chief geologist of the United States Geological Survey, removes from the public service another of the highly skilled technical men who have given distinction to one of the great bureaus at Washington. Born in Sweden and trained at Freiberg, Mr. Lindgren found his first opening on the Northern Transcontinental Survey, that brilliant concept of Henry Villard, which did so much to give solid value to the holdings of the Northern Pacific railroad. Later Mr. Lindgren saw service in smelting, and in teaching at Stanford University, but his largest opportunity came in connection with the Geological Survey, in which he has risen from field assistant to the position of highest rank in the technical branch. He first succeeded S. F. Emmons in general direction of the investigations relating to metal mines, and later when Mr. C. W. Hayes retired to take charge of Lord Cowdray's operations in the Mexican oilfields, Mr. Lindgren became chief geologist. No one enjoys writing obituaries, and it is a pleasure to occasionally say good things of men before they die. We will be pardoned, therefore, we hope, for saying that he has filled this position, as all others, admirably and that there will be general regret at his retirement. He goes to Massachusetts Institute of Technology, where, with the new funds and new facilities available, he is certain to build up a centre of geological research of high character. The rapid successive resignations of two chief geologists, and the constant leaving of other good men occupying subordinate positions, would raise a feeling of uneasiness for the future of the Survey if it were not that the latter has deep and strong hold on the imaginations of the young graduates. Good men go but others come, and the Geological Survey is fast becoming, as an incident to its main work, a great graduate school of

instruction. To call the roll of ex-employees is almost to list the successful men of the mining profession. So long as the spirit remains right and the work is honest and thorough, the Survey can continue, like a university, to send its men out into other branches of professional service.

The Measure of Precision

The story is told of a Southern gentleman, who, desiring to employ his negro coachman as chauffeur for his newly acquired motor car, sent him to a school of instruction for some weeks. Upon his return the man showed commendable skill in adjusting the mechanism and guiding the car, and his master enquired: "Rastus, do you thoroughly understand the car?" "Yaas, boss; I unnerstan's her right froo, jest—" "Just what, Rastus." "Well, boss, I unnerstan's the whole endurin' machinery—all ceppin' whar dey keeps de mule dat makes it go." Such simplicity is ridiculous, and yet it is not too much to say that many engineers show, at times, no clearer comprehension of the real nature and limitations of the mechanisms and methods of their profession than did the unenlightened darky. Especially is this true in regard to the theory of precise measurement, and in engineering computations. A vivid illustration occurs in a paper upon precision in mine reports, recently published in the *Bulletin* of the Institution of Mining and Metallurgy and widely quoted in technical journals, in which such sentences as the following occur: "lode widths are usually measured to the nearest inch, so that it is mathematically incorrect to calculate the average width to anything less than a whole inch." • • • "The writer has not been able to find this principle definitely stated as a law in a mathematical textbook, but it would appear only a matter of common sense that, in determining the mean of a number of quantities the result should be expressed to the same degree of accuracy as that observed in measuring the several quantities." Remembering that Laplace's 'Philosophical Essay on Probabilities' was published in 1744, it is truly amazing that in 1912 such nonsensical flapdoodle as this could find publication in the proceedings of a learned society and be quoted by supposedly well informed journals. No clearer evidence could be desired that many engineers are devoid of any understanding of the theory of probability, the difference between mathematical computation and experimental observation, and the correction and adjustment of measurements. Surely it ought to be unnecessary to point out that the quotient of $100 \div 3$ is equal to 33.3333 +, but that if the value 3 has been determined by experiment or measurement to have a true value lying somewhere between 2.9 and 3.1, then the value of the quotient lies between 32.2 and 34.5, and 33 is a sufficiently precise expression of the quotient, under the circumstances. On the other hand, if we have a series of 100 determinations of the value of the divisor, the measured results varying between 2.9 and 3.1, then it will be safe for ordinary purposes to assume that the average is correct within 0.002, and say, for example, that the true value is not less than 3.013 nor greater than 3.015. The exact expression for the probable error is: p. e. $= 0.6745 \sqrt{\frac{d^2 + d^2_1 + \ldots d^2_n}{n(n-1)}}$ where n is the number of determinations, and d, d, d_n, etc., the difference between each and the arithmetic mean. Obviously by increasing n or decreasing d, any desired degree of accuracy may be attained. The error in the determined figure will depend upon the methods of computation employed; thus the average error, the mean square error, or the probable error may be computed. The relation which exists between these may be obtained from Merriman's 'Method of Least Squares,' or Wright and Hayford's 'Adjustment of Observations'; two books with which every engineer who may be called upon to make precise measurements should have at least a superficial familiarity. Ostwald's 'Physico-chemical Measurements' may also be read with profit by engineers.

The difference between corrections and errors is not always appreciated. Thus, in measuring a length, the effect of changes in temperature upon the tape used causes variations in the length as determined, but the amount of the correction may be determined with as great a degree of precision as the work may warrant, while the effect of a tree branch which deflects the tape from its true catenary curve, or from a straight line, cannot be determined and allowed. According to the importance of the work, a corresponding amount of care is taken to prevent the occurrence of such experimental errors and determine the amount of all ascertainable corrections. The nature of the work, therefore, fixes the measure of precision required. In cutting a pump-room underground, it will probably suffice to fix its dimensions by pacing or by use of a yardstick. In setting the foundation bolts for the pump a steel tape will be necessary, while in boring the cylinders repeated measurement with a micrometer caliper is essential. The workman who measured the room with a caliper, or the pump cylinder with a yardstick would be regarded as a simpleton, yet in computations from experimental data engineers frequently make no less reprehensible blunders. Innumerable instances could be cited, but we forbear. The most common blunder arises from using a value experimentally determined either as divisor or dividend, and neglecting to observe what the nature of the quotient thus obtained really is. Thus if the gold content of an assay sample is determined with a probable error of $1, and the sample is divided into 100 parts and one of these re-determined, the probable error will again be $1. But if each of these is assayed and the arithmetical mean taken, the probable error of the mean will be a very small quantity indeed. If an erroneous determination is multiplied by a constant, its error is also multiplied, similarly where erroneous determinations are added the errors are summated. The influence of a continued series of errors is too commonly disregarded. The sample cut across the face in a gold mine may differ considerably from the true average value of the orebody at that point, but that does not constitute a valid reason for assaying the sample by crude methods, nor for carelessness in computing and plotting the results. A chain is no stronger than its weakest link, but the way to get the best service from it is to watch that link, and not by weakening all the other links in like degree. Where all the links are weak the probability that one of them will break is obviously much greater than if only one is weak.

All of which leads us to a fundamental defect in the methods of education pursued in many technical schools. It is declared that the demand of industry is for specialization, and as the time which the student is willing to devote to his education in school is limited, the fundamental principles of physics and chemistry, and their applications, are hastily passed over and the time of the student spent upon details of practice, which are expected to yield him quick returns in the shape of a well paid position. Thus the future is discounted for the quick returns of the present. There can be no doubt that an intelligent man who has had a thorough general training can, if he wishes, by entering an assay laboratory make himself in time a better assayer than the man whose general education was skimped to afford time for a long course in assaying. The same principle holds good throughout, and an engineer need not be reminded that upon the excellence of his foundation will largely depend the character of the building he plans to erect.

Success from Sticking to the Job

By E. P. Mathewson

*I want to avoid the pedantic style of oratory and talk to you as one who has had a little experience in your chosen profession, to those just entering the arena. It has been suggested to me by your president that I give you some account of my own personal experiences and those of friends of mine who have become prominent in the mining and metallurgical world. If you will pardon my speaking for myself, I will give you a brief account of my career.

After graduating from college, I was fortunate in securing a position as assistant topographer on the geological survey of Canada. I had several months experience in that line, returning home at the expiration of the survey. I found nothing in my chosen line of work, and so I temporarily took a position as clerk in a wholesale establishment, all the time looking out for something in the profession. Nothing turned up that winter, so I made up my mind, after consulting with some friends, to try my fortune in the Western United States.

I obtained a letter of introduction from the late T. Sterry Hunt to a man who was engaged in lead-silver and copper smelting in Colorado. This man had been a pupil of Hunt's and had gone West shortly after graduation and amassed a considerable fortune. I did not know a soul in the state of Colorado, but I met some people in Denver who gave me the following advice: "Go to the gentleman to whom you have the letter of introduction and present the letter, and if he tells you he has no position vacant, ask him if he will allow you to push a slag-pot away from the furnaces." I went to Pueblo the following day and presented my letter. It so happened that the night assayer had just resigned, so I was offered the position as night assayer of slags and refinery products at the magnificent sum of $50 per month, the work being 13 hours night shift for two weeks and 11 hours day shift for two weeks. I liked the work and it seemed to agree with me.

At the time of entering the employ of the company, known as the Pueblo Smelting & Refining Co., there were 13 technical graduates ahead of me. Shortly after I entered the employ of the company the manager who had given me work resigned and left, and a new man was put in charge. A little later the metallurgist was offered a good position in Australia, and he left. He was followed by the assistant metallurgist, and within a short time so many changes occurred in the technical force that I found myself assistant superintendent in the plant before I had been two years in the employ of the company.

Mine was rather an exceptional case. I was assistant superintendent only one year when the superintendent resigned, and I was appointed superintendent of the lead department, there being another superintendent of the copper department. Shortly afterward the superintendent of the copper department resigned, and the manager asked me to take charge of both departments; at the same time telling me that the wages of the men in the copper department would have to be cut in half. This was a very pleasant opening, as you can imagine. I went to the foreman of the copper department, explaining my new position and the decision of the management regarding wages. The foreman told me politely that he and his men would quit, which they did.

I thereupon took some men from the lead department and put them in charge of the copper furnaces. I had never seen a charge of copper refined, but there was an article published in the *Transactions* of the American Institute of Mining Engineers by Thomas Egleston, which described fully the operation of refining copper in the Lake country. I got this article and camped at the works for 56 hours, directing the men I put in charge of the copper furnaces in every step of the process. Whenever I got stuck I would retire to the office and consult the article, the result being that we ladled the biggest charge of copper that had ever been taken out of the furnace, and that charge was of the best quality ever taken from that furnace. After that things went smoothly enough in the copper department, as the men I had broken in took up their work readily, and as they were accustomed to furnace work, it was not difficult to train them to handle copper.

I want to say, for the benefit of you young men, that the salaries paid in those days were not what are paid nowadays for similar service. My salary, as assistant superintendent, was $125 per month, and that large sum was only obtained after strenuous efforts on my part to have the management recognize my ability. That was the only time in my life that I ever asked for an increase in wages; but the manager, I knew, had no knowledge of the value of a technical man; and I was aware that in other establishments in the vicinity men in my position were paid considerably more than I was.

I remained with the Pueblo Smelting & Refining Co. until the year 1897. At that time the Guggenheim family had a number of smelting establishments, one of which was at Pueblo. The late Benjamin Guggenheim asked me to enter the employ of M. Guggenheim's Sons and take charge, as manager, of their Philadelphia plant at Pueblo—the idea being that as soon as I found a man to take my place I should be transferred East. The transfer was made about three months after entering their employ, and I was placed in charge of the refineries at Perth Amboy, N. J. During the next five years I was sent out to various parts of the country, including Mexico, and was for two years in South America, at Antofagasta, Chile, representing my employers.

My experience in South America was interesting. We had rented a smelting plant from a South American company that supplied us with the ore, and we divided the profits from the operation of the smelter. It was a strange thing to live on a desert, on the shore of the ocean and to receive the ore from the mines, about 30 miles away and at about three miles greater altitude. The water used for the furnace jackets and for the boilers was salt, pumped from the sea; water for culinary purposes was brought in a pipe-line across the desert, a distance of about 200 miles. This water came from an altitude of about 12,000 ft. above sea-level, and consequently the pressure on the pipe-line had to be relieved at frequent intervals by means of relief tanks, in which were openings, whereby the dust of the desert, (consisting of salt, sand, and borax) got into the water, necessitating the distillation of all water used for drinking. A little distilled water is all right, but for a steady 'diet' is not to be recommended. In other parts of the coast and in the town near the smelter salt water was distilled for culinary purposes.

After two years in that port I returned to New York and shortly afterward my association with M. Guggenheim's Sons (who had in the meantime joined interests with the American Smelting & Refining Co.) was severed. A few months later I was offered a position in Montana as superintendent of blast-furnaces at the Washoe smelters, then just constructed. This position I took and a few months later, owing to the resignation of the manager, I was placed in charge of the plant and have remained there ever since.

I will now give you brief accounts of the lives of several men who are or have been prominent in the mining world. First, I recall a friend who was at one time employed by the Pueblo Smelting & Refining Co. of Colorado. The man was a graduate of Freiberg. He came to Pueblo one day without any acquaintance in the town; he applied for work at the smelter; was given a wheelbarrow and shovel and a position as laborer in the sampling mill. He did not mention the fact that he was a graduate of Freiberg, but it so happened that the furnaces were out of order and he dropped a hint to the foreman in charge as to a good way to bring the furnaces around. The foreman reported the matter to the manager and the manager asked him if he knew anything about furnaces. He said he did "know a little," so the manager gave him a trial as an assistant about

*From a commencement address, Montana School of Mines, June 6.

the furnaces. He proved that he knew his work and gradually he was advanced until he was placed in charge of the plant. Leaving that plant later on, he took charge of a smelting plant in another part of Colorado and he was then offered a position as metallurgist to the Broken Hill company in Australia. This position he accepted with many misgivings, but it proved that it was the beginning of the making of his fortune. He built up the smelting industry for the Broken Hill company and then interested himself in other companies in Australia, finally retiring with a large fortune a few years ago. He still retains an interest in the work.

Another man took a very humble position with a placer mining company in California, showed himself to be a good assayer; then later was put in charge of some small quartz properties; from there he was called to South Africa at the time the Rand was coming into prominence; showed his ability as an executive in organizing some of the big properties there and managing them, and is today one of the most highly paid consulting engineers in the world.

Another man, nearer home, worked for years as assayer in Anaconda, then in a similar position on the Pacific Coast, rising to the position of chief assayer at a large plant; then was offered a position as assistant to one of the managers in South Africa on the Rand, which he accepted. He filled that position satisfactorily and was advanced to the managership, and after several years' service in that capacity returned to America to take up the work of consulting engineer, representing the capitalists who had been his employers on the Rand.

Another man who began with pick and shovel around a smelter and gradually worked his way up to the superintendency of one of the large Colorado smelters, was transferred to Butte, where he conducted some of the earliest experiments in the use of magnesite brick for the lining of converters; from there drifted into the mining end of the business and is today one of the leading consulting mining and metallurgical engineers of the country.

Another man began as a field assistant to the United States Geological Survey, was afterward State Geologist of Wyoming, and from there drifted to Arizona, where he became connected with the Copper Queen Mining Co. His ability soon placed him at the head of the technical force of that company, and from that he was transferred to other larger concerns and given more authority, and today is the general manager of one of the largest concerns in Mexico.

Another young man sought employment at the Washoe smelter a few years ago as a laborer, said nothing about his technical knowledge, but put in a formal application for a position when a vacancy occurred in the technical staff. He was offered a position and we were surprised to find that he had been working for us for months as a laborer. He proved his ability in the technical line and when the opportunity was offered of a transfer to another company, at an increase of salary, he accepted it, and today is the assistant superintendent of one of the largest companies in the country.

Many young men at Anaconda and Butte have worked their way up, and today there are dozens of technical men employed about the mines and smelters who are on the road to advancement.

The main things to be remembered are: not to be afraid to tackle any job that turns up; never be above your position; be sober, diligent, and faithful in business; be true to your friends and to your employers; learn to treat your associates and the men under you as men; and as soon as you can find the right girl (provided you have enough money to pay for the license) I advise you to get married. Do not wait to make your fortune before choosing your wife; if you do, the chances are 99 in 100 that you will never have one.

NITRATE export taxes for 1911 in Chile amounted to $30,154,110.

Metal Production in Eastern States

The total value of the mine output of gold, silver, copper, lead, and zinc in the Eastern or Appalachian states for the year 1911, according to H. D. McCaskey of the U. S. Geological Survey, was $11,787,942, against $10,127,304 in 1910. This represents the production of 96 mines, many of them very small. The total gold output from all mines was 7709.52 fine oz., valued at $159,370, a decrease from 1910 of $26,152, and the silver production (recovered entirely in refining the gold and copper produced) was 108,105 fine oz., valued at $57,296, an increase over 1910 of $7835. Of the gold output in 1911 the placers yielded 1447.28 fine oz., or nearly 19%, the quartz ores 5699.64 fine oz. or 74%, and the copper ores 562.60 fine oz. or 7%. This 7% was derived from 801,842 short tons of copper ore mined, having an average gold and silver value of $0.085 per ton, against 774,040 tons in 1910, having a gold and silver value of $0.076 per ton.

The copper production from copper and iron ores was 19,605,386 lb., valued at $2,450,674, an increase of 1,681,974 lb. in quantity and of $174,401 in value as compared with the figures for 1910. All the increase in output was credited to the mines of the Ducktown district in Tennessee, which contributed 96% of the output in 1911 and 94% in 1910. The copper ores yielded an average of 24.4 lb. of copper per ton of ore in 1911, against 23.2 lb. in 1910.

The production of lead, which was nearly all from lead-zinc ores, was 834,742 lb., valued at $37,563, an increase of 635,892 lb. in quantity and of $28,813 in value over the output in 1910.

The zinc output in 1911 was 159,351,558 lb., figured as recoverable spelter, valued at $9,083,039, which shows an increase over the production in 1910 of 18,475,672 lb., having a value of $1,475,741. The output of zinc and zinc-lead ores was 413,332 short tons in 1911, against 411,381 tons in 1910. New Jersey produced 97% of the zinc output of the Eastern states, the remainder being derived from the lead-zinc belt in Tennessee and Virginia and from the mine of the Northern Ore Co., near Edwards, New York.

The accompanying condensed tabular statement of the production of these metals in the Eastern states in 1911 is taken from the report.

State.	Ore mined.	Gold.	Silver.	Copper.	Lead.	Zinc.	Total value.
	Short tons.	*Fine oz.*	*Fine oz.*	*Pounds.*	*Pounds.*	*Pounds.*	
Alabama	6,360	915.06	171				$19,007
Georgia	3,737	1,696.51	212				35,182
Maryland and Pennsylvania	219,868	.43	87	665,110			83,194
New Jersey	374,064					154,890,900	8,828,781
North Carolina	21,810	3,399.89	943				70,782
South Carolina	9,302	987.24	11				20,414
Tennessee	604,538	562.17	106,660	18,850,276		2,234,000	2,551,774
Virginia and New York	18,465	148.22	21	90,000	834,742	2,226,658	178,808
Total 1911	1,258,144	7,709.52	108,105	19,605,386	834,742	159,351,558	11,787,942
Total 1910	1,252,231	8,974.63	91,595	17,923,412	198,850	140,875,886	10,127,304

MINE PRODUCTION OF GOLD, SILVER, COPPER, AND LEAD IN THE EASTERN STATES IN 1911.

The Castle Dome Lead District, Arizona

By J. Nelson Nevius

The Castle Dome mining district lies along the southwestern base of the Castle Dome mountains in Yuma county, Arizona, about 30 miles north of Dome, a station on the main line of the Southern Pacific railroad, 21 miles east of Yuma. It is 15 miles east of the old Castle Dome landing on the Colorado river, which was the shipping point for most of the high-grade lead ore produced in the early days before the railroad was constructed. The elevation is about 1300 ft. and the climate is exceedingly dry, rainfall probably rarely exceeding six inches per year. While unpleasantly hot in summer the climate is always salubrious and is exceptionally fine the greater part of the year. There is a limited supply of ironwood, mesquite, and palo verde growing in the washes, but this is not sufficient to serve as a source of fuel beyond the preliminary development of the mines. The wagon-road from Dome to the mines is unusually good. Close to Dome it crosses the Gila river where there is a mile of fairly heavy sand in the dry season, while in the rainy season there are short periods when the river is entirely impassable. For the remainder of the distance the road leads gradually upward over a gravel plain and is almost as hard and well drained as a macadamized street. The rise from the river to the mines is 1000 ft. On one trip I covered the 30 miles in an hour and ten minutes by automobile going in, and in five hours and fifteen minutes by mule team, on the return trip.

The geology of these ore deposits is rather simple. The

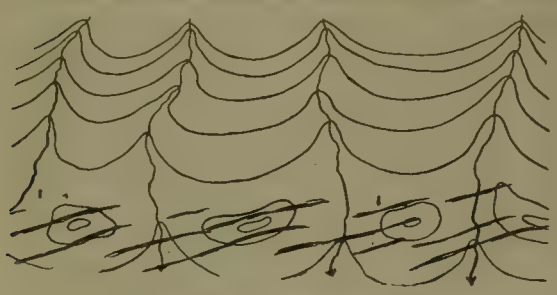


DIAGRAM OF VEIN SYSTEM.

high, rugged mountain range, of which the Castle Dome peak is the most prominent feature, is a volcanic uplift and has been the source of extensive flows of eruptive rock, mostly of a basic nature, that have occurred intermittently over long periods of time. One of the earlier eruptions was a fine-grained diorite which extended out for an unknown distance from the mountains, but has been buried by the wash forming the present surface of the plain. During later seismic disturbances along the trend of the mountain range, this diorite was tilted upward along its edge toward the mountain and became fractured. These fractures occur irregularly throughout an indefinite zone several miles long, and not as one or more continuous fissures. The veins were discovered where they outcrop on the very low foothills, and many of them have been followed out under the wash to considerable distances. Probably the persistence of the veins out under the level plain is due to the present surface of the plain covering what was the lower slope of the mountain at the time the fissures were formed. The sketch is an ideal representation of the vein system.

The outcrops of all the veins are largely stoped for a distance of three miles, beginning at the De Luce property, which is the northernmost of the chain of mines. The stopes indicate that a lens of solid galena was discovered at the surface, as practically no attempt has been made to mine or develop the concentrating ore. Near the south end of the De Luce property several shallow shafts have been sunk on the vein without finding the solid galena streak, and these show the vein structure. In one of these the vein at the surface is 4 ft. wide, sharply walled by diorite, and the filling is ribboned calcite carrying unoxidized inclusions of galena and assaying about 8% lead and 6 oz. silver. To the south 200 ft. another shaft shows the vein to be 2 ft. wide and containing double that amount of galena in nodules up to 4 in. diameter. Near the south end-line a shallow pit shows the vein with a sharply defined hanging wall, but poorly defined foot-wall, and the ribbon structure is less distant. The gangue is calcite with inclusions of galena and fluorite. At the De Luce mine the vein is distinctly a fissure in diorite. There are small outcrops of an acidic rock near the vein, but there is no evidence that this rock has influenced ore deposition either on this, or any of the neighboring properties. Farther to the south some of the dumps show schist, and it is said that in some cases the vein occurs between schist and diorite. This may be the basal schist of Yuma county, but it is more probably a locally metamorphosed phase of the diorite. The vein-filling varies, but the chief gangue minerals in the order of their predominance are calcite, fluorite, gypsum, barite, and witherite. In a few places galena has been oxidized to sandy carbonate, and minium and wulfenite occur occasionally. Calcite is said to occur as an important gangue mineral only within 150 ft. of the surface, below which it gives place to fluorite. The latter mineral occurs almost universally with the galena, and the typical ore-section is a core of solid galena ranging from 3 in. up to 2 ft. in thickness, enclosed within a foot or two of mixed fluorite and galena. Very frequently the galena streaks occur along the hanging wall, underlain by fluorite. Clearly these two minerals are intimately associated in the vein in varying proportions, and form an ore which can be cheaply mined, crushed, and separated. The general strike of the veins is northwest and southeast and they dip steeply northeast, toward the mountains.

The De Luce mine is the northernmost of the group, and has been known at various times as the 'Fera mine,' the 'Castle Dome mine,' and the 'La Lola mine.' From the south end-line the vein can be traced by outcrop and through the mines for 1400 ft., to where it disappears under the wash, just north of Shaft No. 1. How far the vein will continue north of this point can be determined only by development. The shaft is an incline on the vein 220 ft. deep, and the vein exposed in the workings to the north is from 3 to 4 ft. wide, and samples that I took assayed from 5 to 20% lead and from 7.3 to 3.3 oz. silver. As the ore is fluorite with included galena masses of small size, very little dependence should be placed on moil samples. The former operators contented themselves with mining only the solid galena, and did no development beyond the limits of the high-grade ore. This is true of all the mines. The orebody occurring in this mine is irregular, 450 ft. long, and was stoped to a depth of about 300 or 350 ft. It is said that the bottom levels—350 and 400 ft.—show from 2 to 4 ft. of ore ranging from 30 to 60% lead. This could not be verified, as the water stands at the 300-ft. level. The old irregular stope is open to water, and the walls are firm. A few pillars of low-grade ore show the usual mixture of fluorite and galena, also in many places some of this is left on the walls, but probably it would not pay to reopen the stopes and mine it.

A peculiar feature of this mine is that at Shaft No. 2 the stope leaves the vein which it has followed south of that point and follows a distinctly different vein some ten feet in the foot-wall. This condition was noted on two levels, but it remains to be proved by development whether the two veins will continue to carry ore, or whether this condition is due to a 'linked' structure in the fissure—in which case the unexplored portions may be expected to feather out quickly. The exposures of both veins are so strong that

there seems to be a probability that two distinct ore bearing veins approach each other within ten feet and then diverge. The stopes are from 2 to 5 ft. wide and are practically continuous from the surface to below water level, consequently it is readily appreciated that the mine must have yielded a large tonnage of ore in proportion to the vein area exposed. The deepest working is Shaft No. 4, which is said to be 470 ft., of which the last 70 ft. is said to be in profitable ore which has not been mined. The surface equipment is negligible, the shafts are very small and no attempt has been made, either at this or any of the other properties, to develop along economic lines. The type of the vein fissures, the nature and composition of the gangue, and the lateral extent of the veins, indicate that they may be expected to continue to a considerable depth below the present workings.

WASH COVERING OUTCROP, DE LUCE MINE.
CASTLE DOME PEAK FROM THE MINE.

LOOKING SOUTH ALONG VEIN SYSTEM.
DUMPS AT DE LUCE MINE.

The Arkansas mine adjoins the De Luce group on the south, and is on the continuation of the same vein. The entire outcrop has been stoped across the shoulder of a low hill, a distance of some 300 ft. The depth is said to be about 300 ft., but the old works are inaccessible. The walls are diorite and the dump consists chiefly of fluorite, all the galena having been sorted out. Southeast from the Arkansas mine are scattered many other old properties now idle. Apparently these are all in the condition of the De Luce property, namely, that the high-grade galena has been stoped to a depth of 200 to 300 ft., and no attempt has been made to develop or concentrate the lower-grade ore. Among the properties in this district that have been partly developed are the New Deal, Flora Temple, Lady Edith, Chilson, Sonora, William Penn, Silver Dollar, and Nolecheck.

The general conditions affecting the development of these mines are fairly good. The most serious problem is the absence of water, but as the De Luce mine found water at 300 ft. it is probable that other mines will also reach it at that level. This water is potable and the supply is said to be about 10,000 gal. per day. There are no springs of consequence in the neighborhood, but the arroyos offer possibilities, and in case the region develops important mines, water can be pumped from the region of the Colorado river. Freight on ore to the railroad should not exceed $3, as it can be contracted at $3.50. There is sufficient fuel at $4 per cord for preliminary work, but not sufficient for extensive operations. The vein walls are firm and the ore is soft and is ideal for concentration. At present the fluorite cannot be regarded as an asset, but it may become salable in the future, as a remarkably pure grade could be supplied. Seven shipments of ore from the De Luce mine, totaling 100 tons, averaged 70% lead and 30 oz. silver, the two extremes being 65.8% lead with 28.9 oz. silver and 72.2% lead with 28.6 oz. silver. Shipments from other mines are said to have maintained this standard.

CHROMITE production in the United States in 1911 amounted to 120 long tons, valued at $1629, according to W. C. Phalen in an advance chapter from 'Mineral Resources of the United States for 1911,' just published by the U. S. Geological Survey. This figure of production represents the amount that was actually sold or entered the market. The quantity mined was considerably greater, but some of the ore mined did not enter the market owing in part to a somewhat curtailed demand and in part to the difficulty of transporting it. The ore sold came from Shasta, Siskiyou, and Tehama counties, California. Some ore was reported as having been mined in Converse county, Wyoming. California ore is used principally in the manufacture of furnace linings.

COAL has been discovered north of Santiago, Chile, in the province of Aconcagua.

Prospecting Frozen Ground

By Leon Perret

*The process of working platinum alluvial deposits is in the main similar to that adopted in gold mining, although a great difference does actually exist in certain technical details. The methods of prospecting to be described apply equally to gold and platinum deposits. They have not been confined to the practice prevailing in the Ural mountains, but also deal with methods in use in other parts of Siberia.

Everywhere along the Urals and in Siberia it is the accepted rule to place the prospecting pits or bore-holes in straight lines across the alluvial deposit. The system of distributing the prospecting pits or bore-holes at the corners or centres of squares, as is the practice, for instance, in California, when prospecting alluvial deposits for dredging, is not in use in Russia. To determine accurately the direction of the line of pits depends to a great extent upon the experience and powers of observation of the prospector, and even becomes a sort of special gift, similar to the power of diagnosis in a doctor. I know of many instances where the metal-bearing portion of the deposit was not found owing to the line of prospecting pits being wrongly placed, and when the direction was altered it disclosed a rich pay-streak.

In places where there is little snow during the winter, and where the temperature for three or four months keeps at 25 to 50°C. below zero (−13 to −58°F.), as, for instance, in the Amur province or on the eastern side of Lake Baikal, the frost is successfully used for sinking pits, by a method called 'frost prospecting.' This method is the following: At the beginning of the winter, before the frost has set in, pits are sunk to water-level; with the advent of heavy frosts, the pits freeze hard. When the sides and the bottom of the pit are frozen to a thickness of 2 or 3 ft.—and in the localities named, this would take place after a week or ten days of heavy frosts in the first half of November—small piles of wood are placed in the bottom of the pits; they are called 'burners' and after having been set alight, they thaw the frozen ground for approximately half an arshine (14 in.) all round. As soon as thawed it is dug out of the pit. The pit is allowed to freeze for a few days and the operation is repeated, so that by alternately freezing and thawing the pit is sunk to bedrock. The whole art in this method consists in being able to determine correctly the amount of wood required for the 'burner,' and the amount of heat derived from it, bearing in mind that the draught increases with the depth of the pit. Too large a 'burner' would completely thaw the frozen wall which keeps the water from the pit, and this would speedily be inundated ('ripped,' as they say). On the other hand, an excessively small 'burner' would thaw too little ground, and the sinking would be delayed. There are no rules for determining the size of the 'burner', and it depends solely upon the experience of the workman. Skilled and experienced workmen achieve great success by their ability in determining the quantity of wood required by the nature of the ground. Gravel possesses a greater power of conducting heat than clay soil, and therefore requires less fuel than the latter. Slimy ground, or ground that produces a slimy mud which prevents the heat from penetrating, is rather more difficult to thaw. Care must be taken that after each thawing a protecting layer of frozen ground should remain about 1 ft. thick. This the experienced Siberian workmen can tell by the sound when tapping the bottom and sides of the pit with the butt-end of a pick. When the frozen ground is thick, tapping produces a dull sound, while when it is thin the sound will be resonant (the pit 'rings,' as they say).

When a pit become drowned in consequence of being over-fired it is difficult to freeze out again. If this happens they allow the accumulated water to freeze and then take off a thin top-slice of the ice, but not all of it, and allow the pit to freeze over again for a few days while the layer of ice gets thicker. By thus taking the ice off in slices they manage to get down to the bottom of the pit. This operation is a slow one, and occasionally to expedite matters conical sheet-iron pipes of 7-in. diam. at the closed bottom end, and 10-in. diam. at the top end, are placed in the pits in rows; they are loaded to prevent floating, and, as they allow the cold air to get to the bottom of the pit, they hasten the freezing process.

Before putting the pipes into position enough earth is thrown into the water of the inundated pit to dirty it, because dirty water freezes quicker than clean water. When the area covered by the pipes has frozen hard, a little warm water is poured into them, a thin layer of ice surrounding the pipes is thawed, and the latter can be pulled out without difficulty. This explains the conical shape of the pipes. No timbering of any kind is necessary, since the frozen sides of the pit stand well. The raising of the excavated material to the top is done either by a shovel or with a bucket and windlass. The first system is the cheapest, and the Siberian workman, especially in the Amur provinces, has attained an astonishing amount of skill in throwing the material to the surface, and in keeping separate piles of the material mined from each quarter-arshine (7 in.) of depth. The piles are distributed along the periphery of a circle at a distance of, approximately, two arshines (56 in.) from the pit. On approaching one of these pits it is an extraordinary sight to see the dirt being thrown up at regular intervals and to find that each shovelful, with almost mathematical precision, falls on one of the many surrounding heaps. These are afterward washed to determine the metal content.

The dimensions of the pits are generally 9 by 11 or 10 by 10 quarter-arshines (5 ft. 3 in. by 6 ft. 5 in. or 5 ft. 10 in. by 5 ft. 10 in.). A Siberian prospector, standing in the bottom of a pit of these dimensions, can throw the excavated material from a depth of 25 quarter-arshines (14½ ft.), and there are crack men who can throw it from a depth of 20 or even 24 feet.

The depth to which this kind of working may be carried depends not only on the strength and skill of the workman, but also on the nature of the ground. Gravel being lighter, and separating more easily from the shovel, can be thrown out from a greater depth than heavy clay soil. Generally speaking, one can say that when throwing the excavated material with a shovel a pit may be sunk, on an average, in gravel to 25 quarter-arshines (14½ ft.), and in clay to 20 quarter-arshines (11 ft. 8 in.). If the depth of the pit is greater, 'shelves' are resorted to, that is, recesses are made in the walls of the pits, in which rest small beams. A floor of boards or poles, covering about half the pit's section, is made on these beams. The material excavated is then thrown out in two stages.

The pit is entered and left by means of a rope. It is essential that this be well protected, as when lighted the strong draught causes the 'burner' to flare up in an instant. At a depth of more than 25 or 28 ft. a windlass is required, but in 'frost prospecting' they endeavor to do without it as much as possible. The sinking of the pits, being intermittent, would necessitate a windlass at each pit; in addition they require one or two men to work them.

The workmen are divided off into pairs, a workman having the right to choose his mate. A pair of these workmen are given 30 pits, which they usually sink in the course of the four winter months, from November to March, or until the heavy frosts cease. On an average 3 ft. of sinking is done per single day shift. Besides the sinking of the pit it is also part of the men's duties to cut, transport, and break up the wood for the 'burners.' The number of pits above mentioned enable the workmen to easily attend to all of them in turn without their being tempted to fire them too frequently. The 'burners' are lit always at nightfall, and, where large prospecting operations are in progress, the several lines of pits present a fascinating sight.

Taking the average earnings of the Siberian workmen during the winter months as Rs. 50 ($25.75) per month, and the average depth of the pits as 30 quarter-arshines (17½ ft.)—this being about the average depth of the alluvial de-

*Abstract from an article on 'Gold and Platinum Alluvial Deposits in Russia,' read before the Inst. Min. & Met., London, May 16.

posits of the Amur and Trans-Baikal provinces we find that 900 quarter-arshines are sunk for a cost of Rs. 100, or, in other words, that the cost of sinking per foot amounts to $0.39. To this must be added the salaries paid to overseers, the cost of washing the samples, and the upkeep of a few horses which are given to the workmen in turn for carting wood, but even then the cost of sinking does not amount to more than $0.46 per foot. The consumption of wood varies from one-third to half a sabic sagene (0.9 to 1.3 cords) per pit of from 18 to 20 ft. in depth.

It is doubtful whether there exists a cheaper or more convenient method of working than that described, and, bearing in mind the sparsely colonized settlements, it has the important advantage of being entirely free from breakdowns of any kind, which are the unavoidable adjunct of all methods entailing the use of machinery. The absence of a heavy equipment renders this method specially suitable for prospecting work in distant localities for prospecting parties and expeditions. The possibility of 'frost prospecting' requires three essential conditions: (*a*) not much snow; (*b*) heavy uninterrupted frosts during a few months; (*c*) that the alluvial deposit should not be too deep.

The total depth of the alluvial should not exceed 30 ft., since at greater depth the ground either freezes slowly or else does not freeze at all. If the depth is more than 25 to 30 ft., 'frost prospecting' is resorted to for that depth, but additional sinking is done in the ordinary way.

In localities with heavy snowfall, the pits are constantly being filled and covered over by it. This causes excessive work through the necessity of cleaning them; while, in addition, the frost cannot take effect under the snow, and consequently the sinking proceeds so slowly that the pits do not reach bedrock before the heavy frosts are over. This is the reason why 'frost prospecting' is not practised in the Urals, the coast provinces, or the Yeniseisk Government, although the cold is intense. In the centre of the Urals, at the platinum mines along the River Iss, I made experiments with the view to introducing this method, but the results were unsatisfactory.

The second condition also essential, heavy frosts over long periods, may be assisted by artificial means, particularly when sinking deep pits or when the cold does not quite attain the required intensity. The artificial means may be one of the following three:

1. In this method the pit is divided into two halves by a cloth brattice across its width and extending from the top to within 3 ft. from the bottom. An ordinary-sized iron stove is placed at the bottom of the pit, and rests on iron rods let into the sides of the pit. It is lit and fired from one half of the pit, while the chimney leads into the other half. This needs firing twice a day only; a strong draught is produced, and a frost of not more than −20 to −22°C. (−4 to −7.6°F.) is sufficient to freeze the pit for about 1½ ft. in depth, and much more round the sides.

2. Here the pit is divided by a brattice in the same way, with, however, this difference, that the two divisions are not of equal size, one being twice as large as the other. The brattice extends to within 3 ft. of the bottom. The larger division is covered at the top by a closely-fitting floor, into which is inserted a rectangular wooden pipe made of tight-joined boards with inside dimensions 21 by 28 in. At a distance of 4½ ft. above the floor an iron grating is fixed; this is accessible through an opening provided with a tight-fitting door. Through this opening a perforated drum of sheet iron is placed on the grating—it contains enough charcoal to keep burning for about two hours. This is repeated about three times every 24 hours. The pit is frozen more successfully and more quickly in this way than by method No. 1, but method No. 2 is more intricate to adopt.

3. An iron stove is placed at the mouth of the pit, with two pipes of 3 to 4 in. diam., one the smoke-stack, and the other the air-supply pipe. This latter extends downward and is let into a bottomless iron box at the bottom of the pit. The iron box is smaller than the pit, so as to leave a space all round it of from 10 to 14 in. The lower part of this box is connected with another draught pipe opposite the one first mentioned—this leads to the top of the pit. The two pipes on the shaft are made of sheet iron, with telescoping joints. The height of the iron box is from 24 to 28 in. The open side of the box, which is toward the bottom of the pit, must be made air-tight by sinking the box as much as possible and piling up earth round it. The doors of the stove should shut tightly, which is best attained with asbestos packing. If the stove is kept continually alight, the bottom of the pit can be frozen by this method in half the time for either of the first two methods. The sides of the pit freeze independently.

The cost of sinking by using any one of the above three methods is about the same as with freezing without forced draught. In the Yeniseisk district experiments were made with air-blowers to hasten the freezing, but they required mechanical energy, which meant expense; they were cumbersome and made transport difficult, so that they were abandoned.

'Frost prospecting' also admits of prospecting the beds of running rivers. To carry it into effect the ice covering the river, which should be about 20 in. thick at the place where the pit is to be situated, is cut away about 12 in. over a section of 7 by 9 ft. The cold penetrates the remaining ice, and in a few days the ice at the bottom of the place which has been laid bare has again attained its former thickness. The operation of sinking or stripping off another 12 or 14 in. is then repeated, and the place is again left to freeze for five or seven days, according to the frosts. By continuing this the bottom of the river is eventually reached through a cylindrical pit sunk through solid ice, which sometimes is so transparent that one can see through the walls of the pit. I once sunk such a pit in a river 5 to 7 ft. deep, in which the speed of flow attained 6 versts (4 miles) per hour.

The chief condition for this work is that the picks should be very sharp, so as to strip the ice off in thin layers. The work also requires great precaution and experience; the thickness of the ice remaining at the bottom of the stripped hole is ascertained by striking it with the butt end of a pick-axe, and experienced workmen rarely make a mistake. If by accident the ice is broken through, and water rushes through the opening, the best means to stop the inrush is to replace the pick into the hole; the cold from the steel causes the hole to again freeze over quickly and the pick can be got out as the sinking proceeds. Wooden wedges, sometimes used for this, strain and crack the ice.

The greatest caution is necessary when the bottom of the pit is reached, as it is here that cracks form more easily than anywhere else in the pit. I believe this to be due to a certain amount of shrinkage of the ground from the ice when it is exposed to the frost. The sinking of more than one or two pits diametrically across the river should be avoided, since this impedes the current and the water is liable to raise the ice in various places, causing cracks through which the pits are flooded. The best remedy for such an accident is to instantly stamp down large lumps of ice into the pits, which will quickly set into thick masses of ice and can then be dug out again without difficulty. The conical pipes above referred to may also be used successfully in such a case. When the pit has reached the bed of the river, it is left for about ten days to freeze, after which the first burner, a small one, is lit, and it is considered highly satisfactory if 6 or 7 in. of the ground has been thawed. Further sinking of the pit is carried on as above described, and its dimensions are decreased to the ordinary size. The part of the pit sunk through the ice is made larger—7 by 9 ft.—in order to prevent the sides of the ice-pit melting from the heat of the burners.

A few districts (such as the greater part of the Lensky and Irkutsk provinces, as also part of the Amur province) have ground which is perpetually frozen. Here the pits are sunk by means of burners in the same way as above described, with this difference, however, that the firing goes on continuously, and, while the burner is alight in two or three pits, the excavated material is being thrown out of the remaining two or three; in this way, up to six pits per day can each be thawed and excavated.

The Iron Ranges of Michigan

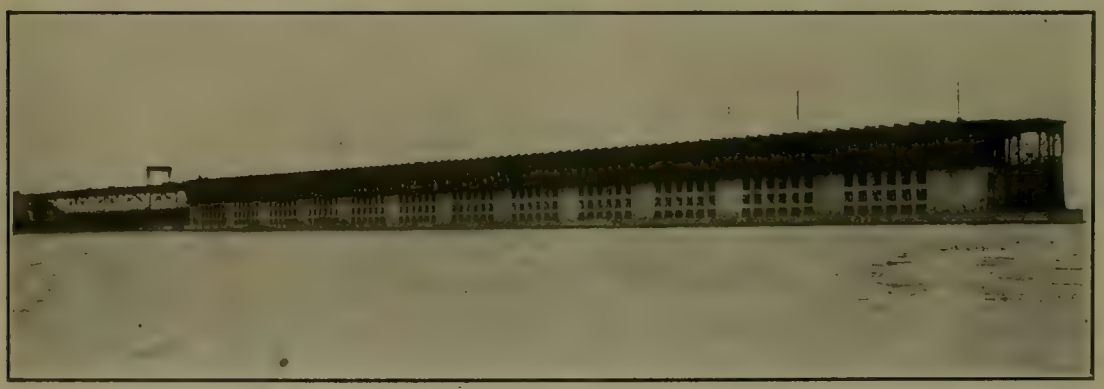
By P. B. McDonald

The Marquette, Menominee, and Gogebic ranges of northern Michigan, by the close of the season of 1912, will have produced approximately 250,000,000 tons of iron ore. Calling $4 the average selling price per ton at the lower lake ports, the total value approximates $1,000,000,000. It is probable that at least as much more will be produced in the future as has been mined in the past, making a grand total of $2,000,000,000. The estimating of ore reserves on the intricately folded Michigan ranges is not conducted with the ease possible in predicting the future of the great Mesaba range in Minnesota where the shallow flat deposits lying just under the surface are quite accurately delimited by churn-drill holes, nor is there any great necessity for trying to develop ore too far ahead of actual mining. It is predicted that the deeper iron deposits of Michigan will be producing ore when the Mesaba is a barren waste, even though the latter now overshadows the older districts in amount of ore blocked out.

DIAMOND-DRILLING AT NEGAUNEE. THE LANDS WERE CONSIDERED VALUELESS FOR YEARS UNTIL DEEP DRILLING DISCLOSED LARGE OREBODIES.

J. R. Finlay, in his recent appraisal of mines for the State Tax Commission, put a value of $119,150,000 on Michigan's iron ore reserves, his estimate of the present worth of ore in the ground being 50c. per ton; no value being put upon unexplored iron-ore formation, of which there is a large amount. As an example of the conservatism of this estimate of future production, it may be noted that Mr. Finlay says of the Iron River district: "All these comparisons would lead one to believe that this district would produce 110,000,000 tons by the time it reaches the state of development in which the other districts are now." Yet his figure for total tonnage expected from the district is only 42,122,000. One mine at Iron Mountain, the Chapin of the U. S. Steel Corporation, has produced 18,000,000 tons of ore and is estimated to contain 9,000,000 tons more; this total of 27,000,000 tons at the lower lake ports would be worth $108,000,000 at $4 per ton. The old Lake Superior mine at Ishpeming, opened in 1857, has shipped ore every year since, making a total of 15,000,000 tons, and is estimated to be good for twenty years more. The Newport mine of Ferdinand Schlesinger at Ironwood, assessed at $8,535,000 for ore in the ground, had a tax levied against it in 1911 of $100,000.

During the season of 1910 there were 77 mines on the Michigan iron ranges which made shipments of ore; at the present time several of these are closed because of dull times in the iron market. There are, however, a number of new mines developing which will ship ore for the first time within the next two years; this is particularly true in the Iron River district, where a dozen diamond-drilled properties are being developed by shafts for producing ore. The prevailing business conditions of the country have each year a marked effect upon the Lake Superior iron mines. It is predicted that the lowering of the import duty on iron ore will permit most of the blast-furnaces on the Atlantic seaboard to obtain their ore from Cuba, Newfoundland, Sweden, or Brazil, while the Rocky Mountain and Pacific Coast states will probably get ore from deposits in their own territory or from Oriental countries, such as China. This leaves to the Lake Superior district the furnishing of iron ore to the great industrial territory extending from the Appalachians to the Rockies.



THE NEW STEEL AND CONCRETE ORE-DOCK UNDER CONSTRUCTION AT MARQUETTE FOR THE CLEVELAND-CLIFFS IRON CO.

Michigan is particularly fortunate in the large amount of unexplored territory likely to contain iron formation; recent developments in the Iron River and Crystal Falls districts by independent companies have indicated the possibilities in this direction, as have the discoveries by the Cleveland-Cliffs Iron Co. on the Swanzy range south of Nagaunee and at North Lake west of Ishpeming. There is a great amount of territory underlain by iron formation, lying between the Marquette range and the Menominee

ranges, and the U. S. Steel Corporation and the Jones & Laughlin Co. have been conducting dip needle exploration and diamond-drill work there during the past winter. Other promising regions are as follows: between Iron River and Crystal Falls, between Florence, Wisconsin, and Iron Mountain, Michigan; between Amasa and Crystal Falls; and in the Atkinson country northwest of Iron River.

There have been many decided innovations in the practice on the Michigan ranges during the past ten years. The old method of exploration by shafts and test-pits has largely given place to diamond-drilling by which orebodies are searched for to a depth of 3000 ft. The tendency has been toward fewer and more permanent shafts, with concrete gaining in popularity as a lining. Electric haulage underground is common, and several water-powers have been developed to furnish power for hoisting and compressing air. At Vulcan on the Menominee river the Penn Iron Mining Co., a subsidiary of the Cambria Steel Co., is successfully operating the Sturgeon Falls plant; at Marquette the Cleveland-Cliffs Iron Co. has completed its Carp river plant for furnishing power to its mines in the Marquette and Gwinn districts; near Iron Mountain the Peninsula Power Co. is developing the Twin Falls water-power for retailing power to independent companies in Iron River and Crystal Falls. Electricity has been successfully applied to hoisting machinery, either directly or through a motor generator set which, though costly, eliminates peak loads at the power-house. Air-compressors are run directly by electric power. Changes in underground practice have tended toward lighter, quicker rock-drills, run by one man, or two machines in a heading run by three men; the application of water to the drill-hole for removing chippings has been the subject of much experiment and has been solved in a variety of ways, depending upon the ground. Carbide lamps are gaining favor in place of candles or 'miners' sunshine.' In surface construction, steel head-frames are common, as are steel and brick buildings; concrete is used a great deal, and the so-called 'hy-rib' concrete construction for building has proved satisfactory in service and is cheaper than brick.

SAFETY DEVICES AROUND MACHINERY AT MINES OF OLIVER IRON MINING COMPANY.

MANGANESE ore deposits occur at Cay bay in the Dutch part of the island of St. Martin, West Indies, not far from the town of Philipsburg and quite near the sea. Some ten or twelve years ago two shipments of manganese were made to New York and sold readily, the analysis showing about 44 or 45% manganese. Not long ago the deposit was visited by a Dutch government engineer, whose opinion was favorable. Though there are outcrops of manganese in various parts of the island, Cay bay is the only place from which ore suitable for shipping has been obtained.

Mine Accidents and Their Prevention

By ED RYAN

*In the hunt for and production of gold, silver, and other metals, men are called upon to follow a vocation which is extremely hazardous. To lessen the number of accidents and fatalities is certainly worthy of the time, attention, and thought of our best men. The old world is farther advanced than are we in the matter of providing protection for the toilers and in taking care of those left dependent by reason of fatal accidents. It is realized there that the greatest and best resources of any nation are its producers; those who work, and that when you add to their health and comfort and by the passage and enforcement of wise and wholesome laws, protect them, you add to their self-respect, increase their earning power, and thus add to and conserve one of the greatest of the nation's resources. From a humane standpoint all agree that the prevention of accidents is absolutely necessary. From a business standpoint it is equally wise. Dr. Kaufman, president of the German Insurance Department, says: "The wisdom of giving employers' associations all possible freedom of action becomes especially evident in accident prevention. Recognizing that it is of prime importance to prevent injury, since compensation will never replace a father who has been killed or make up for lost limbs, state officials and officers of employers' associations have concentrated their efforts upon prevention, and with wonderful results. Scientific accident prevention is now recognized as a special and important branch of technical engineering. Invention and prevention have gone hand in hand in this work as advance agents of civilization. The workers' lives preserved means maintenance and increase of our national resources and gives plentiful returns for the heavy financial burdens which social insurance places upon our economic structure." Dr. Spiecker, chairman of the League of German Employers' Associations, says "Twenty-five years have changed obligatory results to voluntary performance. Today everybody who views the situation without prejudice must acknowledge, and does acknowledge, that the task of employers' associations in this field, prevention and compensation, is a great blessing, not only to the workers, but to the industries and the nation. It is perfectly evident today that higher efficiency in industries has been secured by increased workers' efficiency, all brought about by relieving our workers from worries and distress on account of sickness, injury, superannuation, and invalidism. The spirit which enters into this problem is best illustrated by the fact that in addition to the systematic work carried on by the state, employers' associations, and individual employers, a large fund was raised a few years ago by voluntary subscription among employers and the general public, for the special purpose of stimulating and promoting accident prevention through investigation, education, and invention. The occasion for the establishing of this fund was the silver wedding of the German Emperor. He, with the best men of the nation, believes that a monument of this sort is of greater lasting value than marble or bronze."

It might not be amiss to quote from a recent speech made by Mr. Roosevelt along the same line. He said: "Let us remember also that conservation does not stop with the natural resources, but that the principle of making the best of all we have requires with equal or greater insist-

*Address before the Engineers' Club, Mackay School of Mines, by the Mine Inspector of Nevada.

ence that we shall stop the waste of human life in industry, and prevent the waste of human welfare which flows from the unfair use of concentrated power and wealth in the hands of men whose eagerness for profit binds them to the cost of what they do. We have no higher duty than to promote the efficiency of the individual. There is no surer road to the efficiency of the nation." Men who have given the question thought agree that protection to the soldiers of industry adds to the strength of the nation. But how to get that protection is the question.

Superintendents and managers know from experience that the expense of providing better working facilities is more than returned by the confidence the workman has in his employer, and this awakening and strengthening of his energy which comes from the knowledge that his employer has his interest at heart and is doing everything possible for his protection. It has been well said "His is the mental attitude of the soldier who knows he is fighting under a capable leader and who stands ready to go through fire and water if necessary." These superintendents and managers are frequently denied this possible advantage by the folly of a niggardly board of directors, far removed from actual operations, and whose knowledge of mining is so limited they cannot look beyond the original cost of some device. I often think what a blessing it would be if many of the managers could follow the example set by Admiral Dewey, and cut off all communication leading to the board of strategy and use their own judgment.

In times past it was perhaps true that liability laws passed by the states have been a fruitful source of dissatisfaction and friction between employer and employee. But in late years, especially since a majority of the courts have defined more clearly the contributory negligence clause, employers, especially the more humane ones, have taken more interest in providing systems of relief and prevention, many of which are models and have attracted the attention of thinkers in that line. The mandates of common humanity should cause all to get together on this important subject. In Nevada, since the passage of the present employer's liability law, the mine managers have met and exchanged ideas on the subject of accident prevention. Such meetings are bound to bring good results. Why not go farther in these meetings and take in the miners? Let them know they, too, have a duty in this connection. A man working daily in an atmosphere of danger becomes careless of his surroundings and thoughtlessly takes chances uncalled for and which he would not take were they called to his attention. Almost daily men not only expose their own lives but those of others. Many of them do not understand that they are asked to do or not to do a certain thing because of the law. Bosses cannot constantly watch over them, therefore they must share in the responsibility of carrying out the law. Let all meet together, discuss frankly our responsibilities, tell one another what is expected, and a better feeling will prevail. Only a short time ago, while standing at the collar of a shaft of one of the mines in the southern part of the state, I saw a cage loaded with men come up, the 'eager' was on the cage, and the gates on the cage, which under the law must be closed when hoisting men, were open. I do not believe he understood the urgent need of the gates. How much better equipped he would be to fill such a position of responsibility if he could but attend a meeting and hear discussed the duties of a eager and the terrible consequences which are almost sure to follow any carelessness on his part. Let him know that he is one of the spokes in the wheel of industry, that the law wants to protect him, and in turn wants him to help protect others. Occasionally men may be seen riding on cages with tools, contrary to orders; in fact there are many infractions of the law which could and would be done away with were they discussed in the meetings of the different labor organizations in these joint meetings as before suggested.

Unfortunately for the industry, many men work in the mines in positions where not only their own but the lives of others may be sacrificed through a failure to comprehend an order, but who can neither speak nor understand the English language. Such a condition is deplorable, and steps should be taken by the law-making power to curtail, as far as possible, this growing evil. The other day I went through a property where most of those employed underground were unable to speak or understand our language, and there was a sharp contrast with the conditions in mines in Virginia City where English-speaking miners are employed. Here the boss and men discuss conditions, and any orders given are readily understood. In the other, well, it was impossible to make them understand either by words or signs, and the boss, in an effort to enlighten them, goes through signs and gesticulations that would make a mute think himself a professional linguist. The bosses have given strict orders for the men to pick down the places in which they work, to timber when necessary and plenty of timbers are provided, and not to place burning candles around on the timbers. And yet I found flagrant violations of those orders, and when the boss would take the pick and sound the back and, finding it dangerous, by signs and motions make them pick down, or make them put out a burning candle that had been placed on a timber, they would look at him in amazement. Evidently they did not understand the orders given. Now it seems to me when a person unable to understand the language spoken by those in charge, gets hurt or killed, even though he has violated an order given, the company should be held responsible, for the one issuing the order, knowing it was not understood, must be presumed to have done it merely as a matter of form.

Fortunate indeed is the young graduate, who has the health and strength when leaving school, who secures a place in the mines under some progressive mine manager. Take a position as shoveler, learn to run a machine, to timber, contract a little so as to be thrown on your own resources, study the different methods used, get right in and be one of the boys, learn their customs, see what they have to contend with, and you will find that you have picked up many things not to be found in books, and you will be the better for it. Add to your technical knowledge practical experience, knowledge of the habits and desires of the miners, which is only gained by associating and working with them, and your services will be sought. Many have the technical knowledge, but by reason of lack of knowledge of human nature they fail when called upon to handle men.

The history of mine inspection in the state of Nevada is brief, as the law creating the office of Inspector of Mines was only passed in the year 1909. The law was a compromise, as a bitter fight had been waged against the original bill, the claim being made that it would cause the closing of many mines. The present inspector was appointed deputy at that time, and well do I remember the frowns with which I was greeted on my first visit to many mines, and it seemed that the less the experience of the man in charge the darker the frown. Many seemed to regard the mine inspector as a natural enemy. It was a new and untried field as far as Nevada was concerned, and I realized that to properly place the functions of the office before the people one would have to move with great care. It took some time to get acquainted, but after getting acquainted, all learned that each was imbued with the same spirit; that of building up the great mining industry of our state.

With large areas of mine development comes increased risk to the men employed therein, and with such increased risk comes the necessity of better safeguarding them. So with that end in view I, believing the law as it existed failed to meet the required needs for better protection, reported to the Governor and Legislature, and made certain recommendations, which were later drawn up as a bill, introduced, and passed unanimously. This law provides that only powder enough for 24 hours' use shall be stored underground, and then only in such a place that its accidental explosion will not cut off the escape of the miners working in the mine. One not acquainted with the facts would perhaps say that provision is needless, as one would not store sufficient powder underground to do any damage. Prior to the passage of this law I have found as high as three tons stored underground, and that but a short distance from the shaft. Even then some tried to argue that there was no

danger. Some of the most terrible disasters known to the mining world were caused by just such storage. The use of wooden tamping bars is enforced by an old rule in vogue in nearly all the mining states, yet we found in some of the mines metal bars being used. The need of a law forbidding the use of gasoline was forcibly brought to my attention by the killing of two men in Manhattan. A small engine was being used to run a pump in a shallow shaft. The engine was in a small station just a few feet back from the shaft. In working around the engine the gasoline was exploded and the fumes killed the men.

Passing hurriedly by the sections relative to leaving decayed timbers underground, providing for indicators on hoists, forbidding men riding with powder, tools, or timber, I come to section 19, which provides for ladders in all shafts, and that shafts over 200 ft. deep shall be divided into two compartments, one of which shall be partitioned off and set aside for a ladderway, and that landings shall be placed in manway at intervals of 30 ft. and at all working levels. When I first entered this work there were mines in this state where the men have been compelled to climb 600 and 700 ft. on perpendicular ladders, and the only way they could rest was by sitting on an 8 by 8-in. wall or endplate. Not a platform in the entire distance. If a man should have fallen the chances are he would have stripped the ladder from one end to the other. Even the loss of a boot-heel by one of the men might cause the loss of many lives by knocking off one of the men below, he, in turn, knocking off others while falling. Some of the mines did not even have ladders in the shafts, and only the one outlet at that. The necessity for keeping at least one raise or winze connecting levels is certainly apparent to all.

The need of section 20, providing for more than one exit, was indelibly written on my mind when I was a boy. One of the mines in the county in which I lived, and at which I sorted ore, took fire, or rather the shaft-house which covered it did. The fire started in the change room which was directly over the boilers. Some powder had been placed on the top of one of the boilers to thaw. The flames quickly reached the powder and exploded it, knocking a hole in the boiler, and allowing the steam to escape, thus leaving powerless the engineer, who bravely stood at the throttle trying to hoist the cage. This mine had only one outlet. As a result the burning building over the shaft sucked all the air out of the mine and ten men were found on the 500-ft. level dead. Had that shaft been equipped as our law now requires, the manway would have been bulkheaded at least 25 ft. below the collar, and an adit run from that point to the surface. It would have been partitioned off, the hoisting compartment would have been upcast, and the fire would have pulled the fresh air in through the adit, thus giving the men fresh air to climb through.

Section 21, requiring sign-boards underground, is simple and only asks the same protection for men underground that most of the laws governing towns and cities give to their citizens when they enter a theater or to the traveler when he enters a hotel; that is that sign-boards directing men to different outlets shall be placed at each departure from the continuous course. Crews in different mines are constantly changing and as a result many are strangers in a strange place and should anything such as a mine fire happen, without these sign-boards many of the men would be liable to be trapped. The Tonopah Mining Co. has the most complete system of sign-boards of any mine in the state. If one can read, it is absolutely impossible for him to get lost. Passing sections 22, 23, and 24, which regulate the use of gasoline underground, use of chain ladders when sinking, and the use of guard-rails in front of shaft-levels, I come to section 25, which in my opinion is one of the most important sections in the law. This section provides for the placing of gates on all cages in shafts over 350 ft. deep, the same to be made of sheet iron or steel not less than ⅛ in. thick, or of netting not less than of ⅛ in. diameter, these doors to extend at least 4 ft. above the bottom of the cage, the doors to be closed when hoisting or lowering men, the only exceptions being when timbermen are riding on the cage to attend to timbers that are being hoisted or lowered, or when cage is only used for sinking. No one will ever know the number of lives this device has been the means of saving, but it is known that since this provision has been put into effect, on four different properties in this state men have fainted when coming up on a cage loaded with men, and no damage has resulted. Without the gates it is reasonable to suppose that when the men toppled over they would have knocked off some of their companions. That has been the usual result in mines where gates are not provided.

I do not want to weary you, so will not stop to comment on sections 26, requiring a pillar of ground to be left next to the shaft, 27 and 28, which deal with the erection of structures over the mouth of shafts or adits. Sections 29 and 30 deal with the questions of ropes and cables. These two sections were recommended by the committee appointed

RESCUE HELMET USED BY BUREAU OF MINES.

by the American Mining Congress and the Mining and Metallurgical Society to frame a suitable mining law for the metal mines of the United States. These sections fully cover the matter of factor of safety and have been a wonderful help to us in our work.

Section 31 provides for the inspection of boilers by a qualified person at least every six months. There are only a few steam plants in the state, and in the absence of a regular state boiler inspector, it was thought best to so fix it that a check could be kept on them. Section 33 provides that when repairs are being made in any compartment of a shaft that only the hoisting necessary to make such repairs shall be done in that compartment. This makes it possible for a man to work in a shaft with some degree of safety and not have to keep dodging a cage. One busily engaged might in a moment of forgetfulness neglect to dodge and be seriously injured. This section fixes it so he, and he alone, can use the cage, therefore he knows where it is at all times.

Section 34, providing that wages shall not be paid on any premises used for the sale of liquor, probably looks out of place in a bill of this kind, but it was found necessary to furnish the miner a little protection on the surface. In a couple of places it was found that the manager of

the property had his office in a saloon. It was presumed that he and the saloon man were working together. So many congenial spirits meeting and receiving money in such a place resulted in some of them going home broke.

Section 35 is a very important section and the text reads as follows: "The operator of every mine, whether operated by shaft, stope, or drift, shall provide and maintain for every such mine a good and sufficient amount of ventilation for such men and animals as may be employed therein, and shall cause an adequate amount of pure air to circulate through and into all shafts, winzes, levels and all working places in such mine." The matter of ventilation is probably the most serious of the many that confronts the mine operator and miner. Good ventilation, all agree, is absolutely essential both from a humane and economical standpoint. The cost of production depends to a large extent on the working capacity of the men engaged in mining and getting out the ore, this working capacity is either advanced or retarded by the health of those engaged or by the degree of comfort with which men may exert themselves. The object of ventilation is the removal of impure air and the supplying of fresh air in its place. The required amount of air which should be forced into a mine is a question upon which men may well differ. Some mines are naturally cool, and in some the ground is such that very little gas emanates from it, and in some little powder is necessary. Now it is plain that under such conditions the same amount of air is not necessary, as in a place where the ground is naturally hot and the rock constantly emitting gas, or the rock is of such character as to require the use of large quantities of powder. It is hard, therefore, to lay down a general rule. Some writers on the subject recommend, and at present I am inclined to believe it the better method, that the fitness of the air to work more judged by the amount of gas and oxygen in it, in tion, words, by quality rather than by quantity. Here, it tention to me, is a splendid field for the student in this uni- huma You have every facility for making the proper subject. this being a question with which every mining ployer's comes in contact, ought, in my judgment, to be exchanged by those who have chosen this as a life work. Such should be gathered upon which to base a judgment go fa the quality of the air in which men may work without endangering their health.

Some of the mines in this state are ventilated by what is known as natural ventilation, secured by being connected with one or more shafts other than its working shaft, one being a downcast, the other an upcast. By means of raises and winzes connecting levels it is possible to conduct the air through the main portion of the mine. But as a general rule devices for mechanical ventilation should be erected at most mines, especially the deeper ones. The long prospect drifts or cross-cuts are frequently at such a distance from the main air-course that no benefit is derived therefrom, and it is expensive running raises to make frequent connections with levels when the drift or cross-cut shows nothing but waste. In many places where machines are used, reliance is on the compressed air, which furnishes the proper ventilation. My experience has been that this is unsatisfactory. In many of the mines thus ventilated, as soon as the men shoot, which is generally as they go off shift, the compressor is shut down and it is only started again when the other shift comes on, consequently the mine is hot and gassy. Compressed air for ventilation alone is found to be expensive, and bosses, as a rule, want the air turned off when the drill is not running.

In most of the larger mines the working places, so situated as to derive no benefit from the natural air-course, are supplied with air by means of fans or blowers. Many of the blowers are arranged so as to be used for blowing or exhausting the air through pipes. Where used as a blower the air is forced through the pipes to the point of discharge, forcing the smoke and bad air back through the passage way. In the exhaust system the foul air is sucked through the pipe and the good air comes through the passage way. There is some difference of opinion as to which is the better method. I am inclined to think a mixture of the two could be practised successfully. When the face is full of smoke and gas, immediately after shooting a round of holes, it seems to me the exhaust system would be the better for the reason that it would be the means of keeping the smoke from the drift through which the men must tram. But when the men go in to work, I favor the plan of forcing the air to the face through the pipe; one reason is, you can force the air a considerable distance beyond the end of the pipe, while when used as an exhaust, the current is scarcely to be detected a few feet from the end of the pipe. Then, again, if the place is exceptionally hot and moist, and the men perspire freely, all agree that the working power of a person is greatly diminished and frequent rests are necessary. In order to keep down the heat in the body, radiation from the skin is necessary, and to produce that, it is necessary to have a fair current of air to absorb the moisture, and for that purpose air should be forced to them, and in order to get the best results by the cooling effect of evaporation, the air should be moving with some velocity.

Another great menace to the lives of the miners, is that slow and insidious disease known as miners' consumption. The very nature of the disease makes it difficult to combat, for it slowly but surely saps the vitality of a miner, and ere he is aware of it he has suffered a complete breakdown. Since the introduction of the machine-drill, and especially the hammer stope-drill, the increase in the number of miners affected by this terrible disease can be noticed. While the men on the drills are the most affected, many cases have been discovered among others who work in the mines. Trammers loading from the chutes are also compelled to breathe an atmosphere laden with dust. I know of one mine in this state where no machines at all are used in the stopes, yet the air is at all times filled with a flour-like dust. These fine particles enter the lungs and slowly do their deadly work. Strong young men will suddenly notice a shortness of breath, a little hacking cough, and gradual wasting away. Then at an age when a man is ordinarily at his best he finds himself unfit to work underground, and the knowledge gained by years of experience is lost to himself and the industry. These conditions I have seen with my own eyes, and one of the officials of a labor union in one of the southern districts told me they then had seven cases of miners' consumption that they knew of in that one local. Not a year goes by that the national government and the different state governments do not spend thousands of dollars to destroy germs, worms, and insects in order to protect the fruits and vegetables of our country; yet we never hear of the spending of a dollar to guard against a disease that is daily spreading its blight and sapping the heart's blood out of those brave men who take their lives in their hands, delving in mother earth to bring forth the golden treasure to be poured into the channels of trade. You can scarcely go into an up-to-date planing or flour mill without finding exhaust pipes running to every point from which dust is created. Exhaust fans are used to pull this dust from places where men are working and deposit it where it can do no harm. Why not try something like that in our mines? Some suggest using jets, sprays, and water machines. The question is, which is the best and most practical and what conditions should govern their use? I would suggest that since there is a United States Bureau of Mines, with a brilliant man at its head and by which wonderful work is being done for the coal mining industry, it would be well for Western men to show that they, too, are interested in this Bureau and its work and want it to be interested in them. Why should not this engineering club and every organization of like kind, the miners' unions, and the different mine operators' associations, write to this Bureau and ask it to take up this question from a scientific standpoint and give data upon which to base a law that will deal fairly and squarely with all. I feel confident they will do it. I have met Mr. Holmes, the director, and some of the young men under him, and know them to be honest conscientious workers, anxious to do all in their power to aid this industry. Let us give them a trial.

Mining at Treadwell, Alaska

Upon Douglas Island, opposite Juneau, Alaska, are three great and closely connected gold mines, the Alaska Treadwell, Alaska Mexican, and Alaska United. For the whole group F. W. Bradley is consulting engineer, R. A. Kinzie, superintendent, and E. P. Kennedy, assistant superintendent. Of the three mines, the Treadwell is the oldest, the Mexican comes next, and the United is youngest. They all operate upon one body of ore, though the Alaska United owns, in addition to the 700-Ft. claim between the Alaska Treadwell and Alaska Mexican, and the Ready Bullion mine, which is upon a distinct ore-shoot about 2500 ft. south of the main orebody. The geology of the deposit has been frequently described and was well summarized by Oscar H. Hershey in the *Mining and Scientific Press*, February 25 and March 4, 1911.* Briefly, the ore consists of parts of a body of meta-gabbro, mineralized in connection with the intrusion of later albite-chlorite dikes. The ore is considered to be of primary origin and is a simple gold ore treated by stamp-milling, amalgamation, concentration, and recently cyanidation of the concentrate. The great size of the orebodies have led to development of interesting and unusual mining methods.

TABLE I. ALASKA MEXICAN ORE RESERVES

HISTORICAL STATEMENT OF ORE RESERVES AND ORE MILLED

Year.	Estimated Ore Reserves				Ore sent to Mill	
	Tons in Place.	Broken Ore in Stopes. Tons	Total Tons.	Average Assay Value per Ton	Total Tons	Average Assay Value per ton.
				$		$
1901	101,930	28,230	130,160	2.56	178,960	2.03
1902	117,750	43,700	161,450	2.90	207,455	2.19
1903	152,001	100,415	252,416	2.76	239,458	3.18
1904	338,116	74,814	412,930	2.88	227,899	3.10
1905	670,105	171,771	841,876	3.11	238,985	3.19
1906	619,261	240,129	859,390	3.28	167,859	3.32
1907	[illegible]	235,187	794,924	3.37	156,987	3.21
1908	514,787	191,704	706,441	3.38	246,955	3.01
1909	395,054	201,350	596,404	3.58	230,976	3.94
1910	843,029	250,000	1,093,029	3.41	216,960	3.56
1911*	680,511	349,614	960,025	3.14	227,081	3.261
AVERAGES	449,299	171,525	620,825	$3.24	211,409	$3.11

* NOTE—For the period beginning December 16th, 1910, and ending December 31st, 1911.
† This value is derived by adding the tailing value to the returns from the Mill.

TABLE II. ALASKA UNITED ORE RESERVES

HISTORICAL STATEMENT OF ORE RESERVES AND ORE MILLED
READY BULLION MINE.

Year.	Estimated Ore Reserves				Ore sent to Mill.	
	Tons in Place.	Broken Ore in Stopes Tons	Total Tons.	Average Assay Value per Ton	Total Tons	Average Assay Value per Ton
				$		$
[illegible]	—	—	—	—	170,642	2.05
1902	183,160	69,000	252,160	2 09	226,522	[illegible]
1903	194,868	102,842	296,210	2.04	202,891	1.79
1904	294,558	136,158	430,716	2.11	196,365	2 01
1905	904,102	126,903	1,091,065	2.38	288,480	2 07
1906	886,560	184,384	1,070,944	2.34	286,600	2.13
1907	1,186,332	192,299	1,378,631	2 42	213,370	1 88
1908	984,178	214,028	1,198,206	2.46	231,570	2 28
1909	821,821	294,329	1,116,650	2.68	227,710	2 34
1910	1,500,891	253,969	1,751,850	3.02	232,380	2 28
1911*	1,165,252	292,856	1,448,108	2.94	228,688	2 529
AVERAGES	817,024	186,681	1,008,706	$2.58	217,748	$2 09

NOTE—* For the period beginning December 16th, 1910, and ending December 31st, 1911.
† This value is derived by adding the tailing value to the returns from the Mill.

Beginning at the north in Alaska Treadwell ground the ore-shoot at the surface extends from the south boundary nearly 1500 ft. north. The pitch is to the south so that at 1450 ft. in depth about 700 ft. of the ore-shoot remains in Treadwell ground. In the 700-Ft. claim at the surface the ore-shoot extended south to the shaft, roughly 300 ft., and from that point south 900 ft., and into Alaska Mexican ground 500 ft., the rock was too lean to work. The Mexi-

*See also 'Types of Ore Deposits,' pp. 157-171.

TABLE III. SUMMARY OF RETURNS, ALASKA MEXICAN MINE

Dates.	Tons Crushed.	Yield Free Gold including Base Bars.	Concentrates (Sulphurets).		Total Yield.	Total Yield per Ton.	Operating Profits.	Operating Profits per Ton.	Operating Costs per Ton.	Dividends Paid.
			Tons Treated.	Yield.						
1894.		$		$	$	$	$	$	$	$
Jan. 1st to Dec. 31st...	73,141	151,643 33	1,393 50	49,899 13	204,042 46	2 79	60,215 60	0 82	1 97	25,500 00
1895.										
Jan. 1st to Dec. 31st...	79,489	155,637 54	1,575 10	70,620 53	226,258 07	2 85	71,391 78	0 90	1 95	79,881 00
1896.										
Jan. 1st to Dec. 31st...	101,702	169,532 32	1,652 20	76,329 66	245,861 98	2 42	61,650 43	0 61	1 81	72,000 00
1897.										
Jan. 1st to Dec. 31st...	158,005	226,321 71	3,472 50	109,306 96	335,628 67	2 12	87,101 46	0 55	1 57	72,000 00
1898.										
Jan. 1st to Dec. 31st...	162,457	257,484 67	3,402 00	118,397 69	375,882 36	2 31	100,663 07	0 62	1 69	72,000 00
1899.										
Jan. 1st to Dec. 31st...	166,054	231,841 23	3,053 09	115,573 74	347,414 97	2 09	62,383 42	0 38	1 73	72,000 00
1900.										
Jan. 1st to Dec. 31st...	166,449	233,105 08	3,141 76	81,900 37	315,005 45	1 89	33,821 02	0 20	1 69	72,000 00
1901.										
Jan. 1st to Dec. 15th...	178,960	213,923 07	3,198 83	125,529 24	339,452 31	1 90	24,709 63	0 14	1 76	—
1902.										
Dec. 16/01 to Dec. 15/02	207,455	216,772 25	3,528 28	209,960 31	426,732 56	2 06	86,025 51	0 41	1 64	—
1903.										
Dec. 16/02 to Dec. 15/03	239,453	337,803 44	5,077 73	361,581 66	699,385 10	2 92	257,634 12	1 08	1 84	108,000 00
1904.										
Dec. 16/03 to Dec. 15/04	227,898	316,441 87	4,900 70	344,732 86	661,174 73	2 90	241,968 91	1 06	1 85	216,000 00
1905.										
Dec. 16/04 to Dec. 15/05	283,985	358,459 64	4,407 63	342,277 63	700,737 27	2 99	288,620 20	1 02	1 98	477,000 00
1906.										
Dec. 16/05 to Dec. 15/06	237,862	392,778 15	3,876 10	328,696 84	721,469 49	3 03	281,127 84	1 18	1 86	216,000 00
1907.										
Dec. 16/06 to Dec. 15/07	214,263	351,813 03	3,885 18	296,164 74	647,977 77	3 02	288,910 89	1 34	1 68	234,000 00
1908.										
Dec. 16/07 to Dec. 15/08	245,955	397,100 49	4,205 83	303,871 26	700,971 75	2 85	311,475 88	1 26	1 59	324,000 00
1909.										
Dec. 16/08 to Dec. 15/09	220,976	475,326 96	4,043 86	403,443 54	878,770 50	3 97	499,488 29	2 26	1 71	360,000 00
1910.										
Dec. 16/09 to Dec. 15/10	218,960	390,198 06	4,166 67	375,523 82	765,721 88	3 50	380,753 73	1 74	1 76	342,000 00
1911.										
Dec. 16/10 to Dec. 31/11	227,081	323,965 49	5,150 40	353,442 86	677,407 85	2 98	257,880 90	1 14	1 84	•126,000 00
TOTALS	3,360,035	5,203,143 33	64,126 36	4,066,751 84	9,269,895 17	2 76	3,845,772 18	1 00	1 76	2,868,381 00

NOTE.—Interest, &c., amounting to $31,418.36 is included in the above Operating Profits.
Other profits amounting to $111,762.06 were also earned, making a total profit of $3,457,534.24.
Part of the ore crushed during the two years ending December 15th, 1909, was milled in the Mexican Mill and part in the Alaska United Gold Mining Co.'s 700 Ft. Claim Mill.

can ore-shoot, however, is itself roughly 1200 ft. long and pitches north. At 700 ft. deep in the 700-Ft. claim the two ore-shoots have met and ore is found throughout the length of the claim. On the 1250-ft. level ore is continuous for 2200 ft. The Ready Bullion ore-shoot is not so long, 400 to 500 ft., but as both the shoots are 300 and more feet in width, the amount of ore is enormous. It is interesting to observe that it costs approximately $300,000 to open each new level and that six years elapse from the time it is opened until it is abandoned. The methods of mining employed have been described by T. A. Rickard† and others.

At the close of 1910 the total measured ore reserve in the Alaska Treadwell was about 7,000,000 tons, of an average value of $3, whereas the average value of the ore milled to that date was $2.40, of which 85c. per ton had been paid in dividends. The report of the senior company for the year 1911 is not yet available, but from recently issued reports of the Alaska Mexican and Alaska United companies, the accompanying tables have been taken. The historical statement of ore reserves in the Mexican mine shows a present total of 980,025 tons, worth $3.14 per ton, as against an average reserve since 1901 of 620,825 tons, worth $3.24. The ore milled last year amounted to 227,081 tons, worth $3.26, the latter figure being obtained by adding the recovery to the tailing loss. The average of all ore milled has been $3.11. Details are shown in Table I. In the case of the 700-Ft. claim the present reserve is 1,387,076 tons, worth $3.08, as against an average of 394,913 tons, worth $2.57. The tonnage in 1911 was 225,403 and the average value $2.52. The average value of all ore sent to the mill since 1901 has been $3.11. Corresponding figures for the Ready Bullion mine are shown in Table II. A comprehensive view of the business of the two companies may be obtained from Tables III and IV. The Alaska United had paid, up to 1912, $837,930 in dividends. Hoisting is now done through separate shafts, but the 700-Ft. claim shaft has been re-timbered to the 1600-ft. level of the Treadwell and is to be used as a main central shaft for the three mines. The equipment will permit of hoisting 5000

†*Mining and Scientific Press*, July 18, 1908.

TABLE IV. SUMMARY OF RETURNS FROM ALASKA UNITED MINES

Dates.	Tons Crushed.	Yield Free Gold including Base Bars.	Sulphurets. Tons Treated.	Sulphurets. Yield.	Total Yield.	Total Yield per Ton.	Operating Profits.	Operating Profits per Ton.	Operating Costs per Ton.
READY BULLION CLAIM—		$		$	$	$		$	$
1898—Nov. 15th to Dec. 31st	19,612	47,495 81	—	—	47,495 81	2 42	22,100 18	1 18	1 29
1899—Jan. 1st to Dec. 31st ...	162,107	317,546 84	3,232·21	123,146 41	440,692 75	2 72	121,389 75	0 75	1 97
1900—Jan. 1st ,, ,, 31st ...	179,410	254,910 45	4,141·56	130,818 44	385,728 89	2 15	86,418 18	0 48	1 67
1901—Jan. 1st ,, ,, 15th ...	170,642	223,475 20	3,257·80	107,949 35	331,424 55	1 94	14,476 61	0 08	1 86
Dec. 16/01 to Dec. 15/02 ...	226,522	197,105 70	4,158·80	137,032 22	334,137 92	1 48	Loss ... 5,385 70	0 02	1 50
,, 16/02 ,, ,, 15/03 ...	202,881	205,295 07	4,452·57	124,163 00	329,458 07	1 62	,, ... 9,085 88	0 05	1 67
,, 16/03 ,, ,, 15/04 ...	196,865	211,450 78	1,025·11	143,861 04	355,311 82	1 81	Profit 24,099 94	0 12	1 69
,, 16/04 ,, ,, 15/05 ...	238,180	284,875 46	4,039·62	153,259 70	438,135 16	1 88	75,989 60	0 32	1 56
,, 16/05 ,, ,, 15/06 ...	236,690	290,006 88	3,920·78	171,393 20	461,400 08	1 95	105,312 81	0 44	1 51
,, 16/06 ,, ,, 15/07 ...	218,370	224,150 16	3,881·21	136,201 26	360,351 42	1 69	30,261 44	0 15	1 54
,, 16/07 ,, ,, 15/08 ...	231,570	286,927 93	4,506·96	196,687 91	483,615 84	2 09	124,816 42	0 54	1 55
,, 16/08 ,, ,, 15/09 ...	227,710	278,868 11	4,221·61	215,359 10	494,227 21	2 17	138,354 77	0 61	1 56
,, 16/09 ,, ,, 15/10 ...	232,330	281,877 15	4,616·23	207,815 98	489,693 13	2 11	149,040 30	0 64	1 47
,, 16/10 ,, ,, 31/11 ...	223,668	278,034 88	5,461·23	241,248 84	519,283 72	2 32	137,095 61	0 61	1 71
TOTALS	2,756,857	3,382,019 92	58,415·19	2,088,936 45	5,470,956 37	1 98	1,014,834 23	0 37	1 61
700 FT. CLAIM—		$		$	$	$		$	$
1899—April 15th to Dec. 31st	85,065	99,345 49	1,234·36	46,749 07	146,094 56	1 72	3,405 88	0 04	1 68
1900—Feb. 15th to Dec. 31st	125,612	140,164 98	2,508·29	87,573 87	227,738 85	1 81	31,571 05	0 25	1 56
1901—Jan. 1st to Oct. 15th ...	89,450	90,385 13	1,541·86	43,374 63	133,759 76	1 50	Loss ... 42,797 49	0 48	1 98
Dec. 16/01 to Dec. 15/02 ...	118,541	96,171 02	1,271·39	61,611 51	157,782 53	1 67	Profit 19,362 64	0 44	1 23
,, 16/02 ,, ,, 15/03 ...	—	386 37	972·21	39,771 04	40,107 41		,, 33,802 48		
,, 16/03 ,, ,, 15/08 ...	149,326	176,065 24	2,120·43	139,248 63	315,313 87	2 11	Loss 4,959 56	0 03	2 14
,, 16/08 ,, ,, 15/09 ...	190,474	259,979 26	3,333·29	199,266 91	459,246 17	2 41	Profit 119,465 81	0 63	1 78
,, 16/09 ,, ,, 15/10 ...	188,329	239,892 76	3,217·09	162,872 04	402,764 80	2 14	99,800 60	0 53	1 61
,, 16/10 ,, ,, 31/11 ...	224,968	284,430 37	4,477·34	244,198 22	528,628 59	2 35	178,484 05	0 79	1 56
TOTALS	1,171,765	1,386,770 62	20,676·26	1,024,660 92	2,411,431 54	2 06	487,635 46	0 37	1 69

TABLE V. RECORD OF ALASKA MEXICAN MILL

Month Ending	Time Elapsed.	Running Time. Steam.			Running Time. Water.			Time Lost.			Tons Crushed.	Tons Crushed per Stamp in 24 hours.	Sulphurets. Tons Saved.	Sulphurets. Per cent. saved per Ton of Ore Crushed.	Ounces Quicksilver Used. Batteries.	Plates.	Vanners.	Cleaning Amalgam.	Total.	Supplies Used. Shoes.	Dies.	Cams.	Cam Shafts.	Stems Broken and Replaced.	New Stems.	Tappets.	Boxheads.	Blankets.	Vanner Belts.
	D.	D.	H.	M.	D.	H.	M.	D.	H.	M.					Oz.	Oz.	Oz.	Oz.	Oz.									
1911.																												
Jan. 15th ..	31	25	15	28	4	1	56	1	6	36	18,753	5·28	390	2·08	4,050	144	—	716	4,910	55	10	—	—	41	—	3	—	—	8
Feb 15th ..	31	30	16	12	—	—	—	—	7	48	18,501	5·03	390	2·11	3,856	140	—	1,093	5,089	40	20	1	1	54	—	4	—	—	2
Mar. 15th	28	25	11	18	2	5	30	—	7	12	16,548	4·98	300	1·81	3,242	130	—	1,178	4,550	45	35	—	—	53	—	3	—	—	—
April 15th ..	31	30	12	57	—	—	—	—	11	3	19,362	5·28	438	2·26	3,108	130	—	500	3,738	50	35	—	—	59	—	2	—	—	1
May 15th	30	11	11	49	14	7	38	1	2	33	18,060	5·20	428	2·37	3,003	114	—	461	3,578	30	25	—	1	43	—	4	—	1	1
June 15th	31	—	—	—	30	16	52	—	7	8	19,173	5·20	450	2·35	2,928	121	—	227	3,276	50	15	—	—	40	—	4	—	—	1
July 15th	30	—	—	—	28	17	34	1	6	26	18,459	5·35	424	2·30	2,678	139	—	645	3,462	35	30	1	—	22	—	2	10	1	3
Aug. 15th	31	6	14	11	24	1	21	—	8	28	19,341	5·26	431	2·22	3,083	140	—	863	4,086	10	25	—	—	31	—	2	10	1	2
Sept. 15th	31	18	13	7	12	3	15	—	7	38	19,516	5·30	457	2·34	3,097	142	—	914	4,153	60	25	1	—	33	—	5	—	1	1
Sept. 30th	15	—	11	20	14	8	2	—	4	38	9,261	5·21	238	2·57	1,598	114	—	173	1,885	15	20	—	—	7	—	3	—	—	—
Oct. 31st	31	5	20	40	24	20	55	—	6	25	20,864	5·60	464	2·24	2,921	395	—	764	4,080	40	15	—	—	30	—	4	—	—	1
Nov. 30th	30	23	15	52	6	1	19	—	6	49	19,887	5·57	447	2·24	3,632	488	—	395	4,515	60	15	3	—	23	—	3	—	—	—
Dec. 31st	31	19	7	19	10	9	33	1	7	8	18,858	5·29	484	2·56	3,727	495	—	199	4,421	30	15	—	1	23	—	4	—	—	—
TOTALS AND AVERAGES	381	201	8	13	171	21	55	7	17	52	236,583	5·27	5,341	2·26	40,923	2,692	—	8,128	51,743	540	285	6	2	459	—	43	20	4	14

tons per day from a depth of 3000 ft. Present operating costs at the Mexican mine are shown in Table VI, and the record of the Alaska Mexican mill, for the year, in Table V. Concentrates from all the mills are now treated locally in a cyanidation plant owned jointly by the three companies. The new power plant at Nugget creek is to be built this summer. A transmission line has already been

TABLE VI. ALASKA MEXICAN COSTS

	Per Ton Milled.
Operating Costs -	
Mining Development, 9,613 ft., Stoping, 327,020 tons ore, Stoping, 13,516 tons waste	$1·2086
Milling (236,383 tons ore), 227,081 tons Mexican ore, 9,302 tons 700 ft. Claim ore, 5,841 tons Sulphurets saved	·2697
Sulphuret Expense, 5,383·108 tons treated ...	·0999
General Expense Douglas Island	·1259
San Francisco Office Expense	·0170
London Office Expense	·0031
Paris Office Expense	·0005
Taxes	·0161
Bullion Charges	·0128
Total Operating Costs	1·7481
Construction and Repair Costs -	
Construction, Central Shaft	
,, Sheep Creek Dam	
Repairs to Railroad Track	
,, ,, Air Compressor	
,, ,, Assay Office	
Addition to Pump Pier	
Installation of Motors	
Total Construction and Repair Costs charged to Profit and Loss	·0244
Total Operating and Construction Costs ...	1·7725
Boarding House—Loss for Year	·0011
Interest	·0012
Balance—Net profit for period	1·0909
	$2·8657

erected and power will be sent from the Sheep creek plant to Nugget creek during the period of construction. When the new plant is completed a large part of the power will be used in pumping tailing from the various mills into underground slopes in order to fill them. The year 1911 was a busy and successful one with results quite in keeping with the quiet efficiency that has long characterized operations at these great gold mines.

Japanese Copper Production

The total copper production of Japan for the year 1911 amounted to 115,308,000 lb., equal to an increase of 5,609,333 lb. over 1910, and 30,520,000 over 1907. The value of the 1911 product was $13,469,000, an increase of $559,500 over that for 1910. Detailed figures for the five leading producers are given below in pounds:

	1911.	Increase or Decrease.
Ashio	16,964,227	+1,332,901
Besshi	15,145,070	+301,904
Kosaka	13,245,527	-836,475
Hitachi	12,608,761	+1,863,411
Osarazawa	4,344,521	-500,973

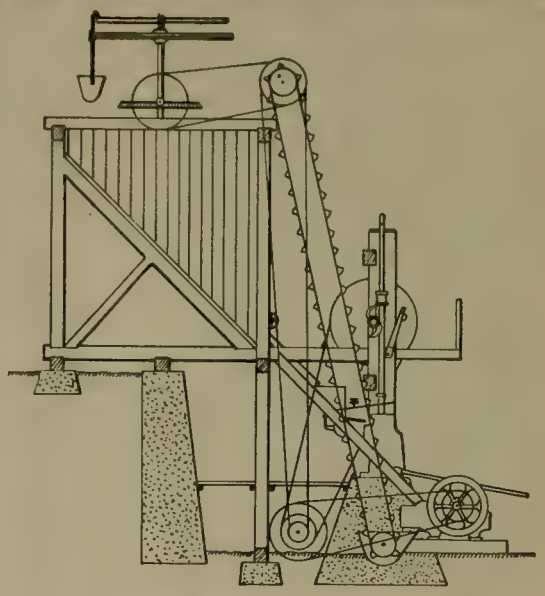
The increase in the case of the Hitachi is especially remarkable, since it brings this mine into the leading class. Improvements and extensions have kept the Ashio mine at the head, though the race between it and the Besshi for first place is becoming keener. The present will undoubtedly be a good year for the Japanese copper mines. Since January 1 the price of copper manufacture has increased 20% and the demand is good. The wire mills are especially busy.

COPPER smelting equipment is in course of erection at the Kalatinsky mines in the upper Isset district, Russia. The ore is a cupriferous pyrite containing as high as 3% copper.

An Unusual Type of Mill

By W. G. FRESCH

In the 10-stamp mill of the Fort Bidwell Consolidated Mines Co., at Fort Bidwell, Modoc county, California, the arrangement of the crushing machinery is unusual, and a description of its operation will be of interest to quartz-mill operators. The topography and other conditions existing at the millsite necessitate a departure from the usual type of stamp-mill construction and arrangement of the machinery. The ore from the mine is delivered directly to the mill-bin by an aerial tramway one-half mile in length. This ore-bin consists of two sections, one for the



ARRANGEMENT OF CRUSHER AND STAMPS.

tramway delivery, the other for the rock-crusher product or battery feed. The entire tramway delivery is conducted from the bin to the crusher, the jaws of which are set for an opening of two inches. No sizing by grizzlies or screens is employed. The unusual feature of this mill is that the rock-crusher is placed on a level with the apron plates, and to one side of the mortar. By reference to the sketch it will be noted that the crusher is belted directly to a driving pulley on the line-shaft, which runs beneath the feeder floor. Driving pulleys on this shaft operate the 5-stamp batteries and also the elevator. The tramway is also operated from a countershaft belted to this line-shaft. The entire product from the crusher is handled by means of a belt and bucket elevator, and delivered to the battery feed section of the ore-bin, whence it is delivered by the usual method to the stamps. Some of the main features to be noted in this arrangement of mill machinery are that it obviates the use of large timbers in construction of bins and eliminates the ever-present danger of oil coming into contact with the ore, through careless handling about the crusher when the crusher is set directly over the ore in the bin. When the necessary height or fall is not obtainable for the usual type of installation this method will, in some cases, solve the problem, as less fall is required. In most cases the millman can attend to the operation of the crusher, thereby reducing the cost of mill labor.

PERMISSION has been granted by the authorities of Puerto Cabello to Eusebio Rodriguez and Esteban Sivisa to exploit a goldfield, which, according to a document filed with the public registrar, they have discovered in Borburata, a small village in the suburbs of Puerto Cabello, Venezuela. They claim that the goldfield is 200 hectares (494.2 acres) in extent and has much gold quartz, which also contains other metals.

Appropriations for Mining

Funds for the United States Geological Survey and the Bureau of Mines, the two great federal organizations in which mining men are interested, are appropriated in what is known as the Sundry Civil Bill, originating in the Committee on Appropriations, of the House of Representatives. This bill carries, of recent years, over $100,000,000 annually, covering a large part of the Government's field of activity in civil affairs. As reported this year the total proposed to be appropriated is $109,577,414, and the bill makes up a book of 182 pages. While the amounts fixed in the report of the committee are not final, Congress has a deep rooted objection to revision downward, and the total is likely to be increased rather than the reverse.

The items for the Geological Survey are as follows: Office of director, $35,340; scientific assistants, $29,900; skilled laborers and temporary employees, $20,000; topographic surveys, $350,000; geologic surveys, $300,000; mineral resources of Alaska, $90,000; chemical and physical researches, including potash investigation, $40,000; preparation of illustrations, $18,280; preparation of the report on mineral resources, $75,000; gauging streams and water-supply studies, $150,000; purchase of books, $2000; engraving and printing geologic maps, $110,000; topographic surveys in national forests, $75,000; making a total of $1,295,520. In addition there is appropriated to the public printer $145,000 for engraving and printing of Survey reports.

For the Bureau of Mines the proposed appropriations are: General expenses, $66,100; general investigations of mine explosions, methods of mining, etc., $320,000; analyzing and testing fuels, $135,000; mine inspector of Alaska, salary and expenses, $6500; purchase of books, $1500; purchase of land and construction of railway siding for headquarters for mine rescue cars, $4000; making in all $533,100. A special appropriation of $100,000 for investigations in the metalliferous mines of the West was asked but not granted by the committee. An effort will be made to amend the bill on the floor of the House so as to obtain this sum for the work.

Copper Queen Miners' Benefit Association

Benefit associations for the employees of large corporations are not new, but the results secured by the association maintained by the employees of the Copper Queen Consolidated Mining Co. have been so uniformly successful as to make a short account of the plan and results attained of general interest. We are indebted to S. W. French, general manager for the Copper Queen company and chairman of the board of directors of the benefit association, for the following data. The association is governed by a board of directors, of which the general manager is chairman, four members are heads of departments of the company and four members are workmen, elected by ballot by the members of the association. The funds of the association are provided by a yearly contribution of $25,000 by the Copper Queen company and a contribution by members at the rate of 2% of their wages, such contribution during 1911 amounting to $40,303. Benefits are paid for loss of working time due to accidents at the rate of half pay for each working day lost from this cause. For loss of working time due to sickness, half pay is granted for each day after the first seven days. Neither accident nor sickness benefits are continued for a longer period than one year. For serious injury, from one-half to two years average pay is granted, according to the nature of the injury. In the case of death from accident, two years average wage is paid, and for death due to sickness, one year's wages. During the year, 6.33% of the membership received benefits; 4.96% being accident benefits and 1.37% sickness benefits. At Bisbee approximately 70% of the men are members of the association, and at Douglas 60% are members. An interesting feature of the work of the association is that the cost of administering the benefit fund of over $66,000 was less than $2000, since the directors serve without pay, while the duties of superintendent and assistant superintendent are combined with those of paymaster at the Bisbee and Douglas plants, the former received $50 per month and the latter $25 for this service. This is in sharp contrast to the report of the New York Employers' Liability Commission in 1910, where it was shown that of the premiums paid by employers to liability insurance companies less than 37% is paid to the injured employees, over 63% being paid to attorneys, claim agents, and cost of administration. In this case over 96% of the contributions is paid to the injured members. The work of the association has been satisfactory and without friction, perhaps largely because of the wise policy of the company in making no effort to secure members for the association, thus emphasizing that it belongs to the employees and is under their direction.

May Metal Review

By Misha E. Appelbaum

During the greater part of May copper continued to advance, principally due to domestic buying. Toward the close of the month, however, Europe had again turned buyer and another sharp advance took place, because of this. Quite a cry has been raised in some corners that copper is being manipulated, but as I stated some time ago in these columns, the advance in copper is due to the fact that none of the consumers expected the metal to go higher than 14 to 15c. When the market reached that figure they entirely withdrew, and after watching it for a little time and being absolutely in need of copper, tried to buy at the then prevailing prices without much success. The principal refineries and producers being sold out up to about the end of August, are unable to supply the spot demand, which, while not great, is enough, considering the small supply, to cause further sharp advances.

Everyone has also been predicting that on account of the high price of copper, the consumption will fall off. Past experience indicates that 4, 6, or even 18 months of high copper prices does not affect the consumption; similarly, a few months of the low copper prices does not stimulate consumption. In order for the consumption to be stimulated by low prices or to be affected by high prices, they must prevail for at least two years. Personally, I feel that if copper remains at 18 to 20c. for several years, the production will be pushed and many mines will be opened, so that in time the world supply of copper will be much greater than the consumption. Such an increased supply usually comes on the market at the time when consumption shows signs of falling off. This has been the history of the copper market for the past twenty years, and I believe that in this case history will repeat itself. However, it is safe to say that, so far as the next few years are concerned, in view of the business outlook, copper prices, irrespective of the final adjustment, will rule on a higher level, and the sooner the consumers realize this fact the more profitable it will be for them. Financial conditions are sound, and conservatism is the word. With this policy I believe a period of a few years of prosperity has begun, and I do not believe that political conditions will interfere. Both parties realize the conservative temper of the masses and will frame their platforms accordingly.

Zinc mines at Franklin Furnace, in Sussex county, New Jersey, continued their important output of metal during 1911, according to the report by H. D. McCaskey of the U. S. Geological Survey. The New Jersey Zinc Co. treated 306,168 short tons of ore at its concentrating-plant and shipped 67,896 tons of crude ore to smelters. Figured as metallic zinc, the total recoverable output was 154,890,900 lb. of spelter, valued at $8,828,781, an increase of 17,535,681 lb. over the production in 1910. The crushing plant at the mine has a capacity of 2240 net tons in 24 hours and the separator a capacity of over 1100 tons.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Free Use of Timber from Public Lands

The Editor:

Sir—I note in your issue of March 30, 1912, under 'Concentrates' an item about the cutting of timber on public lands which says "there is no authorization to cut any small or limited amount of timber under this act without a permit." I quote from the circular of the Department, dated February 10, 1900: "Rules and Regulations Governing the use of Timber on Non-mineral Public Lands in certain States and Territories, under the Act of March 3, 1891 (26 Stat. 1093), as Extended by the Act of February 13, 1893 (27 Stat. 444)."

Sec. 3 says: "Settlers upon public lands and other residents of the states and territories above named may procure timber free of charge from unoccupied, unreserved, non-mineral public lands within said states and territories, strictly for their own use for firewood, fencing, building, or other agricultural, mining, *manufacturing*, or domestic purposes, but not for sale or disposal, nor for use by other persons, nor for export from the state or territory where procured. The cutting or removal of timber or lumber to an amount *exceeding* in stumpage value of $50 in any one year will not be permitted, except upon application to the Secretary of the Interior, and after granting of a special permit.

Except as above provided, it is not necessary for actual residents to secure permission to take timber from public lands in said states and territories for the purposes aforesaid. The exercise of such privilege is, however, subject at all times to supervision by the Department with a view to such restrictions as may be deemed necessary."

ERNEST V. ORFORD.

De Lamar, Idaho, May 3.

[The circular quoted by our correspondent is an old one and has been superseded. The regulations as to the free use of timber from the public domain were last week discussed in full detail by T. D. Woodbury, assistant district forester in charge of silviculture.—EDITOR.]

Mr. Roosevelt and the Japanese

The Editor:

Sir—In your editorial, May 18, you condemn reference to Mr. Roosevelt's Japanese message. To me it seems so important for every voter in the United States to understand this matter, that I cannot help thinking that the important point has escaped your attention. Mr. Roosevelt threatened to use the Army and Navy of the United States to force California to grant the Japanese rights in the schools which he said were *guaranteed to them* by treaty. It seems a vital question whether the Senate and President could by treaty grant rights in our public schools which they could not grant by direct legislation. Elihu Root, when referred to, said that a treaty was beyond question the supreme law of the land, but he stopped there. It was not till public interest in the question had subsided that the Boston *Transcript* asked Richard Olney for his views. Mr. Olney in reply (published in the Boston *Transcript*) said that when Secretary of State under Mr. Cleveland he was the author of the treaty in question, and that he incorporated in the treaty a section that secretaries of state were accustomed (because of the dual character of our government) to put in similar treaties. He then quoted the section, which was in substance that any rights granted by the treaty were subject to all municipal laws and police regulations. He concluded by saying that under the treaty the Japanese could claim no rights in our public schools except such as were granted by the municipal laws. The point that I wish to call your attention to is this, that when Mr. Roosevelt said that the treaty granted them rights in the schools, either he was attempting to discuss an important treaty without having read it, or he deliberately misrepresented the facts to the American people. It is a great risk to elect for President a man who is superficial and inaccurate as to his facts.

H. W. REED.

Salt Lake City, May 29.

[Our correspondent has slightly mistaken the purpose of our comment. We have no desire to argue the question whether Mr. Roosevelt should or should not be elected President. There are grave differences of opinion upon that point even among those who greatly admire him. Neither is the matter of aliens in San Francisco schools now a question for debate. So far as we know no alien has any *right* to entrance in the public schools, and all aliens are admitted by courtesy. The mixing of adults and infants in the same schools is bad pedagogy and likely to lead to bad morals; but to draw the line against a race rather than individuals is contrary to the spirit of our institutions and breeds trouble. To discriminate against one alien people and not another is bad manners as well as bad policy. It is the President's duty to use all the force at his command to protect aliens in whatever rights are conferred upon them by treaty, though interpretation of those rights is by no means wholly in the President's hands. However, what we said in the paragraph of which complaint is made was that "stirring up race prejudice is disreputable politics"—surely there can be no difference of opinion as to this. It cannot matter greatly whether a President was right or wrong in a particular interpretation of his duty, whether a given man should or should not be elected to office, if an appeal to underlying and unreasoning race prejudice must be made to defeat him. Rousing the passions of the multitude by such means is demagogic to the last degree. We do not believe our correspondent means to disagree with us as to this, however much he may distrust Mr. Roosevelt. —EDITOR.]

Edison and Ore Dressing

The Editor:

Sir—Referring to recent press comments concerning Thomas A. Edison's efforts in the low-grade ore problems, will you kindly state that he is not working upon a solvent, as seems to be the prevailing impression. Over a year ago my company interested Mr. Edison in the question of an improvement in concentration, utilizing his fine-grinding rolls as the basis for the prevention of sliming. During the past year considerable progress has been made in making higher savings from the finer material, and also in the general treatment of complex ores, separating the lead, zinc, iron, and copper by a system of concentration. These experiments have been conducted in a large 100-ton unit in his laboratory at Orange, but there is yet considerable to be done before we will feel justified in erecting a practical plant.

Mr. Edison does not anticipate entering mining or milling; but by his arrangement, if this improvement works to his satisfaction, my company is to attempt to commercialize it by erecting a large plant somewhere in the West, so that a thorough demonstration of its practicability can be made before offering the improvement to the mining public. Mr. Edison has made no claims whatever, as he is still experimenting on the problem. What I desire more to impress is that he is not working upon a solvent; simply an improvement in concentration.

HENRY B. CLIFFORD.

New York, June 10.

DREDGING in New South Wales continues to steadily decline in output, the yield for 1911 being 23,364 oz., a decrease of 5296 oz. during the year. During 1911 the number of bucket dredges at work was 20, handling 5,122,476 cu. yd. of an average value of 7¼c. per cu. yd. The 9 pump-dredges handled 1,260,429 cu. yd., of an average content of 7.6c. per cubic yard.

Special Correspondence

NEW YORK

EL PASO AND GUGGENHEIM EXPLORATION CO. FEATURES OF THE MARKET.—PROMISING FUTURE OF BUTTE & SUPERIOR.

The principal feature of the mining market in New York, in the way of active trading, is the effort being made to distribute stock of the El Paso Consolidated of Cripple Creek. Besides the active trading in the Street, a plan of consolidation of the leading properties in Cripple Creek is being outlined in the daily press. A corporation with a capital of possibly $35,000,000 is to be formed, with El Paso and other leading properties going into the merger. It is claimed that the new concern will have an output of probably 20% of the entire gold production of the country. El Paso has paid about one and a half millions in dividends, and it is stated that some 400,000 shares of the stock has just been sold to certain German and Swiss banking interests. The shares of the Guggenheim Exploration Co. are now being traded in on the floor of the New York Stock Exchange, and the public is trying to analyze the value of the various holdings of this concern. The Exploration company has sold out all of its Esperanza holdings, from which it at one time received a very large revenue. Its holdings in the other Guggenheim companies, Utah Copper, Ray Consolidated, Chino, Yukon Gold, and Braden Copper, are not hard to appraise, as active markets are made in all of them; Braden Copper especially having been a favorite with traders during recent weeks. There has been a considerable absorption of Yukon Gold during the past few weeks. It is expected that the showing for the present year will be very much—possibly 50%—better than it was during 1911. The Yukon Gold company has obtained control of the placer fields at Iditarod, Alaska, and these holdings are looked upon as adding considerable value to the company's property.

The Phelps-Dodge shareholders are participating in the prosperity due to the advance in copper metal, receiving the regular dividend of $2.50 per share and $2 added dividend, both being payable June 28. It is said that this distribution of profits comes from earnings accumulated before the last advance in copper, and that the latter half of the current year will probably see a considerably larger disbursement made.

The stubborn skeptics on copper conditions are having their attention directed to the increased dividends as an unanswerable argument as to the position of the copper metal. In the meantime, however, the buying of copper shares continues sporadic.

The followers of Porcupine have continually pointed to the Hollinger and the Dome as the two properties that would redeem the camp. The Hollinger is evidently laboring under some financial difficulties. It owes $125,000 to the original Timmins-McMartin-Dunlap syndicate, and it is now proposed to issue 50,000 shares of treasury stock; 12,500 shares to be taken by the syndicate in liquidation of the company's indebtedness to them, and the remaining 37,500 shares to be offered to the stockholders at $10 per share. Inasmuch as the stock is selling in the open market at $9.50, it is a little difficult to see how the stockholders can be expected to absorb this treasury offering very readily.

There is a very interesting rumor afloat in regard to a group of the independent properties of Butte, including the Tuolumne, Pilot Butte, Butte & Superior, and the Butte Ballaklava, anent a merger of these and one or two properties of minor importance. There has been some steady absorption of Tuolumne stock by Boston interests, said to be for the account of William A. Paine, of Paine & Webber. The House of Paine & Webber has always had a very large share of the Boston copper business between the Lake country and Boston, and traders are hoping that the present rumor will prove to be founded on fact.

Butte & Superior was particularly fortunate in developing its mine at a time when the market in zinc began its rise. A large amount of money had been expended on the Butte & Superior ground in the search for a body of commercial ore when, in sinking its shaft, the company ran into a body of bonanza zinc which is said to show ore continually from the 500 to the 1600-ft. level. The present ore reserves are estimated at $2\frac{1}{2}$ million tons, 22% zinc. At the present prices for zinc, Butte & Superior is one of the most spectacular properties ever developed in the camp.

The real hope for the proper revival of mining interests in the near future lies in Mexico. While the stories of the war correspondents still picture a very much unsettled state of affairs, the railway lines report that the refugees who have been seeking sanctuary in San Antonio are returning to Mexico; work is being commenced on the extensions of the Mexican National railway, and the making of the loan by Speyer & Co., mentioned in a previous letter, is having a reassuring effect.

BOSTON

LAWSON INTERESTED IN AFRICAN COPPER FIELDS.—INCREASE IN COPPER DIVIDENDS.—BOOM IN BUTTE & SUPERIOR.

The African copper fever has infected Thomas W. Lawson. A few days ago he dispatched Charles C. Clapp on the *Canopic* from New York to Naples, where Clapp will meet a party of mining engineers. They will get up their equipment and start for Mombosa, on the east coast of Africa, whence they will travel inland to the copper fields. It is said that Lawson desired to accompany Clapp, but as he is a red-hot Roosevelt champion, and is also a candidate for the United States Senatorship to succeed Crane, his political engagements kept him from carrying into Africa a personally conducted copper campaign. Lawson wishes to emulate Roosevelt in his African adventures. He is looking for a copper mine, while Roosevelt's quarry consisted of lions and other wild beasts.

The Lake Copper Co. is on a steady shipping basis. Some 300 tons of ore go to the mill daily from its stock pile. The ore assays about 28 lb. of mineral, netting about 18 lb. per ton. This is a satisfactory showing, because it maintains the average of the Lake mine. The management expects to start shipments from its underground workings, and to work these shipments up to 800 tons per day by fall. Lake is no longer watched every day and every hour of the market, for some new sensational developments, as was the case something over two years ago, when it was a brilliant prospect. The mine has now reached the tenth level and the ground holds uniformly with that in the upper levels. The Lake lode, which created such a sensation in the Boston market, still keeps people guessing as to which way it is going. On the seventh level this famous vein turns toward the North Lake mine, but the tendency of the lode has been to wave or roll first one way and then the other, its general course being in the direction of the South Lake mine. The developments of the lode are of absorbing interest to both these neighboring properties, one to the north and the other to the south. There are also other South Range properties whose managements are narrowly watching Lake developments, hoping that the Lake lode will come into their ground. It is one of the interesting situations which are always to be found in the Lake copper country.

Ahmeek has increased its quarterly dividend rate from $4 to $5 per share, placing the stock upon a $20 per share annual rate. At this rate the parent Calumet & Hecla will receive around a half million dollars annually in dividends from this most interesting and important subsidiary. Ahmeek's dividend course has been upward and onward with each quarter. Nine months ago it started paying dividends on a quarterly basis of $2 per share; three months later this was increased to $3; three months ago the rate was increased to $4; now it is $5 quarterly. The stock is inactive on the Exchange and will probably always re-

main so. It is selling around $360 per share, which makes it a net dividend payer of 7.2%. It is now said that if the 17c. copper market continues there will be another increase in the dividend rate of Quincy to $1.75 per share or $7 per year. At the last quarter dividends were increased from $1 to $1.25 per share quarterly, the increase being based on 14½c. copper. Quincy is earning around $14 per share on 17c. copper. The Anaconda may also increase its dividend rate at the meeting on June 25, as it has increased production and has brought costs down to nearly 9c. per pound, almost rivaling the lowest costs of the porphyries. It is expected the rate will be advanced to at least $3 per year. Inasmuch as Anaconda is earning $5.50 per share on the present high copper market, evidently the directors could, if they so wished, make the dividend even $4 per year. Anaconda can pay $3 per year on the present market and add at least $10,000 annually to its surplus. Another dividend increase which will exert a good effect in market circles is expected at the directors' meeting, July 20, of the Tennessee Copper Co. They will probably place the stock on a quarterly basis of $4 per year. The last dividend, a semi-annual one, was $1.50 per share, declared on February 20. The disposition of copper companies to share high-priced metal prosperity with stockholders without delay will do much to attract the public into the market, and is one of the best signs of the times in copper.

Not reconciled to the United States Supreme Court's decision as an ultimatum, A. S. Bigelow, of Boston, promptly petitioned the court for a re-hearing of the case of the Old Dominion Copper Co. of New Jersey against him. Bigelow hoped by this course to at least gain a considerable amount of time, as it was not thought that the Supreme Court could get around to the case until next fall. But the court has acted without postponement, and hence Bigelow has no longer any hope in that direction. It is said now that he will fight the validity of the 'trust receipt' creation and will question the rights of receipt-holders to share in the distribution of assets put up by him with the New England Trust Co. The belief in Boston is that Bigelow is now making a vain fight, after having held out for ten years and availed himself to the limit of the law's delays. His securities put up with the trust company will undoubtedly be liquidated as soon as the formal order is received from Washington, and with that will end what has been in many respects one of the most remarkable cases ever tried in the history of the courts. Bigelow has figured in something like $15,000,000 worth of copper law-suits in the courts, his cases ranging from the lowest to the highest courts.

The Butte & Superior market boom continues in Boston. Butte & Superior has about 3,000,000 tons of developed ore running 22% zinc, with high content in silver, and within the boundaries of present development work it can be depended upon to increase this to at least 5,000,000 tons. The new mill is saving nearly twice as much of metal content as the old. The company is fully financed, having sold, in April, 30,000 shares of stock at $27.50 per share for the treasury. On the present price of spelter, and with its capacity advanced to 1000 tons per day, Butte and Boston authorities agree in estimating the net earnings of Butte & Superior at approximately $3,000,000 per year. Even this estimate does not include the revenues received from by-products, which amount to about 75c. per ton. Butte & Superior lies to the north of North Butte, and was for a time considered to be outside of the mineral—and especially the copper—zone of Butte. The company, encouraged by the remarkable discovery and development of the Edith May vein in North Butte, began the search for copper in its own property. It failed to find copper of commercial extent, though the management put down a shaft 1600 ft. in quest of it. It found some copper, but the ore changed into zinc—good clean zinc which is exceptionally amenable to treatment—and today Butte & Superior stands out before the world as a copper failure, but one of the biggest zinc successes in the world. The company's developments have been among the most sensational in the history of Butte. Boston traders are freely talking $75 per share for the stock. Nothing like the remarkable run it is making on the Exchange has been known since Lake was advanced to $94 per share. In the south of the district, Davis Daly and Butte Central are demonstrating that the boundaries of the rich mineralized section extend beyond the estimates of a few years ago. Davis Daly has found a body of rich copper ore on the 1900 ft. level, and Butte Central has entered the copper zone at around a thousand feet in depth. Both Butte Central and Davis Daly are evidence of the presence of the Rarus fault-zone, the largest fault-zone in Butte, which has given the district a considerable production to date. Butte Central has the famous shear-zone crossing its property and Davis-Daly, in the vicinity, presumably has it at greater depth. With Butte developing its mineralized boundaries both to the north and south and with its deepest workings to be developed to nearly double their present depth before its shafts are as deep as those of Calumet & Hecla and Tamarack, it is no wonder that engineers say it has many years to go before reaching the height of its productive career.

LONDON

VENTILATION IN LONDON.—USE OF OZONE.—POTASH AND KELP.

The ventilation of metal mines is receiving so much attention nowadays that any novelty bearing on the subject attracts attention. For instance, the new ventilation apparatus installed on the Central London railway is interesting. The circumstances and conditions are somewhat similar to those in mine workings. The Central London railway, commonly called the 'Tube,' is 7 miles long, with 13 stations, and is from 60 to 100 ft. below the surface. There are two lines, each contained in a tube 11 ft. 8 in. diameter, and at intervals connected by cross-overs. Hitherto the ventilation has been effected by the passage of the trains and by an exhaust fan near the British Museum; and in the night hours during which no trains run, by an exhaust fan at the western end at Shepherd's Bush. In spite of all these precautions, the atmosphere is depressing and unpleasant, but, as usual, the cause is difficult to analyze. It is held generally to be the result of organic constituents of the air due to the continuous passage of large numbers of people. The company therefore decided to adopt the 'ozonair' apparatus for introducing sterilized air containing a small proportion of ozone to give it an oxidizing effect. At twelve of the stations an independent apparatus has been provided. The air supply is first filtered in the usual way, and then passed between fine metallic gauze and mica sheets across which discharges are caused to pass by means of a 5000-volt alternating current. The current of air passed through averages 6000 cu. ft. per minute at 10 of the stations, and 10,000 and 18,000 respectively at the other two. The air is sent along mains having a cross-section of about 3 sq ft. made of galvanized mild steel, the shape of the section depending on the space available. Some of the air is discharged at five or six points along each platform and 7 ft. above them, and the remainder into the tunnels about 40 ft. from the station in the direction the trains run, to be drawn along by the train to the succeeding station.

For several decades the Stassfurt deposits in Germany have provided the bulk of the commercial salts of potash, chiefly kainite, a double salt of potassium chloride and magnesium sulphate. The imports of this article into the United States have been large, and the imposition of an export duty by Germany greatly upset the American trade. In Norway and Japan the old kelp industry is being revived. Until the invention of the Leblanc process for the manufacture of alkali from common salt about a hundred years ago, practically the whole of the alkali and alkaline salts used in Europe were derived from kelp, that is, burnt seaweed. Along the western coasts of Ireland and northern Scotland, and also in Normandy, the Celtic population was actively engaged in its manufacture. The Gulf Stream continually carries great quantities of the marine vegetation to these neighborhoods, and its collection is a simple matter.

The amount of valuable salts is larger in the deep-sea vegetation than in the weed that grows in the shallower waters around the coast, so that attention was usually confined to the ocean drift. Unfortunately the methods of treatment were not altered to keep pace with scientific requirements, and the industry gradually shrunk to nothing. There is no reason why it should not be revived, for the scientific treatment for the extraction and separation of the salts is not really troublesome or complicated. The kelp prepared in Scotland averaged 23% potassium chloride, 7% potassium sulphate, 17% sodium chloride, and 4% of sodium and potassium carbonates, together with 45% of insoluble matter. It is probable that some other process might be adopted instead of the old-fashioned burning; maceration and retorting have both been suggested and tried on a small scale. Seaweed also contains iodine salts, and the production therefrom of iodine is at present the only commercial application of the vegetable kingdom.

BUTTE, MONTANA

WORK OF THE ANACONDA.—LOSS AT THE BUTTE-BALLAKLAVA.—NORTH BUTTE PROFITS.

The Anaconda Copper Mining Co.'s annual statement for assessment purposes has been filed and the figures, given under oath, show the vast sum of money expended and the amount realized from the properties of the company. The net proceeds this year, on which the company will pay taxes, is $10,525,729.82, as compared with $5,096,445 in the previous year. This is the largest profit reported in any year during the past five, and may be accounted for in two ways. First, by the many new economies put into use during the past twelve months, and, second, by the fact that for the past six months the production has been greatly increased and copper has been sold at a higher price than for a long time. The fact that the company has a little more than doubled its net proceeds in the past twelve months is clear indication of the prosperous condition of the copper industry. The statement shows that there were 4,319,994.77 tons of ore extracted, of a value per ton of $8.86, giving a gross yield of $38,277,753.14. The cost per ton for mining was $3.709, and the cost of transportation to the Washoe smelter at Anaconda and the smelter at Great Falls was 0.308c. per ton per mile. The total amount of money paid for transportation was $1,332,464.55. The cost of reduction was $1.673 per ton, and the total amount expended in reduction was $7,227,773.93. The company spent for labor $13,440,936.66, while $9,809,629.07 was paid for machinery and supplies. The marketing charge, including seaboard refining, freight, and selling charges, was $3,168,993.04, making the total costs $27,752,023.32. There is one item of $9,809,629.07 for machinery and supplies, that will give some idea of the amount of money the company has put into new and modern equipment during the past twelve months.

The Butte-Ballaklava company was operated during the past year at a loss of $45,956.94, according to the report filed with the county assessor by C. W. Newton, superintendent. It is reported that but 310 tons of ore was extracted during the twelve months, which yielded $5.68 per ton, the total gross yield being $1760.71. The cost of extracting the ore was $775, and there was paid for transportation $32.80. The cost of reduction is put down at $930, while there was expended for labor $40,290.90 and for supplies $5688.95. The company is not shipping any ore at the present time. A small amount of development is going on, both on the 1400 and 1600-ft. levels, but not any ore of shipping grade has been found. For fully six months of last year the company did not attempt to do any mining, but after the fire in the High Ore had been extinguished, a considerable amount of money is said to have been expended in the shaft repairing damage alleged to have been done while fire fighting was in progress. The development now being done is in ground not in dispute with the Anaconda company and the management has strong faith in opening a body of ore on the 1600-ft. level.

The Tuolumne company is still negotiating with the Anaconda company for a lower rate on smelter charges. The present rate is $3.25 for second-class ore and $5.25 for first-class. The Anaconda company has offered a reduction, but Edward Hickey, president of the Tuolumne, considers that a still greater concession can be made and negotiations are still pending. In the meantime the Tuolumne is shipping about 300 tons of first-class ore per day. Development is being extensively carried on at the 1600 and 1800-ft. levels and the ore thus opened will enable the company to increase production. There will be a meeting of the directors on July 1, and at that time it is expected a dividend will be declared payable in August. Some of the directors, in discussing the matter, favor a 25c. rate per quarter, while others think that 15c. will be the amount ordered, and that, if in another three months the conditions warrant, the rate can be raised to 25c. The Tuolumne has now $140,000 cash in the treasury, with no indebtedness.

The North Butte company net proceeds for the year are given at $986,212.82, an increase of about 65% as compared with twelve months ago. The report shows that 411,908 tons of ore of a value of $10.164 per ton was extracted. The cost of mining was $4.19 per ton, and the reduction cost was $3.426 per ton. The construction charges amounted to $13,421 and the total expenditures $3,200,524.32. The company paid during the year for the transportation of its ore to the smelter $49,360.05, the cost per ton per mile being 0.12c. Development was carried on at the 2000, 2200, 2400, 2600, and 2800-ft. levels, but up to the present time no large or important bodies of ore have been found. On the Snowball vein on the 2200-ft. level the ore is still high in copper and silver, and it is from this level a large portion of the ore going to the Washoe smelter is being mined. The ore reserve as given in the annual report is being maintained.

The Raven Copper Co. was operated at a loss during the year ended May 31 of $68,815. In explanation of this, however, it should be stated that the mine work was confined to development and the only ore shipped was that taken out in the course of development. Shaft sinking is now going on and the management is quite confident that good ore will be found at depth. The report filed for assessment purposes shows that 490 tons of ore was extracted, giving a gross yield of $27.72 per ton. The reduction cost was $6.06 per ton. The sum of $46,760.77 was expended for labor, while $4093.85 was expended for machinery and $27,309.12 for supplies. The Butte & Superior concentrator has not yet reached its capacity of 500 tons per day, but in the course of a week everything is expected to be running so smoothly and satisfactorily that the full amount will be handled. A committee has been formed with Edward J. Carter as chairman, for the purpose of safeguarding the interests of the holders of Stewart Mining Co. stock.

JOHANNESBURG, TRANSVAAL

RANDFONTEIN CENTRAL.—UNFAVORABLE RESULTS OF CONSOLIDATION ON THE WESTERN RAND.

A mine on the Rand that has of late been commanding attention is the Randfontein Central, that occupies, on the farthest extremity of the western Rand, a similar position to that of the East Rand Proprietary Mines on the eastern Rand, its area being about three thousand acres. One feature of attraction is its huge mill of 600 stamps with the necessary equipment for secondary treatment which, by the way, has never been fully employed. This mill is situated at the northern end of the property, the southern portion being served by four other mills, each equipped with cyanide plants and formerly known as the Randfontein South. At the beginning of last year the whole of the Randfontein properties were combined under the title of Randfontein Central with an issued capital of £4,000,000.

Prior to its union with the Central, Randfontein South with its 400 stamps worked independently, and made an average monthly working profit of £44,000, with a yield of 27s. 5d. at a cost of 18s. 3d. per ton, the average working profit per ton being 9s. 2d. It was confidently expected

that with all the benefits likely to accrue in the shape of lower working costs from large scale workings, as a result of the combination the profits per ton would be increased, but, as is invariably the case on the Rand, lower working costs were accompanied by a more than compensating fall in the grade of the ore, with the result that profits per ton declined. Three hundred stamps of the Randfontein big mill were hung up in February of last year, and 105 more in April of this year. For the six months preceding the last curtailment the Randfontein has maintained the highest production of any property on the Rand, and was therefore the premier gold producer of the world. Lately there have been rumors that the northern section of the property was not coming up to expectations. No. 8 and Ferguson mines were said to be sending ore to the mill assaying between 3.6 and 3.8 dwt. per ton, and frequently the screen assays at the big mill fell to about 3 dwt. per ton, which, with a working cost of 16s. 8d. per ton could scarcely be considered satisfactory. In the light of these rumors the following comparative results obtained before and after amalgamation will be interesting:

RANDFONTEIN SOUTH BEFORE AMALGAMATION

	Tons milled.	Revenue per ton.	Expenses per ton.	Profits.	Per ton.
1909	1,121,224	27s. 11d.	18s. 8d.	£519,041	9s. 3d.
1910	1,168,641	27s. 5d.	18s. 3d.	538,584	9s. 2d.

RANDFONTEIN CENTRAL AFTER AMALGAMATION

1911	2,159,032	24s. 7d.	16s. 8d.	854,241	7s. 11d.
1912—					
Jan.	215,556	24s. 3d.	17s. 5d.	74,000	6s. 10d.
Feb.	211,443	23s. 6d.	17s. 4d.	65,000	6s. 2d.
Mch.	229,642	22s. 5d.	17s. 10d.	53,000	4s. 7d.

As a direct result of the amalgamation it will be seen that last year the average grade of the ore milled fell from 27s. 5d. to 24s. 7d. per ton, the working costs were reduced at the same time from 18s. 3d. to 16s. 8d., and the profits fell from 9s. 2d. to 7s. 11d. per ton. These figures attracted attention at the time of the issue of the annual report for last year, but owing to the fact that working costs had declined, and the fall of grade and profits per ton milled were only in keeping with the general results attained last year on the Rand, they lost much of their significance. Better results were prophesied for the current year, which had the effect of consoling some of the leading stockholders, but there were others inclined to express misgivings on this point from the lessons taught by the East Rand consolidation.

How these promises have been kept the monthly results for the current year appearing above will show. It is true that in March a record tonnage was milled and treated, but the recovery has fallen from 24s. 7d. per ton for the average in 1911, to 22s. 5d. per ton in March, while costs of working have risen from 16s. 8d. to 17s. 10d. per ton. The result is seen in the decline in profits from 7s. 11d. to 4s. 7d. per ton for March, being exactly one-half the average profits realized per ton by the South Randfontein south section in 1910 before consolidation, of which so much was expected, became an accomplished fact. Regarded in another light, the March results show that by adding in the proportion of a million and a half tons per year from the central section to the tonnage milled from the southern section, this extra tonnage only earned in March a profit of a penny per ton. No wonder need therefore be expressed that the chairman should visit the property and dismiss those responsible for the administration of the mines, the stockholders should become concerned, and the stocks fall in price in what, for other stocks, was a rising market.

Since that date the whole of the administration has been reorganized, but the results are not yet fully known. In April, however, 199,518 tons only were milled and treated, but the recovery per ton milled was increased to that of December last, namely, 24s. 1d. per ton. Whether costs and profits will be restored to last year's figures remains to be seen.

REPUBLIC, WASHINGTON

SHIPMENTS FROM REPUBLIC. NEW MILL FOR SAN POIL CONSOLIDATED. POWER DEVELOPMENT ON THE PEND OREILLE.

Shipments of ore from Republic district were lighter than usual during the month of April, amounting to only 3077 tons, as follows: By the Republic Mines Corporation, 2433 tons; San Poil Consolidated company, 360 tons; Knob Hill company, 248 tons; Rathfone Reduction Works, 35 tons. The shipments during May, contrary to expectations, were even less than for April, amounting to only 2547 tons, as follows: from the Republic Corporation, 2077 tons (including 560 tons sent to the North Washington Power & Reduction mill); Knob Hill, 196 tons, and San Poil Con., 274 tons. The decrease in the shipments is probably due to ore being held back for treatment by the local mills.

In the Surprise mine the Republic Mines Corporation is getting out a good average value of ore. Some very good ore is coming from above the 500-ft. level. On the main 500-ft. level drifts are being driven both northerly and southerly on the hanging-wall side of the veins in shipping ore, a stope has been opened which is 8 ft. wide, 50 ft. high, and 80 ft. long, and there is ore still remaining on the foot-wall. Below the 600-ft. level the underhand stope is down 73 ft., in line with the main incline shaft, and produces about 100 tons of ore per week, assaying better than $50 per ton. From all other parts of the mine from 500 to 600 tons per week are being hoisted through the main incline. The management will probably increase the output 50% for shipment to the smelters. Recently a sample taken from across 7 ft. of the pay-shoot below the 600-ft. level assayed $404.82, and later a grab sample from the ore-pile broken at that point assayed $481.90 per ton, of which $480 was in gold and $1.90 in silver. The company has over 70 men on the pay-roll.

The Imperator-Quilp company has retimbered the Quilp mine and put it in good shape for breaking ore for the mill. Recently, while breaking ore of milling value on the 200-ft. level, some high-grade ore was found which assayed $548 in gold and $98.68 in silver per ton. In the San Poil Consolidated mine the North San Poil No. 2 stope, on the 300-ft. level, has been lately producing ore which assayed from $15 to $45 per ton from a shoot believed to be 200 ft. long. The San Poil Con. mill is completed, the machinery is placed, and the plant will begin operation as soon as a railway trestle for the delivery of the ore is finished.

The International Power & Manufacturing Co. has announced its intention of using 10,000 hp. on the Pend Oreille river, and several thousand acres of land in Stevens county will be used in manufacturing lime hydrates, nitric acid, and soil food for the enrichment of lands bordering along the Pend Oreille river. A dam will be constructed about two miles south of the international boundary at a cost of over a million dollars. The outlay of several million dollars in the enterprise is anticipated. Messrs. Ham, Yearsley, and Ryrie, of Spokane, represent the company. Slip clay, good for glazing of pottery, has been discovered in the Orient district.

The Michigan Mining Co. will build a mill on the Gwynn mine, on Hall creek, on the south half of the Colville reservation. A 200-hp. hydro-electric plant, including a compressor, drills, and concentrator, has been purchased. A body of $35 ore has been found in the shaft, at a depth of 160 ft. It is 6 ft. wide at the bottom. The valuable minerals are chiefly copper and silver.

On account of failure to find sufficient ore of shipping value, the Hope company has closed down the Black Tail mine until arrangements can be made to mill the ore at home. The North Washington Power & Reduction mill has been completed and the machinery is wearing down to its bearings. A large tonnage has been crushed and is under treatment, and assays of the head and tailing indicate a higher extraction than was expected at the start.

General Mining News

ALASKA

Fairbanks

Sluicing on Sullivan creek in the Hot Springs district was started about the middle of May. The season was delayed on account of the mild winter and the shortage of snow. Unless heavy rains come as an aid to the situation, the season of 1912 will be short on the creeks in this district.

Iditarod

The tramway which connects the town with Flat creek is being rebuilt for the transportation of the dredge material which the Guggenheims are shipping in from Dawson. Several miles of new road have also been built on Flat creek in order that the freight may be landed at the point where the dredge is to be set up.

Ketchikan

The Mt. Andrew Mining Co. will resume operations about July 1 with a complete crew working two shifts. Development will be confined to finishing the adit on the lower level which was begun for the double purpose of prospecting and drainage. If ore is found, another still lower adit will be driven and the mine worked continuously instead of confining operations to the summer, as is necessary with the present glory-hole system. The company is also planning to recover the 2300 tons of ore which was lost on a sunken barge two years ago. This ore was the richest mined at the Mt. Andrew, with 5.5% copper and some gold and silver. Divers will be brought north and an attempt made to save the ore.

Seward Peninsula

The New Era Mining Co. has been organized in Nome to take over the two small stamp-mills which have operated in that district in past seasons and move them to Snow gulch, where the eight stamps will be assembled in one building for the treatment of a large body of quartz ore, which is reported to carry $20 per ton.

Six new dredges are expected on the first steamers into Nome, and if it is possible to get them into operation before winter they should add materially to the output of the district. Two of the dredges expected are for the Port Clarence district, two others to be used on Casadepaga creek in the Ninkluk region, and the other two are for the Kotzebue country, where they will be placed on the Inmachuk river. The prospects for a favorable placer season have been greatly improved by recent heavy rains which have been general all over the peninsula. Sluicing was started in May on winter dumps and dirt hoisted from drifts, but open-cut mining was delayed by anchor ice in the streams.

Valdez

A new company to be known as the Alice Mining Co. has been formed, chiefly of Vancouver, British Columbia, capitalists, to operate the Alice property on Shoup bay. The mine will be in charge of M. T. Callaghan, who has ordered machinery, tools, and supplies necessary to begin operations.

ARIZONA

Cochise County

The Copper Queen and Calumet & Arizona mining companies have granted all their employees an increase in wages, to go into effect at once. The Copper Queen has posted the following schedule: Underground employees now working 8 hours will be reduced to 7½ hours and will receive the same pay as for 8 hours work, thus increasing the rate per hour. Surface employees now working 8-hour shifts to continue 8 hours. Those now receiving $2, raised to $2.15; $2.25, to $2.40; $2.50, to $2.65; $2.75; to $2.95; $3, to $3.20; $3.25, to $3.50; $3.50 and over, raised 25c. per shift. Employees now working 9-hour shifts will be reduced to 8-hour shifts and will receive the same pay as for 9 hours work, thus increasing the rate per hour.

Gila County

The Superior & Boston Copper Co. is shipping to the Old Dominion smelter, according to a Globe despatch to the El Paso *Herald*, three cars per week of ore averaging about 8% copper. The ore is coming from the stope below the sixth level on the Great Eastern vein. On the twelfth level the southeast cross-cut is being steadily advanced and is now in the Pinal schist formation. A cross-cut has also been started south toward the Limestone vein, which has been opened through the Limestone shaft to the third level, there being a considerable amount of shipping ore blocked out on the second and third levels. About 55 men are employed.

The Gibson mine, nine miles west of Miami, is shipping three cars of ore per month to the Old Dominion smelter at Globe. The ore is reported to average about 16% copper and is all coming from the fourth level on the Pasquale vein. Drifts are being driven south on the fourth and fifth levels and encouraging results are reported. Ten cars of ore have been shipped since the Gibson Copper Co. resumed the working of the mine in February. About 20 men are employed.

At the Copper Hill shaft of the Arizona Commercial, the drift west on the fourth level has reached the boundary line and connections have been made with a drift from the Gray shaft of the United Globe mine of the Old Dominion company. Work is now being concentrated on enlarging the shaft from two to three compartments, beginning at the fourth level and working upward.

The lease of P. S. Tate and the Lyle brothers on the first level of the Black Warrior mine has expired, and the mine is now being worked by the owner, the Warrior Copper company. Develepoment work is in progress on the fifth or lowest level, where it is reported that good shipping ore is exposed. It is proposed to sink a winze below this level. A small amount of ore is being hoisted and stored in the bins. E. M. White is manager.

Churn-drill hole No. 1 of the South Live Oak Development Co., is still around the 640-ft. mark, no progress having been made for the past two weeks on account of serious caving of the ground and the loss of a string of drilling tools in the hole. The tools have just been recovered and casing will now be put in, and it is expected that drilling will be resumed within the next two or three days. The last 40 ft. of the hole has been in soft altered granite, carrying a considerable amount of copper carbonates, some chalcocite being reported. At the Southwestern Miami, churn-drill hole No. 5 is 680 ft. deep, in schist formation. Hole No. 6 is 545 ft. deep and is in schist. A string of tools is lost in the hole, which is being enlarged with a 10-in. under-reamer preparatory to driving the casing before attempting to recover the tools. Hole No. 7 is in conglomerate and is 305 ft. deep. Hole No. 8 is 100 ft. deep, in schist. None of the holes is yet in ore. One churn-drill is at work drilling hole No. 52 at the Keystone mine. Henry Krumb is making an examination of the mine for the Inspiration Consolidated Copper Company.

The sinking of one of the Inspiration Con. company's new 3-compartment working shafts has been started, and a head-frame and hoisting equipment will soon be erected. The spur from the Arizona Eastern to the millsite and mine has been located. Grading for the concentrator is expected to start in about a month. Three of the development shafts are being sunk to greater depth and the ore is being blocked out for mining. Additional boiler and compressor capacity is being provided at the portal of the main tunnel, after which the underground force will be increased. W. H. Aldridge, representing the controlling interests, is now at the mine.

Mohave County

The annual report of the Tom Reed Gold Mines Co., near Kingman, shows a production of $798,630.95. Of this amount, $69,461.76 was added from operations in March 1912, the last month of the fiscal year. Dividends during

the year amounted to 40% on the issued stock, or $363,822. To the reserve $25,000 was added.

PIMA COUNTY

The Pioneer smelter at Tucson has been forced to shut down for a few days by a break in the flue dust chamber. The smelter has been running full blast for two weeks, and the storage bins were full of ore from recent consignments, so repairs will be rushed and operations resumed as soon as possible. The break was due to the fact that the supports of the dust chamber were not strong enough to hold up the chamber when full of dust.

PINAL COUNTY

The Douglas Copper Co., which owns 15 claims between Ray and Superior, reports the discovery of a 30-ft. vein in the No. 2 adit. A general assay of the ore showed 14% copper with 12 oz. of silver and 3 oz. of gold per ton. The company has been developing its property for the past two years, and now hopes to be able to sell a controlling interest in its claims to one of the large copper companies. The El Paso & Southwestern railroad has secured a right-of-way through the Douglas property, and the county road to Superior runs through it.

YAVAPAI COUNTY

The Bunker Hill shaft in the Big Bug district has been unwatered and the mining of ore resumed. This shaft is 200 ft. in depth and cuts three ore-shoots with a dip of about 60°. The company intends to mine the richest streak, which is 40 in. wide and averages about $60, and mill this ore at the Little Jessie plant. The mine is also opened by an adit 2185 ft. long, which is within 50 ft. of a point 350 ft. vertically beneath the shaft. A connection will be made with the shaft for drainage and ventilation.

CALIFORNIA

CONTRA COSTA COUNTY

The officers of the Selby Smelting & Lead Co. have been cited to appear in the Superior Court at Fairfield on June 25 to show cause why they should not be punished for contempt for the alleged violation of the injunction whereby the company is prohibited from so operating its plant as to permit injurious fumes to be emitted therefrom.

The injunction was issued several years ago by L. G. Harrier, presiding judge, when he occupied the bench, but the company has succeeded, by complicated litigation, in preventing it from being enforced.

The matter has been before the State Supreme Court for a long time, but recently that tribunal handed down a decision affirming the judgment of the Superior Court in the granting of the injunction and the opportunity for the contempt proceedings is now open.

PLUMAS COUNTY

Development on the Gruss mine has opened an 11-ft. vein of $15 ore, in the new shaft now sunk at the lower workings to a depth of 200 ft. The Gruss mine has been noted for small rich pockets, and the discovery of a wide vein is encouraging. It is reported that the company has leased the Sobrero water rights. This will give an opportunity to develop about 160 hp. with turbines working under an 80-ft. head. The 15-stamp mill on the property is being moved to the new shaft, from the old workings 1000 ft. away, and it is expected that stamps will be dropping on rock from the new orebody by the middle of July.

SACRAMENTO

The executive committee of the Anti-Débris Association met at Sacramento on June 15 and received reports from their watchmen who had made inspections of the hydraulic mining property in the state. The Neocene Placer Mining Co. at Scales, Sierra county, which was served with an injunction last month, filed an affidavit that mining would cease after the next clean-up. The Brandy City company, operating near Comptonville, Yuba county, has just been served with an injunction and will probably stop work. This company has been using two giants and attempting to restrain the débris with dams. Complaints have been made of other companies working on the headwaters of the Yuba river.

SHASTA COUNTY

The Mammoth Mining Co. has purchased the stock pile of coke at Coram, belonging to the Balaklala company. Approximately 1000 tons of coke was on hand when the Balaklala closed, and this will now be shipped to the smelter at Kennett.

TUOLUMNE COUNTY

The last clean-up at the Confidence mine was made last week by C. W. Terry. All the ore about the millsite, accumulated from the active operation of the mine, was put through the mill, and several tons of rich concentrate was recovered and shipped for treatment. All the machinery will soon be sold and the mine abandoned. All the ore in sight has been taken from the mine, but the claim contains some unexplored mineralized ground. The Confidence was located in 1853, and is one of the earliest discovered quartz mines in the state. Placer mining was

GENERAL VIEW OF SELBY SMELTER.

demanding the attention of the industry at that time, and only a little work was done on the vein. Some fifteen years later Ben Holliday, the stage owner and pony express man, acquired the property and operated it profitably. Under later owners the mine was worked for years and is credited with an output of over $4,000,000. At first the concentrate was sent to Wales and a profit of 60% realized on the shipment. Crude methods of treatment were used at the mine, and much money lost in the poor recovery made of the pyrite.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—The property of the Dives-Pelican and Seven-Thirty M. Co. was sold this week at public sale to satisfy judgments obtained out of the District Court. G. W. Tarkington, who has served as manager of the mines for three years, was the successful bidder, the consideration being $32,750. The Bard Creek M. Co. is maintaining heavy shipments of both smelting and concentrating ore. The mill ore is being consigned to the Mineral Chief plant. Hummer & Herber, leasing at the Capital mine, are producing from 125 to 150 tons of mill ore each week that is worth $14 per ton. This ore is sent to the Combination mill at Idaho Springs for treatment. Farragher & Co., leasing on the Gambetta mine on Repub-

lican mountain, started a shipment of 70 tons of lead-zinc ore this week, the product being consigned to the Mineral Chief mill. The Scotia mill is being operated on three 8-hour shifts and lead-zinc-iron concentrates are being shipped.

Georgetown, June 15.

OURAY COUNTY

The Atlas mine, near Ouray, is reported to have discovered a body of high-grade ore.

TELLER COUNTY (CRIPPLE CREEK)

A body of rich ore has been found on the 1500-ft. level of the Vindicator, apparently a continuation of the No. 3 vein south, which produced high-grade ore in the 1400-ft. level. Three ore-shoots have been opened south of the shaft, on the 1500-ft. level and there remain to be found four more, which were mined on the upper level. A change in the drainage system will soon be made at this mine. At present the water is kept at the 1500-ft. level, being lifted from there to the 1400-ft. level, and from there sent into the Golden Cycle shaft, where it is pumped to the surface. A connection has now been made with the Cycle shaft on the 1500-ft. level, and the water will be sent through that level. The production of the Vindicator mine is limited by the capacity of the ore-house, but an attempt will be made to increase the output. The Vindicator No. 2 shaft is maintaining an output of about ten cars per month, shipped by lessees from ore found by following stringers in the old stopes.

The Jolly Tar claim, on Battle mountain, within the corporate limits of the town of Victor, has been sold to Charles Walden, of Victor, who is supposed to represent Colorado Springs capitalists. The price is reported as $100,000.

NEVADA

ESMERALDA COUNTY

The Florence Goldfield has shipped four carloads of ore from the rich vein recently found by the cross-cut on the 250-ft. level. Development is in progress on the 350-ft. level in search of the downward extension of the same orebody. At the Goldfield Merger mine the shaft is now 1150 ft. deep, but sinking will be carried to a depth of 2000 ft. before any attempt is made at lateral development in the search for ore.

HUMBOLDT COUNTY

The Imlay Mining Co. is overhauling the plant on its property and expects to start milling before July 1. The capacity of the mill is 50 tons per day and over 1000 tons of $12 ore has been hoisted in readiness for the run. R. H. Siddoway, secretary of the company, reports the discovery of a vein 3 ft. wide, of high-grade ore in the No. 1 level. Assays have run as high as 122 oz. of silver, 65 oz. of gold per ton, with 8.1% lead and 1.3% copper. This vein, which is on the contact between limestone and porphyry, carried only milling ore in the upper levels. It is the intention of the company to drive on the No. 2 level to the vein, unwater the mine, and then raise to this rich ore-shoot.

LINCOLN COUNTY

The railroad from Pioche to the property of the Prince Consolidated M. & S. Co. is completed and ready for operation. The company's locomotive has not yet arrived, but the line may be utilized for transporting ore by the Salt Lake route engines. The company is at present shipping 12 to 15 cars of Bullionville tailing to Tooele daily, and expects soon to be in position to ship from the reserves in the mine of the so-called iron-manganese ore. There is actually developed nearly 900,000 tons of this ore, on which a profit of $5 is expected.

LYON COUNTY

(Special Correspondence.)—The Yerington Copper Co. is developing an excellent body of copper ore on the 250-ft. level and is sending out occasional shipments. A blower has been installed and development is about to start at the 400-ft. level, where good ore has been found. Arrangements have been made for the building of ore-bins. D. W. McKenzie and associates have commenced shipments from their Northern Light lease. In the glory-hole a 12-ft. vein is exposed, with about 4 ft. carrying good copper ore. A hoist will be placed and the 150-ft. shaft sunk to the 350-ft. point. It is reported that the Mason Valley company is about to blow in its second furnace, as the first unit is growing inadequate to handle the ore constantly arriving. The solitary furnace is treating 700 tons per day, and producing a matte averaging over 40% copper. The blowers have a capacity of 275 cu. ft. and the blast pressure ranges from 30 to 38 oz. The sulphide ores of the Mason Valley and the carbonates from the Nevada Douglas form an excellent fluxing charge, with only about 5% of lime rock employed. Custom ore is coming in from numerous small gold properties in the district. Converters may be provided before the end of the year. At present the matte is shipped to Garfield, Utah, for conversion into blister copper. The Nevada Douglas reports steadily improving conditions. A raise is under way from the 750 to the 650-ft. level, and from the former a winze is down 30 ft. Three feet of high-grade chalcocite ore is reported exposed. A new adit is being driven below the Douglas Hill tunnel to tap the orebodies at further depth. The company is shipping over 11,000 tons per month to the Mason Valley plant. Considerable attention is also being paid the gypsum deposit, the Western Gypsum Co. recently contracting to take 4000 tons of the product, according to late advices.

Yerington, June 15.

NYE COUNTY

The report of the Tonopah Mining Co. for May shows that 14,948 dry tons were milled, with an average value of $18.08 per ton. The bullion shipped amounted to 254,700 oz. with a total value of $206,700. There was also 100 tons of concentrate shipped, valued at $34,350. The net profit for May was $141,152. The Tonopah Belmont Development Co. reports a net profit for May of $125,646.27. There were 7956 dry tons of ore milled, with a net value of 207,405.47. Gold bullion to the amount of 2650 oz. was produced and 261,197 oz. of silver bullion. This is a decrease both in tonnage and net profits from the month of April, due to a break-down of the hoist at the Desert Queen shaft on two occasions and similar trouble with the underground hoist on the 1000-ft. level of the mine. By July 1 it is expected that the new mill will be in operation, and both the tonnage output and the profits should show improvement. Recent development on the thirteenth level has produced good ore. The MacNamara 10-stamp mill treated 2084 tons of ore in May, an increase of over 420 tons from the March and April returns.

The Catherine group of claims at Ione, which were under development by the Midas Gold Mining Co. of Tonopah have been transferred to the Manchester Gold Mining Syndicate of Manchester, England, represented by M. J. Doolin, of San Francisco, who now owns 14 claims in the Ione district.

The Manhattan-Earl property has been bonded to S. H. Brady of Tonopah and John S. Whilldin of Philadelphia. Included in the deal is the Priest mill, which has been owned and operated by the Manhattan Milling & Ore Co. It is reported that the new owners will enlarge the mill, equip a cyanide plant, and enter into the competition for custom ore. They will take possession of the mine when the Swanson lease expires August 1, and will enlarge the shaft, preparatory to sinking deeper.

STOREY COUNTY

The Consolidated Virginia Mining Co. has received a net return from the Selby smelter of $14,066.04 as a result of the recent milling of 520 tons of ore at the Kinkead mill. The concentrate consisted of about 20 tons, with an average value of $566.82, while the bullion gave a return of $2337.86. The ore came from the 2400-ft. level of the mine from a recent discovery in the southwest drift.

The Comstock-Phoenix Mining Co., operating on the Brunswick lode, has made a shipment of high-grade ore to the Selby smelter. This company has sent its ore to

the Fischer mill in Sixmile canyon and has shipped concentrate from there for several months, but this is the first car of ore to go direct to the smelter since last fall.

White Pine County

(Special Correspondence.) A discovery of platinum has been made on the Ely National, near Illipah in the White Pine mountains thirty miles west of Ely. A shaft was sunk for 127 ft. and a drift run for 60 ft. through heavy black sand, which gave returns from assays ranging from $2 to $7 per ton. It is believed that the ore can be mined by steam-shovels and treated by a process of dry magnetic separation into a product worth $25 per ton.

The Boston Ely Mining Co. has succeeded in lowering a churn-drill to the 1240-ft. level, and will set it up to operate next week. This is the first churn-drill to be used in underground work in this district. For several weeks a diamond-drill has been operated from the same level. A company has been financed which will build a hydro-electric power plant on Cleve creek about 25 miles east of Ely. This plant is expected to cost $200,000 and will generate 2000 hp. for use in the district.

Ely, June 20.

The Nevada Consolidated has ordered two Shay geared engines to be used in hauling the ore from Copper Pit to McGill. The incline into the steam-shovel pits is now too steep for the locomotives of the Nevada Northern. Some of the engines of the Nevada Northern are being remodeled for the use of oil as fuel. The long haul from California makes this fuel expensive, but it is expected to be more satisfactory than coal.

At the Zack shaft of the Ely Consolidated, sinking will be resumed in a short time and continued from the present depth of 600 ft. to 800 ft. Development in the lower levels will be carried on, as fast as the shaft is deepened, in search of the continuation of the orebodies found about the 600-ft. level. The new pump in the 600-ft. station is ready for service, and a second 4-in. water column has been placed in the pipe compartment of the shaft. This doubles the facilities for taking care of the water of the mine, and it is believed that there will be no trouble with increased flow.

The California shaft of the Amalgamated Nevada at Blackhorse will be sunk an additional 100 ft. to a depth of 200 ft., and further development commenced at that level. The mill of the company at San Pedro is not running at the present time.

NEW JERSEY

A strike is in progress at the Perth Amboy plant of the American S. & R. Co. and the International S. & R. Co.'s plant at Raritan is expected to be closed shortly by labor troubles. The strikers have been very violent in their demonstrations and have attempted the destruction of the plants by fire. At Perth Amboy the guards fired on a mob of the strikers who were attacking the works, killing one and wounding others.

NEW MEXICO

Grant County

Mining operations have been resumed at Santa Rita by the Chino Copper Co. The places vacated by the strikers were easily filled by new men, and work is proceeding as usual. The concentrator at Hurley was kept running constantly from storage reserves.

Sierra County

The old placers of the Mesa del Oro, northeast of Hillsboro, are being prospected by J. B. Tully, of San Francisco, who has located 1400 acres. This ground has been worked at random for years and Mr. Tully hopes to prove that dredges can be made profitable.

Socorro County

(Special Correspondence.)—The recent fire that destroyed the ore-bins of the Treasure Mining & Reduction Co. caused only a few days delay in hauling, as new bins were promptly erected. The mill was able to run continuously, from reserve tonnage, and is treating 70 tons per day.

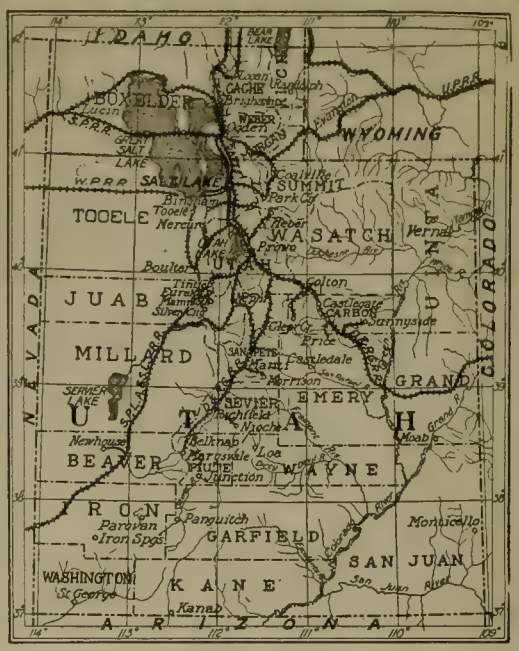
Magdalena, June 14.

Incorporation papers have been filed by the New State Smelting Co., of Socorro, with capitalization of $25,000. The incorporators and directors are: Frank Dull, statutory agent, Socorro; B. F. Darbyshire, M. C. Edwards, W. H. Case, El Paso.

UTAH

Juab County

The Eagle & Blue Bell Mining Co. has been examined by Duncan MacVichie, who reports that ore on the 1300-ft. level has been developed by winzes from the 1000-ft. level, for 300 ft. in length and 70 ft. in width, and the limits of the body has not been found along the strike. The company is driving a cross-cut on the 1500-ft. level to find the continuation of this orebody. High-grade ore on the 700-ft. livel has been opened for 38 ft., from 10 to 12 ft. in width. Two cars shipped from this drift netted about $6000 per car. Mr. MacVichie believes that the orebodies on the



MAP OF UTAH.

700 and the 1300-ft. levels are the same and will be connected by further development.

Salt Lake County

The mill of the Columbus Consolidated Mining Co. at Alta has been put into commission, after a thorough overhauling of the plant and the machinery. Enough ore is in sight in the mine to furnish a supply for all summer. A stope on the 400-ft. level, and the 85 stope above this level, are being developed, and the company hopes to add to its orebodies. It is expected that the mill will turn out 20 tons of concentrate per day.

Summit County

The new tailing dam at Park City, built by the Silver King, Daly Judge, and Daly-West companies has been put to use and is declared a success, as the water leaves the dam clear. The project, which cost $50,000, has as its object the saving of the tailing from the mines, and the water from Silver creek was diverted on the Richardson flats in order to settle the tailing. The ore shipments from Park City for the month of May were as follows: Silver King Coalition, 2814 tons; Daly-West, 2536 tons; Daly Judge, 2138 tons; Grasselli, 328 tons; Ontario lessees, 64 tons; Frank Daly, 28 tons.

Tooele County

The International S. & R. Co. has established a branch office in Spokane, for the avowed purpose of emphasizing

the usefulness of the organization in Coeur d'Alene. Another branch office has been established at Goldfield, Nevada, and F. M. Chambers has been appointed Nevada state agent for the company. The company is in the market for copper, lead, silver, and gold ores, and the competition in smelting fields should work out to the benefit of the ore producer.

WASHINGTON

Ferry County

Work has been resumed on the North Star & Washington mine, situated on the international boundary line, by the British Columbia Copper Co. In the Laurier mine, near Laurier station, the vein has been found in the adit, about 500 ft. in from the portal and at a vertical depth of about 450 ft. In Covada district the Longstreet Mining & Milling Co. has been organized, and work has been resumed on the Longstreet mine with two shifts. New buildings have been erected for living quarters and mining purposes. The Longstreet vein is 60 ft. wide and has produced shipments of very high-grade ore. The Silver Leaf mine has been bonded for $25,000, and work will be started immediately. In Keller camp the Walla Walla company has driven an adit about 400 ft. and interseeted a vein 33 ft. wide. The ore assays $15 to $16 per ton.

The Ben Hur Leasing Co. is breaking ore on two levels, awaiting completion of the mills for its disposal. The Knob Hill company has paid $45,000 in dividends to date and has a cash surplus with which to pay the balance of the purchase money for the mine as fast as it becomes due. Until recently no ore was broken in the mine that would not stand the cost of mining, transportation, treatment, and a profit at the smelters, but the company has a contract for the daily delivery of 50 tons to the San Poil Con. mill, to begin as soon as the mill is ready to receive it. Of late the company has been shipping 100 tons per week to the smelters. Above the 200-ft. level, stope No. 3 has been opened, and from it a drift is advancing toward a high-grade shoot of ore that was first developed in a shaft near the surface. The No. 3 stope is 30 ft. long and from 20 to 36 in. wide, the ore averaging $150 per ton. In the shoot is a streak one-half to one and one-half inches wide, estimated to assay $30,000 to $40,000 per ton. The smelter returns reported from 10 carloads of ore shipped a week or two ago ran from $40 to $99.05 per ton per carload. A new stope of milling ore has been opened above the 400-ft. level.

Stevens County

At the Imperial mine the main shaft is being sunk from the 120-ft. level to a depth of 300 ft. At the latter depth cross-cuts will be driven to intercept five separate veins, which traverse the property within a range of 300 ft. at the surface. About $25,000 has been expended on the property, and as much more is promised this year for development and equipment. Hoisting machinery, compressors, and boilers are now being placed at the mine.

CANADA

Ontario

The May production of the Nipissing mine amounted to 374,129 oz., valued at $226,740. Construction work on the new low-grade mill is proceeding rapidly. The framework on the main buildings has been completed, and a large part of the interior concrete work finished. The 40-stamp mill of the Nova Scotia will be operated again as a customs plant, after a shut-down of several weeks caused by the assignment of the company's assets to its creditors.

Yukon

The Pueblo mine at White Horse resumed shipments of copper ore to Skagway, the last week in April, after being closed for two years. The crew at the mine is loading from three to four cars per day, and later in the summer mining operations are expected to increase this output.

The report of the Yukon Gold Co. for the year ended December 31, 1911, gives the operating profit of the year as $1,462,042, from which dividends to the amount of $1,312,500 were paid. The officials of the company state that the new placers recently acquired at Iditarod will add greatly to the company's assets. Engineers of the Yukon and Iditarod districts report an early season and estimate an output of gold double the production for the season of 1911. This is partly based on the production for May, which was $490,300, as compared with $270,400 in May last year. The average recovery was 81c. per cubic yard dredged, as against 53c. in the same month a year ago.

MEXICO

Chihuahua

All the plants of the American Smelting & Refining Co. in Mexico are running, according to H. R. Wagner, general manager for the company. The smelter in Chihuahua is short-handed, however, and is only able to keep up a force of 350 men. The railway service between the city of Chihuahua and Ciudad Juarez has been crippled, and this also has handicapped the operations of the company. The smelters at Monterey and Aguascalientes are not in the war zone and have had no trouble, while the plant at Velardeña, which is in a troublesome district, has been able to keep a full force of workmen and to maintain a normal output.

Sonora

The Greene Consolidated Copper Co., a subsidiary of Greene-Cananea, has issued its annual report for April. The earnings for the company are given for the last three years as a comparison.

	1911.	1910.	1909.
Total revenue	$6,045,834	$5,592,050	$5,510,846
Operating expense, tax, interest	3,738,703	4,407,301	4,408,287
Net earnings	1,307,131	1,184,750	1,102,559
Depreciation	280,180	864,097	558,542
Net profit	1,026,951	500,653	544,107

The net profit for 1911 was equal to $1.02 per share. The total production of fine copper from the company's own ores was 37,101,119 lb., and 7,886,151 lb. was produced from ores of the Cananea Consolidated. The total production of the Greene-Cananea was therefore 44,987,270 lb. as compared with 45,680,145 for the preceding year. The total production of silver and gold was 1,295,297 and 5892 oz., respectively. The average price received for the copper was 12.886c. per pound. The cost of this copper was 9.088c. per pound, or 9.84c. including construction. The total cost per ton of ore during the year decreased from $5.765 to $5.257, and the extraction in the concentrate was raised to 77.67 from 75% for 1910. The average yield per ton of ore treated was 50 lb. of copper and about 75c. in gold and silver. The assets of the Greene Consolidated on January 1 were $3,570,484, of which $2,588,022 was in the form of cash and metals on hand.

The output of the Greene-Cananea smelter for May was approximately 6,750,000 lb. of blister copper, a larger production than the company has ever attained before. This includes, however, not only the copper mined by the company, but also the contents of the concentrate of the Miami Copper Co., which are handled by the Cananea company under contract.

Work on the property of the Nacozari Consolidated Copper Co. has been steadily in progress since last November, when a compressor and machine drills were put in operation. In the past few weeks several bodies of ore have been found. On the Copper King group, which is on the extension of the Pilares orebody, over 100 ft. of ore was cut through in an adit recently. The adit was run at a shallow depth and the ore was leached to a great extent but samples taken from the ground assayed as high as 11% copper. In the main adit on the Galena group several drifts are being run to cut the veins of lead-silver ore that show on the surface. These drifts have exposed large masses of ore of milling grade, with one to two per cent copper and a few ounces of silver per ton. The company is planning a concentrator for the treatment of these low-grade ores, and expects to have funds for the construction of the mill available during the present month.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

KARL EILERS is at the Fairmont.

LIONEL BILODEAU has gone to Alaska.

HOWARD D. SMITH has returned from the East.

C. S. HERZIG has returned to London from Nigeria.

H. O. HOFMAN was in San Francisco during the week.

T. N. TURNER sails on the *Nile* today for Nikolaievsk.

PHILIP N. MOORE is expected here the last of this month.

HERBERT HAAS has gone to Arizona on professional business.

F. L. COLE has gone to Korea and Siberia on professional work.

H. D. MCCASKEY is in Nevada, visiting quicksilver properties.

CYRIL W. KNIGHT has left Toronto on field work for the summer.

T. KAWAMURA sailed from New York for London, June 15.

J. D. IRVING, who has been ill for several weeks is now convalescing.

ALFRED H. PAGE will be at Vancouver, B. C., for two or three months.

M. K. ROGERS has returned from New York and has gone to Seattle.

H. C. WILMOT is now in charge of the Colorado mine, Philippine Islands.

W. A. PRICHARD has been investigating mining conditions on the Mother Lode.

W. H. STORMS attended the mining congress of Yreka, California, this week.

RALPH ARNOLD was in San Francisco last week and will soon leave for Venezuela.

GEORGE E. FARISH has returned to South Porcupine after a brief visit in New York.

G. W. METCALFE was in San Francisco and has gone to Santa Barbara for a few days.

BERNARD MACDONALD has gone to New York and will be at 35 Wall street for the present.

A. VANDER NAILLEN, JR., is now associated with Heald's engineering school, San Francisco.

EDMUND JUESSEN returned from Sutter Creek and went to Salt Lake City during the week.

NORMAN T. TRACY has been appointed manager at the San José de Gracia, Sinaloa, Mexico.

ROBERT H. RICHARDS was married June 8 to LILLIAN JAMESON, at Jamaica Plain, Massachusetts.

ERNEST R. WOAKES, temporary manager for the Cape Copper Co., has returned from South Africa.

HOWLAND BANCROFT has gone to Utah on professional business, expecting to return to Denver early in July.

N. F. DRAKE has accepted the professorship of geology at the University of Arkansas, which carries with it the state geologistship.

ROSS B. HOFFMANN left St. Petersburg, May 25, for Nikolaievsk, Amur, eastern Siberia, which will be his address for the summer.

F. B. VAN HORN has resigned from the U. S. Geological Survey to accept a position with the Compañia Mexicana de Petroleo El Aguila, S. A.

WALDEMAR LINDGREN is to leave the Geological Survey to become head of the geographical department of the Massachusetts Institute of Technology.

GEORGE I. ADAMS has accepted the professorship of geology and mining in the Pei Yang University, Tientsin, China, and will leave for the Orient during July.

H. L. DAY, former manager of the Hercules, has been made president and general manager for the Federal Mining & Smelting Co. E. R. DAY is now manager of the Hercules.

A. J. MCDONALD has resigned as general superintendent of the talc mines and mills of the International Pulp Co. at Gouverneur, New York, which position he has held since the formation of the company nineteen years ago.

Market Reports

LOCAL METAL PRICES

San Francisco June 20.

Antimony	11—11½c	Quicksilver (flask)	41
Electrolytic Copper	17¼—18c	Tin	50—51½c
Pig Lead	4.75—5.70c	Spelter	7¼—7½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.00

METAL PRICES

(By wire from New York.)

NEW YORK, June 20.—Copper continues strong and prices are still advancing. There is good demand both in this country and Europe. Lead is firm at prices quoted. Spelter holds its own well and prices are steady.

Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
June 13	17.25	4.50	6.85	61½
" 14	17.25	4.50	6.85	61½
" 15	17.25	4.50	6.85	61½
" 16	Sunday.	No market.		
" 17	17.25	4.50	6.85	61½
" 18	17.30	4.50	6.85	61½
" 19	17.40	4.50	6.85	61

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	June 20.
Camp Bird Ltd	$ 7
El Oro	4
Esperanza	7½
Oroville Dredging	1½
Santa Gertrudis	8½
Tomboy	5½

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, June 20.		Closing Prices June 20.
Adventure	$ 9⅛	Mohawk	$ 67½
Allouez	48½	North Butte	31½
Calumet & Arizona	76	Old Dominion	58½
Calumet & Hecla	524	Osceola	125
Centennial	25¾	Quincy	92½
Copper Range	59½	Shannon	15½
Daly West	5½	Superior & Boston	2½
Franklin	13	Tamarack	46
Granby	56	Trinity	7
Greene Cananea, ctf.	10⅜	Utah Con	11½
Isle-Royale	34⅞	Victoria	4½
La Salle	7	Winona	6⅜
Mass Copper	7	Wolverine	112

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, June 20.

Atlanta	$ .22	Mayflower	$ .02
Belcher	.64	Mexican	2.75
Belmont	9.90	Midway	.45
B. & B.	.14	Montana-Tonopah	2 25
Booth	.08	Nevada Hills	2.02
Choliar	.03	Ophir	1.12
Combination Fraction	.15	Pittsburg Silver Peak	1.25
Con. Virgina	.52	Round Mountain	.40
Florence	.95	Savage	.15
Goldfield Con.	4.40	Tonopah Extension	1.82
Gould & Curry	.03	Tonopah of Nevada	7.00
Jim Butler	.59	Union	.66
Jumbo Extension	.35	Vernal	.13
MacNamara	.24	West End	1.70

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. June 20.		Closing Prices. June 20.
Amalgamated Copper	$ 86¼	Miami Copper	$ 28
A. S. & R. Co.	84½	Mines Co. of America	3
Braden Copper	7⅛	Nevada Con	22½
B. C. Copper Co.	6	Nipissing	
Chino	34½	Ohio Copper	
First National	2⅞	Ray Con	22
Giroux	5½	Tenn. Copper	45½
Goldfield Con.	4½	Tonopah Belmont	10⅛
Greene-Cananea	10⅛	Tonopah Ex.	1⅞
Hollinger	10⅜	Tonopah Mining	7⅛
Inspiration	19½	Trinity	6½
Kerr Lake	2⅜	Tuolumne Copper	4
La Rose	3⅜	Utah Copper	64
Mason Valley	13⅜	West End	1⅜
McKinley-Darragh	1⅜	Yukon Gold	3⅜

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

POLLUTION OF STREAMS BY MINING—DAMAGES

In an action against upper riparian mine owners for the pollution of a stream by the waste from their mines which flowed down and injured plaintiff's lands, evidence of general benefits accruing to plaintiff's lands, in common with all the land in the vicinity arising from the fact that operation of defendant's mines caused an increase in the population, was admissible in mitigation of damages. But plaintiffs were entitled to recover damages notwithstanding that the pollution of the stream was a necessary consequence of the operation of the mines, for the necessities of one man's business cannot be made the standard by which to measure another's right.

Arminius Chemical Co. *v.* Landrum, (Virginia) 73 Southeastern 459. January 18, 1912.

RIGHTS OF WAY OVER FOREST RESERVES IN ALASKA

Section 4 of the Act of Congress of February 1, 1905, which provides that "Rights of way for the construction and maintenance of dams, reservoirs, water plants, ditches, flumes, pipes, tunnels, and canals within and across the forest reserves of the United States are hereby granted to citizens and corporations of the United States for municipal or mining purposes, and for the purposes of the milling and reduction of ores during the period of their beneficial use, under such rules and regulations as may be prescribed by the Secretary of the Interior, and subject to the laws of the state or territory in which the reserves are respectively situated," has been made applicable and operative in the District of Alaska by a decision of the Land Department.

Alaska Treadwell Gold Mining Co. *et al.*, 40 Land Decisions 426. February 12, 1912.

MINERAL SURVEYS—COMPENSATION OF SURVEYS

Under section 2234, Revised Statutes of the United States, authorizing the Surveyor General to appoint surveyors to survey mining claims, and providing that the expenses of the survey shall be paid by the applicants, and authorizing the Commissioner of the General Land Office to establish maximum charges for surveys, and under the rules of the Interior Department, the employment, manner, and amount of payment for the survey of mining claims, are subjects of private contract between an applicant and a deputy surveyor. But, where an applicant and a deputy surveyor have made an arrangement as to payment, the surveyor must make the survey and return correct field notes without delay, notwithstanding any dispute over the payment of fees.

Fish & Hunter Co. *v.* New England Homestake Mining Co., (South Dakota, 134 Northwestern, February 14, 1912.

NATURAL GAS HELD TO BE A MINERAL

Natural gas is a mineral, and while in place in any particular land it is a part of the land itself. It therefore belongs to the owner of the land in which it is found, and as long as it remains in the particular tract of land, the owner of the surface is the owner of the gas beneath it. It has been uniformly held that conveyances of gas in its natural state in the land require all of the formalities of a conveyance of any other interest in the same real estate, and that the ownership of the gas passes to the grantee of the land itself in event the right to the same is not expressly reserved in the deed conveying the land. It follows that by a conveyance of a tract of land, with no reservation therein the grantee obtains title to all the natural gas that exists in and is captured beneath the surface thereof, although such gas has escaped from the land of an adjoining owner.

Osborn *v.* Arkansas Territorial Oil & Gas Co., (Arkansas) 146 Southwestern 122. April 8, 1912.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

HYACINTH is a clear brownish orange, or reddish colored zircon, which is cut as a gem.

POOD is a measure of weight much used in Russia. A pood is equivalent to 526 troy ounces.

KATANGA copper sold in Antwerp is in the form of bars weighing 100 to 400 lb. and analyzing 89 to 90% copper, 4.5 to 5% cobalt, 0.3 to 2% iron, and 0.5% sulphur.

INDUCTION motors of the squirrel-cage type should be selected for use in damp or wet places, due to the more rugged and reliable construction of the motor, making it less liable to insulation troubles.

GOLD was discovered in Russia in 1733 at the Voitsky mine, Government of Archangel, in a quartz vein. Russia is one of the few countries in which placer mining followed rather than preceded quartz mining.

TUNGSTEN is principally used as an alloy for tool steel. An addition of 16 to 20% used in lathe tools will enable them to be speeded up until the chips leaving the tool are at a blue heat; an operation that would ruin the temper of high-carbon steel.

MAXIMUM speed in hoisting is only attained for a short portion of the time that the skip or cage is in travel. At Kimberley, Alfred Williams found by test that when hoisting 2500 ft. in 59 sec., a maximum of 4800 ft. per minute was attained.

CADMIUM is now recovered as a by-product from the treatment of zincy ores in Colorado. It has long been known that cadmium-bearing minerals occurred with the zincy ores of Leadville as at Joplin, but absence of demand for the metal made it unprofitable to attempt its separation. Even now only a small part of the cadmium occurring in American zinc ores is saved. Where it is recovered it is by treatment of flue-dust caught in a bag-house.

EXTRALATERAL rights apply to the dip, not the strike, and a vein therefore which, on its course extends into patented grounds, conveys no rights upon the discoverer, even though his shaft be upon unpatented ground, except as he may follow down the dip within his actual or constructive end lines. State laws do not affect this matter though it is possible for a state by declaring mining a public use, and providing suitable condemnation proceedings, to open the way to the working of mineral under private lands.

Commercial Paragraphs

THE LODWIC CONCENTRATOR CO., of Los Angeles, claims that the statement that the United States District Court of the Southern District of California on March 5, 1912, granted a perpetual injunction against all persons claiming or pretending to have any interest in or rights under the Lampert patents, is incorrect, and that the court did nothing of the kind. The Lodwic company states that the injunction issued in this case enjoined Jacob Lampert and P. B. McCabe, their agents, attorneys, servants, and employees from claiming to have, by virtue of the Lampert patents, any rights in the invention covered by the Wilfley patents. Also that the said court did not declare the said Lampert patents invalid, and that the Lodwic Concentrator Co. is manufacturing a table which is covered by the claims of the Lampert patents.

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EDITORIAL

SUNNY JIM emerged from the gloom at Chicago for a few moments last Saturday. We had thought groundhog day came in February.

WYOMING has joined the states asking for a local mining experiment station. Delaware, Florida, and Rhode Island are still to be heard from.

RECORD copper production was attained by the Utah Copper Company with a May output of over 10,000,000 pounds. As a monthly output from ores but a few years ago considered as too low grade to be of value, it is interesting evidence of how quickly our point of view can be changed, and serves to lighten the gloom when statisticians compute the brief period of years required to exhaust the known mineral resources of the United States at the present rate of consumption.

MANY stories have been told of the Japanese prince in the kitchen seeking knowledge, and it may add zest to the reading to note that Viscount Inouyé, who describes elsewhere the flotation process used at the Kamioka mine, served his time as an unknown laborer at the Globe smelter. After graduating from the Imperial University at Tokyo and studying some years in Germany, he wisely went to work at the bottom to get practical knowledge. How well he succeeded is instanced by his position as professor of metallurgy in the Imperial University at Kyoto and adviser to numerous important mining corporations.

NO feature of recent development of the mineral industry is more striking than the growing importance of the minor minerals. New uses for them are being found daily and a knowledge of the mineralogy of gold, silver, copper, lead, and zinc no longer suffices the prospector. Ore worth $400 per ton is worth the hunting, whatever be the mineral that gives it value. On another page Mr. H. C. Morris summarizes the points that will be most helpful to those who turn their attention to tungsten. Other minor metals deserve similar treatment, and an open mind as well as a keen eye is worth while to those who would discover mines.

GUIDE BOOKS are necessary evils, and official documents prop many a faulty memory. No formal report, however, gives quite the same vivid picture of a country as does a personal letter from a friend. He tells you informally the many minor points which you would have noticed promptly, but which so few remember to write. We are glad, therefore, to share with our readers the glimpse of the Rand, with which Mr. Edgar Collins has favored us. It is an attractive picture and sets one to inquiring as to steamer dates and rates. The Rand may have passed its first period of youth and may have become an old story to those who have seen it often, but mighty tasks remain and big problems are being worked out. Who wouldn't be in on the fun? Mr. Collins' story is as interesting as that told by the visiting missionary, who, as is well known, never sounds quite convincing when discussing the hardships of his life, but rouses the greatest enthusiasm when talking of its pleasures.

LOSS of gold in dredging operations was recently demonstrated by a dredge on the Ovens river, Victoria, where it became necessary to turn the dredge around and work back through ground already dredged. In two weeks 45 ounces of gold was recovered, though the yardage handled is not reported. It has been urged that the muddy water produced by dredging the whole face, with the overburden of soil, is responsible for these losses, and that the use of resoiling devices gives returns sufficient to justify their employment on the score of economy alone.

OUTPUT of new securities in 1911 amounted to $3,956,129,000, according to a French statistician, of which $1,562,100,000 was floated in North America. The total capital employed in manufacturing enterprises in the United States in 1910 was $18,428,270,000, according to the census reports. Other enterprises would increase this total enormously, but, even so, the rate of growth is remarkable, and when it is remembered that of the value of the output of industry more than one-half represents the cost of work done upon them, the rapid increase of indebtedness represented by this increase of securities may well offer food for reflection.

PUMP hydraulic sluicing is an important factor in the alluvial gold mining of Victoria, Australia, the number of plants employing this method in 1911 being 34, as compared with 54 bucket dredges. The bucket dredges handled 16,400,000 cubic yards, of an average value of 7½ cents per yard, and paid dividends amounting to $230,000 during the year. The pump sluices handled 3,000,000 cubic yards, of an average value of 12 cents per cubic yard and paid dividends amounting to $15,000. This peculiar type of plant was described by Mr. Charles Janin in our issue of November 11, 1911. The total amount of gold recovered by dredging and sluicing in Victoria since 1900 is valued at $18,000,000.

COMPOUNDING confusion is likely to be the result of the action of the provincial authorities of the new government of China in issuing new silver coins. One of the great handicaps of trade has been the fact that the coins in use in each province differ both in weight and fineness from those employed in the other provinces, producing endless complexities of exchange as well as much inconvenience. The establishment of a republic offered an excellent opportunity for the introduction of a uniform national system of coinage; the matter is one of so much importance in the trade relations of China, and the action of the provincial authorities is so contrary to good public policy that it should be reversed and reprimanded.

AUTHENTIC information about mines is not easily obtained, and in some districts the sway of tradition is strong. The old policy of secrecy is gradually giving way, but from certain companies and in certain districts it is still impossible to get exact data for publication. Keen observers are wont to remark that it is in just such instances that the light of day is usually most needed. Disinclination to share with others professional knowledge by no means always flows from a desire to cover crookedness, but one who is behind the times in this particular is apt to be in others. No man or company is big enough to progress alone, and the best results for all will result from the fullest permissible freedom in exchange of information.

WE publish this week a letter on Alaska development written by Mr. Julius Thompson of Katalla. That we do not altogether endorse his views is but an added reason for giving them space. Mr. Thompson is an experienced mining attorney, well known in Colorado and now resident at Katalla. He presents an important and honest point of view. We have maintained, and are still of the opinion, that whether mineral land be opened by lease or by location and patent, is of less importance than the terms offered in each case. As Mr. Thompson points out, in the Australian states it is common to give the claimant the option of fee or lease, but so universal is the preference for the lease as offered, that one American mining engineer, who had operated there ten years, was at first incredulous when told that a fee could be obtained. Indeed, leasing has become so invariable that in the land office of one of the states, high officials did not know that anything else was possible until the law was pointed out to them a few years ago. Evidently, if the leasing system *per se* is so bad as is urged, the Australians have not known that they have been hurt. Not the general theory, but the actual terms of the law seem to us most important. Above all else, we condemn the paralysis that obtains at Washington. Any system is better than none. There is no possible justification for locking up the territory as a whole, and Congress will fail miserably in its duty if it adjourns without making some provision under which development in Alaska can proceed.

The Fourth and Politics

Thursday next will be the Fourth of July. The cage will hang unused in the shaft, the roar of the stamps will cease, only a thin stream of clear water will trickle down the tailing launder, and only a skeleton crew will attend the furnaces. Everywhere in the United States miners and millmen, so far as possible, will observe the national holiday. For one day at least they will turn away from stopes, stamps, and savings, and think of other things. In many an American village, and in many an American community in far away lands, the day of sports will be broken while some rising young lawyer or some 'wheel-horse of the party' reads the time-honored Declaration. As the fine phrases ring out and the sonorous sentences rise and fall, it would be well to remember that it was not words but deeds that made the Declaration vital. The signers pledged their lives and fortunes, and they and their followers freely expended both.

This is evidently to be a tumultuous year in the United States. Politics will absorb attention as in no year since the Civil War. Balanced phrases and resounding eloquence already fill the air, but acts rather than masticated wind will determine the result. Fundamental differences are to be fought out, and it is well that it should be so. Everyone acquainted with American politics has known for years that the differences within the parties were deeper and more vital than those between them. It has long been necessary in defining a man as a Democrat to say what particular kind of Democrat he was, and the differences between Taft and Roosevelt Republicans are now as great as between followers of Tammany and Bryan. Custom, however, has strong hold, and Americans have gone cheerfully ahead electing men to office who held and represented mixed ideas. There is a time for compromise and a time for no compromise. Progress comes in pulsating movements and radicals and conservatives are equally necessary and useful. No good comes, however, from continuous dodging of an issue; and, looking at the matter in retrospect, it is clear that a more radical revision of the tariff or no revision at all would have been better than the half measure actually passed three years ago. We have had four years of business uncertainty and of general turmoil, and the big reason has been that the President has not given the sort of administration that was expected by the majority of the voters

who elected him. He has attempted compromise in an irrepressible conflict between opposing and enduring forces. True results are not obtained that way, and no good can come from preserving forms after substance is gone. A dead body is only fit for a funeral. Normally the country, tired of progress with one party, might turn to the other, but what peace could Mr. Roosevelt and his followers hope to find in an alliance with Tammany? On the other hand, what comfort could conservatives find in an organization where Mr. Bryan holds the balance of power? Whatever may be our individual convictions as to the rate at which change shall come, and that alone divides radical and conservative, isn't it better to have the issue sharply joined and to fight it out? Business can adjust itself to either basis; provided there really be a definite and predetermined program. There is plenty of room for honest differences of opinion in this campaign, but no place for those who have neither convictions nor courage. For ourselves we have a decided preference for the progressive platform and would rather have the opportunity to vote for it squarely and fairly and risk defeat than to be longer distracted by side issues. The particular occasion for the quarrel, and the personalities concerned, are of minor importance. There is a higher law than that of any national committee, and an appeal to the people is always in order. We hope the issue may be clearly defined and the answer decisive; then all good citizens will cheerfully accept the verdict.

Hindsight, Foresight, and Insight

Hindsight is commonly spoken of with a tinge of contempt, as though it were a common virtue and of but little value, but such an attitude can scarcely be justified, for the possession of real hindsight is at once of great value and all too rare. Ostwald regards the scientific man as the only true prophet; one who from his accurate knowledge of facts is able to project himself into the future and unerringly determine what will be the outcome of a given combination of circumstances. Precise knowledge of available facts is the fundamental prerequisite of the twentieth century augur, and a clear and accurate vision of the events of the past is the reverse of valueless.

What the outcome of a given combination of circumstances will be can be predicted with a high degree of precision by the trained man, but to determine what will be the most probable combination of circumstances is a more complex task, calling for the exercise of foresight. The ore can be milled with determinable recovery at an ascertained cost per ton, but how much ore there is available, and whether it will change in character as depth is gained, is a projection of present knowledge into the future; an extension of hindsight into foresight that in its highest degree is rare and wins appropriate rewards. From time to time there is much discussion of the reasons why the trained engineer is too seldom found at the managerial desk and on the board of directors. The prolixity of the discussion evidences the complexity of the topic, but it is none the less clear than an important reason is that, popular impressions to the contrary notwithstanding, the engineer's mental equipment is too largely composed of insight and hindsight and too little of foresight. It has been cynically said that the engineer is at a considerable disadvantage compared with the physician and surgeon, since the mistakes of the latter are quietly buried, while those of the engineer are permanently in view and remain to confound him and cripple his reputation. Not improbably this reacts to produce an attitude of too great caution in the engineer. It is unquestionable, too, that the foresight of the engineer is subjected to more caustic tests than that of his business associates. If a business man starts a commercial enterprise and the hoped for railroad is never built, or changed conditions of living demand a different type of product from that he is prepared to supply, he is regarded as unfortunate but not necessarily inefficient. But if the deep shaft fails to intersect the orebody indicated by the surface development, or if the dam breaks in a flood greater than there was any reason to expect, the engineer in charge cannot hope to escape some, perhaps even a considerable amount, of criticism and condemnation. It is unquestionable that some engineers have never attained more than a limited degree of success largely because they were so unfortunate as to be early associated with one or more enterprises that proved failures, while other engineers have been borne to the top upon the crest of the wave of success by the enterprises with which they have been associated. Then, too, to rub elbows with success indubitably is an aid to successful achievement, while a continual outlook of gloom lowers the mental vitality. On the whole, however, great achievement has been the result of accurate and complete knowledge upon which men of foresight have dared to risk much.

Apples had dropped from trees for ages before Newton saw one fall, and saw it for the first time with insight. The significance of the simple relations between common phenomena is less obvious today than when little was known of the laws of nature, for complexity of outlook produces vagueness of vision. The farmer who sees two or three teams pass his place each day can describe them with almost photographic accuracy, while the city-dweller, at the end of his ride downtown in the morning, can describe but little of what has passed before his eyes, and that inaccurately. The man of insight is he who can eliminate the insignificant from his field of vision and concentrate his mental vigor upon the significant. Fortunate is the possessor of insight, for he shall be greatly rewarded.

Rich Ore and Litigation

National, Nevada, came into sudden prominence about two years ago by reason of the discovery of extremely rich ore. Just how rich has recently been shown by the statement of the manager, on the witness-stand, that ore worth $94,000 was taken from a space four inches wide, three feet long, and seven feet high. Another witness referred to ore worth $8000 per ton as 'low grade.' As seems to be inevitable in Western America, the discovery of this ore has resulted in a bitter law-suit to determine whether the National Mines Company or the Charleston Hill National Mining Syndicate is the proper owner. The case is now being tried at Carson City, and Nevada's capital, as a result, is more crowded than Anamosa, Iowa, when the Jones county calf case was up for trial. Among those present are Messrs. H. V. Winchell, H. L. Hollis, Walter Wiley, A. N. Winchell, W. A. Wilson, Albert Burch, and A. C. Lawson. With such an array of experts, the case, as a local paper states, "promises to be long drawn out and is very complex, involving such questions as earth movements, alterations, faults, dips, spurs, angles, uplifts, depressions, stages of mineralization, genesis of ore deposits, stratigraphy, structure, petrography, refractory elements, basalts, andesites, dikes, fine-grained rocks, planes, cleavages, tales, the tracing of faults, the bearing of same as it pertains to possessory rights at National, epidotes, first and second deposition, molecular replacement, quartz crystals, filling of cavities, older and newer fissures and formations, how made and the causal actions therewith, with their important bearings as it pertains to the different viewpoints of the parties in interest." If the case is as abstruse as all that, and the ore as rich, there would seem to be need even for the talent assembled.

First Impressions of the Rand

By Edgar A. Collins

It is fitting that the first impressions of the newcomer to this, the greatest gold mining district that the world has ever seen (and the records of recent years make it impossible to dispute the title), should be those of amazement at the colossal extent of the mining industry. From the moment when the Cape Town train first begins to skirt the western portion of the 'reef,' with its 25 miles of continuous mining activity, one cannot fail to be impressed with the magnitude of operations. The succeeding days of sight-seeing in the vicinity of the mines only add to this feeling of 'admiration mingled with awe,' for the innumerable producing mines form as great a contrast to the ordinary Western mining 'camp,' with its half dozen producing mines, as the city of Johannesburg, with its 200,000 people, does to a camp itself.

Consider for a moment a practically unbroken line of mines for a length of roughly 50 miles, and you begin to realize why it is that the Rand 'banket' produces over one-third of the total gold production of the world.* Yet it is the magnitude of operations, rather than the number of mines or extent of the district, which finally impresses the visitor most. Elsewhere a gold mine handling 10,000 tons of ore per month is considered a large property and attracts a good deal of attention in the surrounding country. Should the owners be fortunate enough to have ore developed for two or three years' work ahead, the property gains additional notice and becomes locally famous. On the Rand, however, such a mine is so overshadowed by the bigger properties, with their practically assured tonnages for many years, that they are seldom mentioned except by the employees or those more or less directly connected. One may see by the monthly statistics that such and such a mine is maintaining its output, but it creates no further attention. And when the mine reaches a time when the probable ore reserves are less than four or five years, it is spoken of with a kindly but pathetic indifference, as of an old acquaintance already dead and buried.

It is natural that this should be so to a great extent, because the unique conditions make it possible to gauge the life of a mine with far greater accuracy than elsewhere. With the comparative regularity of the profitable ore, and the vertical bounding planes of the property, the available volume of ore can be calculated with reasonable certainty. But the point of view is also influenced very considerably by the scale of operations in surrounding properties. Instead of being one of a dozen or less the mine under consideration is an insignificant one among many.†

The city of Johannesburg is well built and has some 200,000 inhabitants (of whom some 140,000 are whites), with numerous fine buildings, offices, banks, theatres, a fine hospital, court-house, and other government buildings, together with the nucleus of a university. The streets are wide and well kept, and in the residential district a great number of trees have been planted, and there are many fine houses and gardens. The most characteristic sights in the streets, which distinguish it from other cities of its size, are the native messenger and police 'boys,' and picturesque rickshaw pullers, with their painted legs and head-dress of feathers and ox horns; and the numberless automobiles which rush to and fro incessantly. Without doubt there are more motor cars in Johannesburg than in any other city of equal size. These are used primarily for business purposes—and the reason is obvious when one remembers the distances to the more remote mines.

The climate of the Rand is, on the whole, mild and pleasant. Extreme heat and cold are almost unknown, and were it not for the dust and windstorms the climate would be almost ideal. Away from the mines there is no unusual dust, except during the months of August, September, and October, when the veldt is very dry before the rains commence. But in the vicinity of the mines and enormous tailing or sand residue dumps which deface the landscape there is more or less—and usually more—dust during the greater part of the year. Generally speaking, the winter months of April to July, inclusive, are the most enjoyable. The country is then no longer green, but there is little or no wind and the days are sunny and bright, with clear cool nights.

During the summer months, December to February, inclusive, rains are frequent, accompanied by heavy thunder and lightning storms. At such times the rain pours down with tropical violence, and within a few minutes every hollow is filled with water.

It is popularly imagined by Europeans and others having no personal knowledge that the climate of the Rand is unsuited to physical labor for white people. Such is far from being the case. As a matter of fact, it is superior to that of many English-speaking countries. Moreover, even underground, in the deep-level mines, the temperature is lower than it is in many of the Nevada mines.‡ The real reason which makes it undesirable for the white man to engage in the heavier tasks of manual labor underground is purely one of race difference. Whether true or otherwise, it is generally believed that the white man will be lowerd in the opinion of the native if seen performing acts of physical labor. No doubt there is a certain amount of truth in this assertion, but the result has naturally tended to lower the efficiency of the white man. As is well known, there is a shortage of labor in the mines. The number recruited each year has increased until the total number employed is now about 200,000 'boys,' but the work at the mines has increased to the same, or an even greater extent, and the shortage continues and tends to increase in spite of the ever increasing use of rock-drills. At the same time the need of white men has increased in almost the same proportion, and at the present time the demand for good miners far exceeds the supply. Inexperienced workmen and beginners, locally called 'learners,' have filled the vacancies, but really skilful miners are rather scarce and in great demand. Such men can always secure good contracts and can easily earn £40 to £60 ($200 to $300) per month. The average white man, however, is not particularly skilful, and is, on the whole, inferior to the average Western American miner in both skill and energy. To some extent this is due to the ravages of that scourge of the Rand, miners' phthisis or silicosis, which has incapacitated or removed the elderly miner, who would otherwise leaven the majority and teach the younger generation. It cannot be ignored that this terrible disease has been responsible for a large mortality—among the white miners, at any rate—and while the preventive measures now in force in practically all of the mines will undoubtedly prove beneficial, some years must necessarily elapse before the improved results will be apparent, because of the large number of men already infected. The younger generation will undoubtedly reap the benefit, and as they will be the

*The production for the Rand for the year 1911 was 7,896,802 oz. of fine gold, approximate value $163,220,000, while the world's production of gold was valued at $454,874,014.

†During the month of May 1911, for instance, the following list of 16 mines milled more than 40,000 tons of ore, and of these the first three averaged over 160,000 tons each:

1. Randfontein South.
2. East Rand Proprietary.
3. Crown Mines, Ltd.
4. Simmer & Jack.
5. Geldenhuis Deep.
6. Knights Deep.
7. Nourse Mines.
8. Rose Deep.
9. Langlaagte Estate.
10. Robinson.
11. Robinson Deep.
12. New Modderfontein.
13. Simmer Deep.
14. Witwatersrand Deep.
15. Village Deep.
16. Village Main Reef.

‡The natural increase in temperature due to increase in depth is unusually low on the Rand. Roughly, the increase is 1°F. for every 200 ft. in depth, as compared with 1° for every 80 ft. in the mines of Tonopah, Nevada.

miners of the future this is a most important feature.

To the newcomer—unless he has had extensive experience on a large scale in Mexico or South America—the native labor cannot help but prove a matter for grave consideration, and incidentally for surprise and interest. At many of the deep-level mines the daily underground crew consists of some 1500 to 2000 'boys,' as the natives are called. The problem of handling such a large number expeditiously, from the compound to the working points and back again, is no light matter. Many of the main working levels are over 2000 ft. deep, and even with two and three-deck cages, hoisted at high speed, it takes hours to hoist and lower the shifts. Allowing 12 'boys' on each deck, and with three-deck cages making the round trip in 6 minutes (which is quick work), it is only possible to hoist about 700 'boys' per hour, with a single winding engine. Consequently, if the full quota were to be hoisted from one shaft it would require two hoisting engines to complete the work in about

opportunity and individual preference, and forms such a large proportion of those engaged in the profession in the United States, and to a lesser degree in England and other countries, is conspicuous by his absence. The explanation is simple. Owing to its unique occurrence and origin the 'banket' formation of the Rand does not offer the numerous promising prospects and small mines which appeal to the small operator commanding a limited capital. In addition, the fact that 75% of the mines are controlled by three or four financial groups, limits and centralizes the field of the consulting engineer.

The position of the mine manager on the Rand is also noticeably different from that of the same official in other parts of the world. Under the law he is held responsible for the carrying out of the requirements of complicated and detailed legislation. The Mining Regulations are framed by a fatherly government, and, in the main, are doubtless necessary from a humane point of view. Their observance,

THE CITY DEEP SHAFT, JOHANNESBURG.

1½ hours. As a general rule, however, there is more than one shaft available, and portions of the two shifts are handled at the same time. In this way the total time occupied in handling the shifts will probably average about 4 hours per day. In order to avoid delays and accidents from overcrowding, native police boys assist the top-man and cage-tender in supervising the loading and unloading of the cages. In some mines which are not yet producing heavily a single cage and skip is used. In this case boys are allowed to ride in both cage and skip.

Time is of little moment to the native, who will cheerfully wait for hours at the shaft station, dozing, while waiting for his white 'boss' to come down, or to be hoisted to surface. Frequently the hand-drillers (hammer boys) are allowed to go to surface as soon as they have completed an allotted task, in order to encourage them to work hard. For, although the native does not mind waiting around underground, he much prefers to do it on the surface, in the sunshine. It should be mentioned that these hammer boys are paid according to the number of inches drilled (with a minimum task), so that they gain directly in proportion to their exertions.

The status of the professional mining engineer on the Rand is unusual. He holds one of two positions. Either he is engaged as consulting engineer for one or more mines, or he is employed as a manager on one of the mines. In either case he is usually in the service of one of the large financial houses. The independent consulting engineer who undertakes inspections or mine management, according to

however, is a source of endless worry to a conscientious manager, who can never tell when the neglect of a subordinate, and the action of an over-zealous deputy inspector of mines, will result in a summons to appear before the local magistrate, with the more than possible chance of a heavy fine. In addition, the manager has, in the majority of cases, the never failing demand for increased production to spur him in his efforts, with the knowledge that if he is successful in keeping his reduction plant operating at full capacity—additional plant will probably be erected. These are of course part of the ordinary work and trouble of a mine manager in any country, where native labor is employed, with the additional effect of *intensified production.*

On the other hand, however, the manager on the Rand has very little voice in the policy or in the general plans which are formulated. New construction is approved by the Board of Directors and the work may be carried out, against his advice and recommendations. These matters are settled by the directors, acting with the advice of the consulting engineer, as is usual elsewhere, but without the advice of the manager, which is usually called for in other countries. There is a certain justification for this arrangement, for with such enormous properties it is rightly considered that the details of management are enough to occupy all of a manager's time. But where, as is sometimes the case, a consulting engineer is over optimistic, and promises more than the mine will properly produce, or where the consulting engineer is changed (a not infrequent occurrence) the unfortunate manager is not to be

envied. He is called upon to produce more than the mine can efficiently output, and is too often forced to mill unprofitable ore, or else to neglect development, and allow the mine to suffer.

It is not within the province of an article of this kind to attempt to suggest remedies, or to discuss the pros and cons of the matter. I have simply mentioned a few of the troubles which impressed me as to the position of the mining engineer, and more particularly to those acting as mine managers on the Rand. To a lesser degree these same troubles are felt by the subordinate officials around a mine, but naturally they have less responsibility. However, there seems far too much shifting around among the various officials, and efficiency naturally suffers. It cannot be otherwise, when there is a general feeling of uncertainty among the employees of a property, from manager down to 'mucker.' It is only fair to add that the evil results of such a condition as outlined are fully recognized by many of the most influential representatives of the different mining groups, but the problem is a difficult and complicated one, and it cannot be solved in a day.

Cyanidation of Antimonial Tailing

By W. Archer Longbottom

*The treatment of the refractory tailing produced from the mines of the Hillgrove district, N. S. W., has had the attention of metallurgists from time to time, but till lately the results were not satisfactory. The chief cause of the trouble is the antimony, which is present in varying quantities in all the mines. Even after careful concentration the tailing carries quite an appreciable amount. Antimony being present as stibnite (Sb_2S_3), it would be natural to expect a large consumption of cyanide, but work in the field has shown this is not necessarily the case. The cyanide used is never abnormal, even when dealing with the most antimonial tailing. The ore, as a matter of fact, is fairly high in cyanicides; stibnite, a little copper, and pyrite being present besides the gangue.

The chief difficulty is the extraction and the production of gold of good quality from the zinc precipitate. The stibnite is decomposed and the antimony gives trouble throughout the operation. It is an interesting problem to determine the actual manner in which the gold is contained in the tailing. After many experiments I have come to the conclusion that it is not in a free state. With the finest grinding, and studied under the most powerful glass, no free gold could be detected. The question then naturally arises as to how the stibnite and the gold are associated; whether the latter is contained by the former as infinitely small particles, or—and this seems more probable—whether the gold is thinly coated with the stibnite so as to prevent amalgamation. That the stibnite always contains gold can easily be proved. Assays of practically pure sulphide, even in a crystallized form, will show 8 dwt., or occasionally ½ oz. per ton.

The problem resolves itself into attacking and disintegrating the sulphide of antimony, and the freeing of the contained gold for cyanidation. The possibility that at least some of the gold is intimately associated with the stibnite is confirmed by the fact that there appears to be a limit to the value of the residue, and even the most protracted treatment will not lower it appreciably. The metallurgist must start, therefore, with the assumption that complete metallurgical success is practically out of the question, though a fair commercial one can be obtained. All the mines in operation on the Hillgrove field have cyanide plants working, and in addition the tailing from the Eleanora Mines, stacked in the early days, have already been treated by cyanidation—some of them twice—and are being put through again by W. H. C. Lovely, an Australian metallurgist with South African experience.

At this plant the tailing has been exposed to the atmosphere for many years, and is strongly acid. There is some difference of opinion among the local chemists as to whether tailing fresh from the battery is easier to treat than that which has been stacked long enough to permit oxidation. I believe that though the extraction may be a little lower on the raw tailing, the consumption of cyanide is much greater for an equal extraction of the old sand; also the zinc precipitate does not yield the same quality of gold as from fresh tailing. There are 18 treatment vats in use, each 20 by 4 ft., with a capacity of 30 tons. They are arranged in pairs, with a tram line running the full length of the series. They are fitted with the ordinary false bottom of slabs nailed together to conform with the circular section, and covered with hessian cloth, or, better still, cocoanut matting. Each tank has a 2-in. delivery pipe, and may be drained at will into the one common pipe leading to the gold sumps.

The sump capacity consists of six 30-ton tanks, and as quick and convenient means of pumping is provided, this sump room is ample. There are three gold tanks, each of 15 tons capacity, connected with siphons, and can be used separately at will. The precipitation boxes are six in number, and are 20 ft. long by 18 in. square. Pumping is done by 2-in. centrifugal pumps, so arranged that the material can be pumped into any sump required. There are two smelting furnaces for the clean-up, side by side, each capable of taking four '30' and two '90' plumbago crucibles, which are lifted in and out by means of an elevated lever, and are protected by clay liners. The zinc precipitate is treated with acid in six wooden tubs, 3 ft. in circumference, and there are besides six smaller vats. An ordinary flat sheet of thin iron is used for drying purposes, and, contrary to usual practice, the edges of this plate are not turned up. Power is supplied by a large Cornish boiler. The fuel used is ordinary billet wood, and about 1½ cords is burned weekly.

Method of Working.—The dump has been worked on the open-cut system, starting at the middle and working toward the edges, the sand being brought up by means of an inclined tramway. At the surface level the cars are emptied by contract into the treatment vats. The residue is disposed of also by contract. The time of treatment is seven days, including time of emptying and filling, and altogether seven washes of different strengths are run on; the strong solution first, then the weak wash, and finally a quick water wash.

The tailing has been exposed to the atmosphere for many years, the metallic sulphides have given rise to the formation of acids, and this acidity—free and latent—must be dealt with. On the whole, neutral solution, or a very slight protective alkali, is aimed at to give the most successful results. I have experimented with acid solutions, making use of the nascent hydrocyanic acid for the dissolving of the gold, and, by the addition of caustic soda, giving rise to the regeneration of free cyanide according to the equation $HCN + NaOH = NaCN + H_2O$, but the method appears to have two disadvantages: (1) the consumption of cyanide is liable to be larger with acid solutions; (2) the presence of caustic soda is troublesome, and fouls the precipitation boxes. The importance of the alkalinity or acidity of the solutions cannot be overestimated when dealing with antimonial tailing. If the protective alkali is in any excess, antimony sulphide is taken into solution and deposited on the zinc as metallic antimony, which generally means trouble in smelting.

The acidity of the tailing at Mr. Lovely's plant is neutralized by lime. This is added in calculated quantities as the treatment vat is being filled, and all precautions are taken against the solution of the antimony, at the same time allowing the sulphide to release the gold. The amount of solution made up and pumped daily on the vats is 100 tons. The solution from the treatment vats is drained away into gold sumps, and from them flows to the zinc-boxes and is passed through the precipitating room in the ordinary way, and the precipitate solution is once more made up to required cyanide strength and used again. The solution is occasionally purified by the addition of some powerful oxidizing agent, as permanganate. Lead acetate is sometimes used to accelerate precipitation, and also to throw down any sulphides there may be in solution.

The Clean Up.—At regular periods the zinc-boxes are

*From *The Mining and Engineering Review.*

cleaned up. The method does not differ materially from usual practice, and a few words will suffice. Only the short zinc is treated, the long zinc being replaced in the top compartments, while the lower ones are filled with new zinc. The slime is allowed to settle all night under the sulphuric acid, to make sure that all the short particles of metallic zinc has been dissolved. The supernatant liquor is then siphoned off and the heavy black slime dried over a wood fire. This slime when dried will usually average in value about 1½ to 2 oz. per pound. They are then suitably fluxed — soda, borax, silica, and flourspar being used — and smelted. Mr. Lovely departs somewhat from general practice, inasmuch as he obtains the gold in the form of base bullion, by the addition of lead oxide to the charge, reducing it by inserting rods of metallic iron in the charge. The bullion is then cupelled in specially prepared cupels, each one of a capacity of about 40 oz. This method has the advantage of giving remarkably clean ingots.

Mr. Lovely gives the following as approximate costs of treatment:

	Per ton, s.	d.
Labor (total)	2	0
Cyanide	0	8
Zinc	0	1½
Fuel	0	2
Chemicals, etc.	0	1½
Royalty	1	0
Total	4	1

These costs are low, the cyanide item being particularly surprising considering the class of material being treated. All labor is on the contract system, and is quite satisfactory.

Prospecting for Tungsten

By H. C. Morris

Tungsten ores are found in most of the Western mining states, as well as in a few of the Southern and New England states, and usually occur in 'pockety' deposits in quartz and calcite, or as veins cutting silicious, igneous rocks, such as granite, granitic schist, or gneiss. There are exceptions to this, and it is never wise to neglect to test a suspected mineral simply because it happens to be found in a seemingly improbable country rock. The same veins often carry one or more of the precious or base metals. Tungsten minerals almost invariably accompany deposits of cassiterite (tin stone), as in Lawrence county, South Dakota, where the tin and tungsten are found in pegmatite. Tungsten-bearing veins have also been found in limestone near igneous intrusions.

The principal commercial deposits in this country are, first, those of Boulder county, Colorado, which produced two-thirds of the total ore and concentrate mined and shipped in 1910. This is probably the most productive district in the world. The ore is ferberite and occurs in small veins and stringers with quartz in granite and gneiss. Apparently related veins nearby carry gold, silver, vanadium, molybdenum, and tellurium. Some of the mines in this district are three or four hundred feet deep with no apparent decrease in the value or quantity of the ore.

The next largest field is the Atolia district in San Bernardino county, California, where the ore is scheelite. These deposits are not only the largest of the kind in the United States, but the largest known scheelite deposits in the world. The ore occurs in quartz and calcite veins in an acid granodiorite and extends through an area of schists to the northwest, where the narrow quartz veins carry both scheelite and gold. In the Papoose, formerly the richest mine in the district, the ore was almost white scheelite which resembled coarsely crystalline limestone.

Cochise county, Arizona, produces some ore, principally hübnerite, from quartz veins in a coarse granite, but the largest production has come from placers. Comparatively small quantities of ore have also been shipped from Stevens county, Washington; from Nye, Humboldt, and White Pine counties, Nevada; and from several other places.

There are four commercial tungsten minerals, of which the first three are so closely associated that they grade into one another and are not easy to distinguish. They are hubnerite, a tungstate of manganese; wolframite, a tungstate of manganese and iron; and ferberite, an iron tungstate. These three minerals are about three fourths—or 76% tungstic acid, of which the chemical symbol is WO_3. Scheelite, the fourth mineral, is a tungstate of lime which carries more than 80% of the valuable tungstic acid.

As before stated, hubnerite, wolframite, and ferberite—particularly the first two—are so often found together and are so similar that one description will suffice for them all. The color varies from gray in hübnerite to brownish black in ferberite, and the streak or color of the powder when the mineral is scratched, ranges from light yellow to dark brown. Hübnerite is generally translucent, but wolframite transmits very little light and is nearly black, while ferberite is black, transmits no light, and often forms in crystals with chisel-shaped ends. A specimen of any of these three minerals would be about three times as heavy as a piece of quartz of equal size, twice as heavy as zinc-blende, or black-jack, and half again as heavy as magnetic iron ore. Hübnerite can be scratched with the point of a knife, but wolframite is less easy to scratch, and ferberite is still harder.

Scheelite varies in color from a rather glassy white to yellowish or reddish, and sometimes has a slightly greenish tinge. The crystals are shaped like square pyramids, and are sometimes almost transparent. Scheelite has a white streak and is easily scratched with a knife, and is more than twice as heavy as quartz, although lighter than the other tungsten minerals. Scheelite might be mistaken for feldspar, although the latter is harder and is only about half the weight of the tungstate. It is also sometimes mistaken for barite (heavy spar), but is very much harder and much heavier. All four of these minerals are most often found massive, or without easily recognizable crystallization.

The chemical testing of the tungstates is so simple that it is not worth while spending too much time endeavoring to determine them with the eye or mechanically. The only equipment needed is a little hydrochloric acid and a few pieces of zinc, or anything containing tin, such as a tin can, tinfoil, or even solder. It will add considerably to the convenience of testing if a few test-tubes are available, and an alcohol lamp made from a small medicine bottle with some twisted cotton string for a wick will facilitate heating. If these aids are not available, a china cup or drinking glass and the campfire will do.

To test scheelite, a piece the size of a pea should be powdered and put in the test-tube or glass with about a teaspoonful of hydrochloric acid and boiled until a bright yellow powder is formed, which is an oxide of tungsten. After allowing the liquid to stand for several minutes, add a bit of zinc or tin can, tinfoil, or solder as large as a dime. The liquid will then turn blue, changing to wine color, and finally become brown, but the entire change may take several hours.

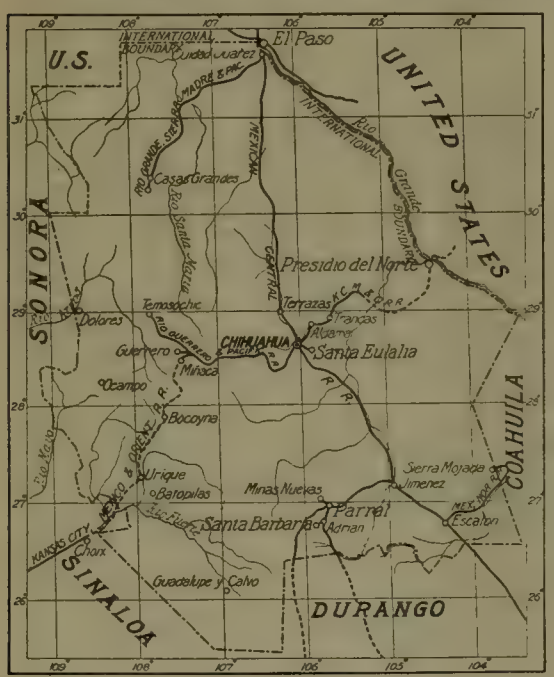
The other minerals should be tested in the same way, but the boiling should last fifteen or twenty minutes. No yellow powder will show, but the blue to brown color will appear on the addition of zinc or tin.

Tungsten ores are milled in stamp-mills, concentrated on tables, the coarse tailing reground in tube-mills, and finished on vanners and canvas. The ore, or concentrate, is paid for according to the percentage of WO_3 at so much per unit (1% of a ton, or 20 lb.). The higher the percentage of WO_3 the greater the price paid per unit. Standard quotations are for ore running 60% WO_3 or over, and the price at present is $7 and $8 per unit, which would make a 60% ore worth between $400 and $500 per ton. Any of the large assay offices will make a quantitative determination of the exact percentage of tungstic acid in samples for about $3 to $4, depending on the form of combination of the mineral, and will advise regarding the best market for such ores.

Mining in the Morelos District

By G. L. Sheldon

The Morelos district is situated in the southwest part of the state of Chihuahua, just south of the Batopilas district, and north of the Guadalupe y Calvo district. It is reached from the east over the Kansas City, Mexico & Orient railway, to within about 25 hours muleback ride north of Batopilas, Morelos being over 40 miles south of there. From Parral it is 60 miles over the railroad built for lumber and timbers, to the terminus, Zandia, and thence six or seven days muleback. The best route is from the west side, leaving the railroad at Fuerte, a journey of 35 to 36 hours, in the saddle. The town of Morelos is on Morelos creek, about two miles above where it empties into the Tenerivia river, which about eight miles below joins the San Miguel, the most eastern and southern headwaters of the Fuerte river. The town lies at an altitude of 2500 ft. and is a very old one, and in the early days the government had a mint there, coining silver slugs of 10, 20, and 50 ounces.



MAP OF CHIHUAHUA.

About 1½ miles northeast of the town is the San Pedro-Anastacio mine, and near by is the San Gil. The former has a record of nearly $2,500,000 (I have seen the records), and in 1867 one of J. B. Haggins' men offered $1,500,000 for it. The orebody is in diorite; when the vein passes into the granite it carries no valuable minerals. The formation and general physical conditions are the same as the famed Batopilas mine where much native silver occurs.

This mine was worked continuously from 1840 to some time in the eighties, when the old owner, who was an enterprising and practical mining man, died. His sons soon let it fill up with surface water and lost it. It has not been worked since until recently, when some Americans bonded it from the present owner, Manuel Perez, who is now the mining agent of the district and has been for the past twenty years. He was educated in California and is a competent honorable man. The Americans are extending a long cross-cut, which was driven in about 300 ft. This cut the vein and was driven some distance on it, but being in granite it carries nothing; it will cut the old workings at 300-ft. depth, in the diorite. The ore is free-milling and was treated by the patio process, being ground in water-power arrastres.

The San Gil, which in recent years has been owned by Henrique Creel, formerly Ambassador to the United States, has the same physical conditions as the San Pedro-Anastacio. It lies higher on the mountain and is developed by adits. It has been worked largely by lessees, more recently by Conness Shepherd, of Batopilas, but this lease was not profitable. The best ore always occurs in pockets of rich native silver; in the San Gil the ore of the vein is low grade when not in bonanza. At the San Pedro the low grade runs about 20 oz., and at Batopilas 12 oz. I saw one pocket which had been taken out of one of the Batopilas mines, on the 2000-ft. level, that was not over 80 ft. in length, 40 to 50 ft. in depth, and would perhaps average 2½ ft. in width; from this they took out $750,000.

At one time Conness Shepherd sent to the mint at Chihuahua over $100,000 of silver bullion that had been taken from the mine, cut out by chisels. As it must be at least 975 fine in order to be received by the mint, he refused to pay the mint tax, claiming it was not bullion, as he had never refined it. The case was taken to the higher courts and decided against him on the grounds that nature had refined it for him. These rich pockets are characteristic of the veins in the diorite. The San Gil has probably produced ₱1,500,000.

Immediately below these two mines is a short gulch about two miles long which is dry most of the year, but during and after the rainy season the native miners used to wash the gravel of the creek in their wooden bateas for native silver. To this they add some lead and smelt it in a blacksmith's forge, obtaining a bullion 975 fine, which contains about $2 gold.

Three or four miles south from Las Tajos an old trail can be followed for some distance on the mountain side. This is said to be an old trail to a lost mine, from which the ore was carried down for treatment; the mine has never been found. Two miles from Las Tajos, and 1000 ft. higher, is the old Rosario mine, worked at the same time as San Pedro-Anastacio. It is only 200 ft. deep, and has a record of upward of $1,500,000 from a silver-lead ore, with some gold value, in andesite. Near the surface the vein was only 1 in. wide, but at depth as much as 4 to 6 ft. It appears quite likely that the production was considerably greater, as there was much rich ore stolen. There are *vasos* at many places in the vicinity where the ore was smelted, wood being used for fuel, with a 25% lead flux. The ore is easily smelted when not too base; the lead is mostly burned off and lost, leaving the bullion 975 fine. I built two of these *vasos* of sun-dried brick, but their capacity is so small, 500 to 1000 lb. per day, that it is not profitable to use them for ores of less than 60 oz. silver content. The walls of the Rosario mine are soft and much oxidized. There was a small spring in the mine from which the water was conveyed in troughs to a sump and carried out in rawhide buckets on the backs of peons. Once the miners were away at a fiesta, in Morelos, for a week and the troughs fell down, softening the walls, which caved in, killing several men including the owner's son. They are still buried, as the mine has never been worked since.

In the early nineties a cross-cut was started and driven several hundred feet to cut the vein 300 ft. below the old workings, but was abandoned for want of means. Later, in 1904, some Pittsburg people completed this adit and cut a vein; in the old workings above there were two veins, one always carrying the ore; when the vein was cut the manager only drove on it, and some small pockets were found, assaying over 3000 oz., but he did not know enough to raise or sink on these, nor to cross-cut to the other vein, which may have carried the ore at that depth. The property has been idle ever since. A mile to the right of the Rosario, at about the same altitude, is an old mine with a large dump; no one knows when it was worked. Two and one-half miles to the west, at 8000 ft. altitude, is the Balojaque mine, which was worked at the same time as the Rosario; there evidently were two ore-shoots of good length worked to a depth of 100 ft., the ores being silicious brom-

ides and chlorides of silver. The old workings are in bad condition, but samples can be obtained assaying 2000 ounces.

To illustrate how easy a mistake may be made in mining, I may add that I and two associates secured the property, and I wished to run an adit on the vein, about 200 ft. in length, to get under the first ore-shoot 100 ft. below the old workings. My two associates insisted on going to the creek level and driving a long cross-cut over 500 ft., because it would thus afford 150 ft. depth. The majority ruled, the cross-cut was driven 354 ft., and we had to quit because the people associated with us would not put up any more money. Not over 2000 ft. south an Indian discovered a new vein on a small mesa, where the ore would pan a little gold. The Indian offered to sell it to my partners (I was in the States at the time) for $100. They examined it when the Indian was not there, sampling the red oxidized streak, which proved to be low grade, but failed to sample the yellow portion of the vein that was rich. The Indian sold it to Cecilio Diaz, who did 30 to 40 ft. of work and sold it to Conness Shepherd, of Batopilas, for $28,060. Shepherd took out and shipped 8 or 10 tons of sorted ore to Parral that averaged over 1000 oz. silver and 4 oz. gold.

At a depth of a little over 100 ft. the vein widened out,

A FARO GAME IN MEXICO.

with plenty of pyrite, some zinc, and low silver. We offered to bond it at $25,000, but he wanted $120,000; the property has been idle ever since. About one and one-half miles northwest of Las Tajos is the old Tajos mine where considerable work has been done, with good results it is claimed. There are several other good prospects in this vicinity worthy of development. Down the Tenerivia river, four miles below where Morelos creek empties in, is the Charcas mine, quite extensively worked by Conness Shepherd, of Batopilas. The vein is about 2½ ft. wide, but while fairly rich the ore was base, and on the whole it was not profitable. Above, on the right-hand side, is an old mine; the old Spanish records give a good report of it. Occasionally when some one re-locates it a little superficial work is done.

Below Charcas, on the right-hand side of the river, are several old mines, worked more or less during the past sixty years. Silver is the principal mineral, but there is a little gold and some lead. A little lower down the river and on the opposite side, in the granite, are several gold-bearing gash-veins, but they pinch out in depth. At the old San Miguel puebla, at the junction of the two rivers, is some placer gravel where the Mexicans wash a little gold. The content is low and the gravel was probably brought down and deposited from the San Miguel river. Back in the mountains several miles west is the old Guadalupe mine, with considerable ore containing 30 to 50 oz. silver. This was extensively worked years ago, and is now owned by a German. Not far away are two silver veins, 6 ft. wide, worked during the past ten years by some Arabs of San José de Gracia; they say the ore will average 30 oz. silver.

Farther up the river on the same side, on a high mesa near the foot of a mountain, upward of $100,000 in native silver was taken out from placer gravel. The source of this has never been found. Up the Tenerivia river, above where Morelos creek comes in, are several other old mines carrying silver and gold. About ten miles above, near the mouth of La Dura creek on the east side, is the old Las Huegueras mine; it has a large dump of good grade and it has a good record. During the past year the owner, a Mexican who has owned it a long time, has done some work and developed a good body of gold and silver ore worth over $1000 per ton. Before commencing work he asked $70,000 for it. Up La Dura creek six or seven miles there is a small gold district, and for the past thirty years considerable work has been done, mostly on the Dolores, El Rico, and San Pedro. There are several other more recent discoveries. Malaney Bros. have been there for the past twelve or fourteen years, but have always been hampered for sufficient funds. They have a small Huntington mill and have taken out considerable bullion. While the Morelos district is isolated it is possible to operate cheaply; labor is abundant and cheap, and nearly all are miners. Wood and water is plentiful, with fine pine timber in the higher mountains for all building purposes, whip-sawed and delivered cheaply (delivered for $30 per M). The climate is fine; oranges and bananas are as good as found anywhere. Three crops of sweet corn per year can be grown and tomatoes nine months of the year for two years from the same plant. Freight can be laid down from Fuerte or Choix for 1½c. per pound, and from Parral for 2½c. per pound. Many of these ores could now be cheaply treated by cyanide, and it is only a question of a few years when this district, which has been quiescent so long, will be rejuvenated.

Australian Dredging

An interesting statement of the output of gold and tin from the various dredges in operation in New South Wales in 1911 is embodied in the annual report of the Under Secretary for Mines (E. F. Pittman), and abstracted by the *Australian Mining Journal*. Mr. Pitman shows that the value was £307,340, or an increase of £27,132 in value on that of the previous year. The yield contributed by the gold dredges shows a decline in value to the extent of £22,496 when compared with that of 1910, but there is an increase of £49,628 in value recorded in connection with the quantity of tin ore recovered. Since 1900 the dredges have furnished an output valued at £2,449,753. In all 71 dredges were in operation. Details are tabulated below:

BUCKET DREDGES

	Gold.	Tin.
Number of dredges	20	4
Number of cubic yards of material treated	5,122,476	577,977
Total quantity won	19,939 oz.	147 tons
Value won	£78,192	£17,565
Average yield per cubic yard of material treated	1.87 gr.	0.57 lb.
Average value obtained per cubic yard of material treated	3.66d.	7.29d.

PUMP DREDGES

	Gold.	Tin.
Number of dredges	9	28
Number of cubic yards of material treated	1,260,429	2,533,782
Total quantity won	5,179 oz.	1,418 tons
Value won	£19,624	£167,284
Average yield per cubic yard of material treated	1.97 gr.	1.25 lb.
Average value obtained per cubic yard of material treated	3.81d.	15.84d.

THIRTEEN gold-mining concessions, aggregating 10,000 acres, in the Changsong district, north Phyong-an province, Korea, have been granted to Keiichiro Yasukawa, a wealthy Japanese.

Mineral Hill, Nevada

By R. H. Toll

Bordering the wide Pine valley, in the eastern portion of Eureka county, Nevada, is a low range of mountains in which valuable minerals in profitable quantity have been found in but one notable locality—a rounded promontory a thousand feet or so in height, which extends westward toward the valley, and is aptly designated Mineral hill. This mountain was widely known in the early days of mining in Nevada, high-grade silver ore having been discovered in 1867 by two prospectors who were searching the hills for a lost horse. Mineral hill is locally credited with a production during the next decade of four to seven millions, according to the state of inebriety of the old-timer who tells the story.

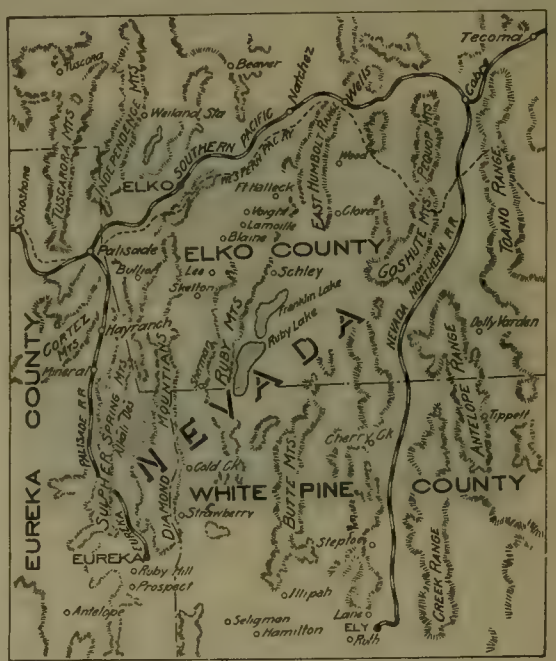
The orebodies were in limestone, which forms the capping of the hill, overlying slates of unknown thickness. All the ore was mined from the eastern end of the hill, where the limestone is thinnest, and the orebodies were irregular in both shape and content, with no apparent relation to the contact between the two formations. Narrow dikes of porphyry cut the sedimentaries from northeast to southwest, and these are probably responsible for the mineralization of the lime. The orebodies do not extend downward to the slate, all those so far discovered being quite superficial; for, though the eastern end of the hill resembles an enormous honey-comb, the greatest depth of the workings is 120 feet.

The mines were worked entirely by open-cuts and adits, and many of the stopes, as well as the cuts, are of considerable width and the ore was cheaply mined. The gangue is principally quartz, carrying 10% of lime and small amounts of iron, copper, zinc, and manganese, with traces of arsenic, antimony, and other base metals. Silver is the mineral content of value, the amount of gold being inconsiderable. In the surface ores the silver occurred chiefly as chloride, bromide, argentite, and polybasite, mixed with carbonate and molybdate of lead, carbonate of copper, and manganese. During the most prosperous times the ore contained 100 to 130 oz. silver per ton, but toward the close of the productive period the value fell to about 20 oz., after close sorting, and this appears to be the lowest grade which could be handled profitably under the most advanced methods at that time, though an extraction of 90% was made.

The treatment of these ores in the early days is a matter of historical as well as metallurgical interest, since the property was managed by no less a personage than M. Eissler, who describes the methods used in considerable detail in his valuable 'Metallurgy of Silver,' from which is taken the information here given regarding the milling process. The first discoverers of the mine shipped eighty tons of ore to Austin for treatment in the Manhattan mill by roasting and pan-amalgamation. The excellent results obtained by this method led to the construction of a 15-stamp mill, provided with a Stetefeldt furnace. The mill was situated about a half mile below the mine, and the ore hauled to it in wagons. After crushing in a Blake crusher it was dried by spreading to a depth of 4 to 5 in. on a cast-iron floor composed of plates about ½ in. thick. Under this floor was a system of 8-in. flues connecting with a fire-box at one end and a stack at the other. The ore was raked and turned constantly until quite dry, after which it was fed by hand to the stamps, one man attending to all the stamps.

The mortars were provided with double-discharge and 40-mesh screens; and the stamps weighed 850 lb. and dropped 8½ in. 63 times per minute. The fine pulp was taken away by a screw-conveyor and delivered to a bucket-elevator of the type now in common use, which fed the furnace. This furnace delivered the roasted ore upon a cooling-floor, from which it was trammed to the pan-room; four pans and two settlers being on each side of the tram-track. Each pan was charged with 1500 lb. of ore, and water to make the proper consistence was added, with a dipperful of sulphuric acid. After stirring for two hours 300 to 400 lb. of quicksilver was put into the pan, with 10 to 15 lb. of iron filings and borings, and the pans were run for six hours, amalgamating as much as 92 to 93% of the silver.

After a short period of operation it was found that 46% of the silver occurred as a chloride, and that this percentage could be increased to 92%, rendering roasting unnecessary. Therefore, the use of the furnace was discontinued and the ore was afterward treated by Washoe process, effecting a saving of $5000 per month in operating expenses and permitting the handling of thousands of tons of ore which previously had been considered waste. In order to prevent the loss of silver chloride by floating away, the ore was



MAP OF CENTRAL NEVADA.

crushed dry, and about 18 tons per day was treated. The bullion produced by this process averaged about 950 fine and brought a premium at the Mint, where it formerly was penalized on account of the large amount of copper. The daily cost of operation under the Washoe process was $220, or $12.22 per ton.

Another mill of twenty stamps was built, but was operated on ore only a few months, on account of the failing supply. Eissler found that the tailing which had been impounded averaged about 12 oz. silver; and, having been exposed to the atmosphere for two years, some of the sulphides had been decomposed, making their re-treatment practicable, and the larger mill was altered to handle this material at the rate of 48 tons per day, making a profit of about $20,000 from 7000 tons of tailing. As this was the first instance in Nevada of the treatment of tailing from roasted chloridized ores it is of interest in comparison with the methods in use for this purpose in later years, and with that adopted for the treatment of the dumps and low-grade ore in the mill now under construction. By reason of its record and the development of cheaper and more efficient milling methods during recent years it is quite natural that Mineral hill should have been the subject of numerous exploitations, which have been uniformly disappointing. Though the mine and dumps are said to contain a large amount of ore of profitable milling grade, the

practicability of economic extraction on a working scale remains to be proved.

About five years ago a portion of the old property was optioned by the Scenic M & M Co., but the panic fell on the enterprise like a wet blanket on a small flame, and smothered it before it was fairly started. Recently other property was added to the holdings of the Scenic company and the concern was reorganized as the Mineral Hill Consolidated Mines Co. Early in November last this company commenced the erection of a large mill, on the same day that marked the inception of construction work on the Eureka & Palisade railroad, which runs within five miles of the mine. Since then nearly 500 tons of freight has been hauled by wagon from Palisade, a distance of about 38 miles, and the last of the freight will be at the mill about the time the railroad is ready for operation. Instead of burning down the old mill to get it out of the way, or building a new one in a more advantageous situation, the fifteen stamps of the old-time Washoe mill were made the nucleus of the modern one, and around these have been placed parts of abandoned cyanide plants from various portions of the West, resulting in a structure which must be remodeled before it is completed. The method of treatment to be followed is probably the proper system; but the lack of design, poor construction, and the woeful arrangement of the machinery have been the despair of five engineers during the period of construction.

The ore will be trammed from the mine to a bin of 60 tons capacity, from which it will be delivered to the mill by a reciprocating gravity tramway 3100 ft. in length, two side-dump cars of 5 tons capacity being used. Thirty-five pound rails discarded by the railroad is used, and the gauge of the track is 30 in. The brake-gear is placed under the mine-bin, where it can be operated by the man who loads the cars. At the mill the cars will be dumped automatically over two grizzlies of different sizes, the one above the battery-bin having $1\frac{1}{2}$-in. spaces, and that over the rolls-bin having $\frac{1}{2}$-in. spaces, each grizzly being about 6 by 12 ft. and set at an angle of 30° from the horizontal. The oversize is divided between a No. 3 Gates and a No. 3 Austin crusher, which reduce it to the size of the grizzly openings, the Austin delivering to the battery-bin, and the other to the rolls-bin.

The number and weight of stamps remains the same as given above. The stamps are operated by the old-fashioned single-arm cams, and make 150 drops per minute. The screens are 4-mesh with No. 18 wire. The foundations of the battery remind one of Lincoln's joke about the length of a man's legs: It seems as if a battery-foundation ought to be long enough to reach from mortar to the ground; but such is not the case at Mineral Hill, there being a space of 18 in. between the bottom of the mortars and the top of the foundation. This is filled in with 6-in. pine blocks laid on their side, so the first few blows of the stamps will render them masses of splinters.

A set of 16 by 30 rolls receives the ore from the bin by means of a belt-driven Challenge feeder, and crushes it to about $\frac{1}{4}$ in., discharging to two 6-ft. Chilean mills, which also receive the discharge of the stamps. These mills are of special construction, similar to the Janney mills which have proved so satisfactory at the Utah Copper mill, and will doubtless be highly efficient here. A unique feature of these machines, so far as the Mineral Hill is concerned, is that some of the parts are new, every other machine in the mill being entirely second-hand. The Chilean mills will crush to 30-mesh, the pulp passing to the tables through a 6 by 8-in. launder set with a slope of $\frac{7}{16}$ in. per foot. The concentrating department comprises eight No. 3 and two No. 5 Wilfley tables, set head to head in two rows, all driven by the same line-shaft and at the same rate of speed. The line-shaft is $1^{15}/_{16}$ in. diameter, and 40 ft. in length, and, in addition to the 10 tables and 2 suction-pumps, it is loaded at the outer end with all the machinery of the sand-leaching department, consisting of a 4-in. centrifugal pump lifting 22 ft., a 7 by 6-ft. Goulds solution-pump, and two Dorr classifiers.

The tailing from the tables will be elevated to the classifiers, which are set on the roof trusses, and from the classifiers the slime will flow by gravity to the 12 by 36 ft. Dorr thickener, the sand going to six 5 by 14 ft. leaching tanks, through a Butters & Merz suspended distributer. It is expected that three days will complete the cycle of treatment in the sand tanks. The thickened slime will be diluted by strong cyanide solution and flow by gravity to the agitation-tanks, which are 10 ft. in diameter and 13 ft. in total height. They are three in number, built of No. 10 steel and provided with conical bottoms. In the centre of each tank an 8-in. riveted pipe extends to within 1 ft. of both top and bottom, being held in place by light angle-iron braces from the sides of the tank. Air is conducted to the bottom of this pipe through a $\frac{3}{4}$-in. wrought-iron pipe. In these three little tanks it is intended to treat 150 tons of slime (dry weight) per day, making an 85% extraction.

From the agitators the slime will be lifted 22 ft. by another 4-in. centrifugal pump to a 5 by 12-ft. wooden tank provided with a mechanical stirrer, from which it will flow by gravity to the Moore filter. This filter consists of two baskets of 34 leaves each, the latter being $4\frac{1}{2}$ by 6 ft. in dimensions. Goulds suction pumps are used, having 7-in. pistons and 6-in. stroke. The crane is to be operated by steam, since the small compressor will not furnish enough air for both this crane and the drills in the mine. The slime will be washed first with barren solution and then with water and discharged from the last vat by a screw-conveyor working in the bottom of the vat. The solution from the Moore filters will be clarified before entering the silver-tank by passing through an iron box similar to the ordinary zinc-box and packed with oakum. The box is so placed that each compartment may readily be flushed out by means of a hole in the bottom.

Precipitation will be effected in four zinc-boxes, each provided with seven compartments 30 in. square and 2 ft. deep. A heavy screen with $\frac{3}{4}$-in. openings rests on wooden blocks, which holds it 2 in. from the bottom, in each compartment. The barren-solution sump is directly beneath the zinc-boxes and partly supports them. It is 10 ft. high by 12 ft. diameter, and built of No. 10 steel. The solution is returned to the storage tanks by a Deming triplex pump, size $5\frac{1}{2}$ by 8 in., discharging through a 3-in. pipe. The storage-tanks are of liberal dimensions, 13 ft. diameter by 19 ft. high, and also of steel. Two of these are to be used for standard solution, and one for wash-water, the two being primarily for the sand department, which has no sump-tanks. The barren solution and wash-water will be drawn directly from the sand by the solution pump and returned to storage or pumped into another leaching-tank, an arrangement which causes no end of annoyance when the slightest leak occurs in a filter-bottom.

Steam-power is used with coal as fuel. A Reynolds-Corliss engine runs the Ingersoll-Rand compressor and the concentration and cyanide departments of the mill, while the stamps and heavy machinery are to be operated by a 16 by 36-in. horizontal slide-valve engine which is a relic of the early days. Water for the mill, as well as for domestic use, is piped from two small springs a mile or more from the mine, which in summer will hardly supply sufficient water for domestic purposes; hence there will be great difficulty in milling during the dry season, even with most careful conservation. In fact, it will not be an easy matter for the mill to operate at any time because of the flimsy construction of the buildings and foundations. The latter are already settling and breaking, large areas of roof cave in under the weight of a light snow, and the upper trestle and ore-chute have been demolished by wind; all of which serves to demonstrate how easily a meritorious enterprise may be ruined by incompetent management.

GOLD MINES are said to have been discovered along a river seven or eight miles from Hanuzuka station on the Fukuoka railway, according to the *Jiji Shimpo*. It is reported the ore averages 3 oz. gold per ton and has been estimated by authorities said to be trustworthy that $1,000,000,000 worth of gold is within easy reach at this place.

Sulphur Trade in America

By Albertus Koch

The past ten years has witnessed the destruction of the sulphur monopoly held for many years by the British owners of the Italian sulphur mines. In the same time the United States has advanced to the position of being one of the leading, if not the dominating, factor, in the world's sulphur-mining business. The development of the great natural sulphur deposits of Louisiana is responsible for these changes. In 1900 the sulphur production of the United States, exclusive of that derived from pyrite, amounted to only 3147 tons. In the same year 167,696 tons was imported, the greater part coming from Sicily. In 1910 the production of natural sulphur in the United States had risen to 255,534 tons, and the imports from Sicily had fallen to 10,704 tons. The imports of sulphur into the United States during 1910, from all sources, was 28,647 tons. But during the same year the United States exported 30,742 long tons of sulphur. This is a remarkable contrast to the situation existing in 1900, when 98% of the sulphur consumed in the United States was imported.

As a result of the decrease of exports to America, the Italian mines are seriously suffering from overproduction, and only 380 were in operation at the close of 1910. Their stocks of sulphur on hand have increased from 310,123 tons in 1901 to 647,567 tons in 1909. As a further blow to the Italian mines, Japan has lately become the leading exporter of sulphur to America. Of the 28,647 tons imported into the United States in 1910, Japan contributed 17,377 tons, Italy 10,704 tons, and other countries 566 tons. But since Japan has so far never produced more than 40,000 tons in any one year, it is not probable that competition from that country will ever become disastrous to the industry now pretty strongly established in the United States.

The rise to prominence of the sulphur mines of Louisiana contributes an interesting chapter to the mining history of the United States, and is another fine example of success achieved through persistent scientific research and experimentation. The Louisiana deposits are in Calcasieu parish, near the town of Lake Charles. For 40 years these deposits have been known to exist, but were never, until recently, exploited successfully, though much labor and many thousands of dollars in money had been expended. Even as recently as 25 years ago the lands on which are now the best mines were sold for taxes.

The difficulty lay in finding a satisfactory method of mining the deposits. The sinking of shafts was repeatedly tried, but failed because of the overlying quicksands. A Belgian company sought to conquer the quicksand by sinking huge iron rings to shut it out. Other methods introduced by well known engineers were likewise failures, and the lands were practically surrendered. Twenty years ago these deposits attracted the attention of Herman Frasch, a German chemist then in the employ of the Standard Oil Co. in the South. After studying the difficulties, he determined on a method for mining the sulphur and formed, in 1891, the Union Sulphur Co., to undertake the work. It was through his efforts that the project was financed, the money being secured from his associates in the Standard Oil Company.

Mr. Frasch's method of mining the sulphur has been described heretofore in the technical press, but the following short review may here be given: A large bore-hole was sunk, as in drilling for petroleum, and in it four pipes concentrically arranged were let down. The outer pipe is 10 inches in diameter, the next 6 in., the next 3 in., and the fourth is 1 in. The operation consists of forcing down the 3-in. pipe hot water and superheated steam at 330°F., to melt the sulphur. Compressed air is driven down the 1-in. pipe and bubbles into the melted sulphur and water. The specific gravity of the mass being greatly diminished, it rises to the surface through the outer pipes. It is then run off into large rectangular tanks made of rough planking. Some of these are as large as 350 by 250 by 40 ft., and they are so arranged that railroad trains can pass between them. After the sulphur cools and solidifies it is broken up and prepared for shipment.

With the solution of the question of mining, the troubles of the company were not by any means over. It was necessary to build a railroad to connect with the trunk lines, and to build and operate a line of small steamers to get the sulphur to tidewater. Then when production was finally started the company found its most likely markets in a precarious condition, because of a move on the part of the British owners of the Italian mines to crush this new enterprise and save their own monopoly. For almost a decade the Union Sulphur Co. fought the foreign combine. Though the public knew little of this industrial conflict, it was an exceedingly important one and meant either the destruction of a promising American industry or American control of the sulphur industry of the world. Inch by inch the Louisiana company won its ground, until it has practically driven Italian sulphur out of the American markets. The Union Sulphur Co. now controls practically all of the proved sulphur deposits in Louisiana, and while it is a close corporation, giving out no figures on tonnage produced or costs of production, it is known that it is yielding at the rate of close to 400,000 tons per year, and is capable of increasing this production at any time to 500,000 tons per year. The costs of production are estimated at $6 per ton. Production was begun in 1901, when the yield was about 40,000 tons. The yield has steadily increased to the figure given above.

This one company produces 98% of the natural sulphur output of the United States, and the product is approximately chemically pure, needing no refining. It seems justifiable to prophesy a further rearrangement of the sulphur business with the completion of the Panama canal. At the present time 60% of the sulphur imported into the United States is entered at Los Angeles, San Francisco, and Willamette, Oregon, and comes from Japan. With cheaper transportation, the sulphur from Louisiana will doubtless displace the Japanese product and be in supreme control of all American markets. It has already cut down imports into Atlantic seaboard points to about 5000 tons per year.

The Chilean Andes, Mexico, China, India, and the Philippines are known to have good deposits of sulphur, but in the light of present knowledge they can hardly expect to compete with Louisiana, where the deposits are known to be of enormous extent and the costs of extraction remarkably cheap. It is appropriate to close this article with the statement that Mr. Frasch, who has rendered such signal service to the sulphur-mining industry of America, recently received from the New York section of the Society of Chemical Industry the Perkins medal in recognition of his work in connection with the development of the Louisiana sulphur deposits.

Natural Gas

The United States Bureau of Mines has been investigating the composition and use of natural gas. In a recent address before the Natural Gas Association of America, George A. Burrell, of the Bureau, pointed out that in natural gas carbon dioxide may range from a trace, as in the gases of western Pennsylvania, to as much as 30% in gas obtained from Kings county in southern California. Nitrogen may occur in quantities ranging from a few tenths of 1% to as much as 10 or 15%. As an example of an unusual and extreme case, a natural gas occurring in the state of Washington contained 98% nitrogen. In general it may be said that those gases issuing under considerable pressure in the great fields which are providing heat and light for many towns consist of paraffine hydrocarbons in which methane predominates along with smaller quantities of ethane and traces of the still higher paraffines. These gases range in heating value from 900 to 1100 b.t.u. per cubic foot at 0°C. and 760 mm. pressure, with the average

more nearly approaching the latter figure. In these days when the heating value is the important factor in determining the usefulness of a gas, such high values are very significant.

The Bureau has issued one publication having to do with the properties of liquefied natural gas. In the production of gasoline a great waste has occurred, because in order to make condensates safe for shipment, the lighter products have been allowed to evaporate. The confinement of the material in iron cylinders for use as a bottled gas is now receiving attention. A gas is produced which has a heating value of at least 2200 b.t.u. per cubic foot, and a candle-power of about 45 when burned as a naked flame at the rate of 5 cu. ft. per hour. The use of a mantel will, of course, increase this lighting effect greatly. I. C. Allen and Mr. Burrell bottled in strong cylinders the condensate obtained by applying a pressure of about 500 lb. to the square inch and a temperature of 0°C. to crude gas obtained from wells at Follansbee, West Virginia. This could easily be done with casing-head gas which is at present going to waste. In the case of the exceedingly rich gas obtained at Follansbee, about 50 cu. ft. of gas per gallon of liquid was realized. Millions of people are so situated that gas is not used by them, but if bottled gas sold at a reasonable price becomes available, the outlet for the material will be large. One company is already in the field for the purpose of exploiting the liquid gas. The new product has been named 'gasol.'

Copper Smelting at Kyshtim

By V. P. Assaeieff

*Production of copper in Kyshtim began in 1907, but smelting in appreciable quantities began only in 1908. This was at the Soimonoffsky plant. It was subsequently determined to construct a new copper-smelting plant on Karabasheffsky hill with large water-jackets and converters, and also to build a large electrolytic refinery at Lower Kyshtim. It was proposed to produce 400,000 poods of copper per year. In September 1911 I saw at Karabash two new water-jacketed smelting furnaces, and a third similar furnace is now being built, smelting 25,000 to 30,000 poods of ore per 24 hours. The matte obtained is turned to blister copper in two 40-ton converters. At Nizhni Kyshtim the largest Russian electrolytic refinery has been built with a daily capacity of 1000 poods of copper, to be almost doubled, it is said, by the installation of new electric machinery. Just recently at Upper Kyshtim a Siemens' regenerative furnace, 145 ft. long, has been built for smelting fine ore and flue-dust.

Between the smelters and the mines a railway has been laid down, and a locomotive (steam and electric), electric cranes, and pneumatic lifts, are at work. The principal operations are as follows:

Karabash plant—

1. Pyrite smelting in large water-jacketed furnaces to matte with 25 to 35% Cu.
2. Converting the matte to blister copper with 99% Cu in large converters.

Lower Kyshtim plant—

3. Refining blister copper and casting in anodes.
4. Electrolytic refining of copper and extraction of gold and silver.

Further important operations carried on are:

Upper Kyshtim plant—

5. Smelting fine ore and dust in large Siemens' regenerative furnaces.
6. Smelting of poor matte in small water-jacketed furnaces.
7. Converting concentrated matte to blister in small converters.

The board is sparing no expense in the search for the required ore reserves. The requirements will reach 90,000 to 100,000 poods per day. On this 400,000 rubles have already been spent, and 300,000,000 poods of ore of 3% copper content have already been proved. Other 200,000 rubles will probably be spent this year, and five diamond drills, two for 500 and three for 1500 ft. holes, are now at work. Three more 1500-ft. outfits may be bought this year. Most of the ore is now produced at the Konyuchovsky mine, then at the Smirnoff and Tisoff mines. Fortunately there is abundance of fluxing quartz and limestone at Kyshtim. The quartz assays 92 to 96% SiO_2, and the limestone 53 to 54% CaO. The pyrite smelting is done with very little coke, at most 1 to 1¼% of the mixture or 1.5 to 1.7% of the weight of the ore, so the annual consumption of coke does not exceed 300,000 poods. It comes from south Russia, England, and Germany, the cost being about the same. Wood is used for the boilers and furnaces, but recently lignite from the Cheliabinsk region is coming more into use.

Copper is now produced in the Karabash, Lower Kyshtim, and Upper Kyshtim plants. The first plant was begun in 1909, and it started full work in January 1911. The chief dimensions of the furnaces are 22 ft. long, 4½ ft. wide, and 19 ft. high. There are 52 tuyeres to a furnace, of which 47 to 48 are always in use; the blowers are of about 600 hp. each, and give 30,000 to 35,000 cu. ft. per minute, under a pressure of 6 to 8 in. mercury column. The blast is cold, and 40,000 to 50,000 cu. ft. is used to 1 ton of mixture, or 50,000 to 60,000 cu. ft. to 1 ton of ore. Gas and dust pass through two wide flues. About 5000 poods of dust is extracted per day with a content of 2.8 to 3.5% copper; thus about 50,000 poods of copper (value 500,000 rubles) is recovered per year. The third furnace (now building) will have the capacity of its dust-trap more than double that of the others.

The efficiency of the water-jacketed furnaces is as follows: The mixture in July 1911 for both furnaces was ore 75%, quartz 15%, limestone 5%, coke 1.25%. The quantity of mixture smelted was 2,040,276 poods, of which 1,512,397 poods was ore. The resulting matte was 135,448 poods, dust 159,530 poods, and slack 1,282,620 poods. The average analysis of the matte was copper 26.53%, iron 41.4%, and sulphur 25.1%. The total of sulphur in the mixture was 608,593 poods, of which 5.63% passed into the matte, 4.38% into the slag, and 1.76% into the dust. The result is considered to have been very satisfactory and to quite justify the expenditure involved in construction of the plant.

To convert the matte into blister copper two Pierce-Smith 40-ton converters are installed at Karabash. From the quantity treated in July 1911, 101,669 poods matte and 24,284 poods of copper was produced. The average copper content of the matte was 26.5%. The special laboratory at Karabash employs five chemists, who made 2500 assays last August.

The blister copper from the Karabash and Upper Kyshtim plants are treated at the Lower Kyshtim electrolytic works. The blister copper is smelted into anodes in regenerative furnaces with wood gas, and the output is 2400 poods of copper re-smelted per 24 hours. One cubic sagene of wood gives 425 poods of anodes averaging 99% Cu.

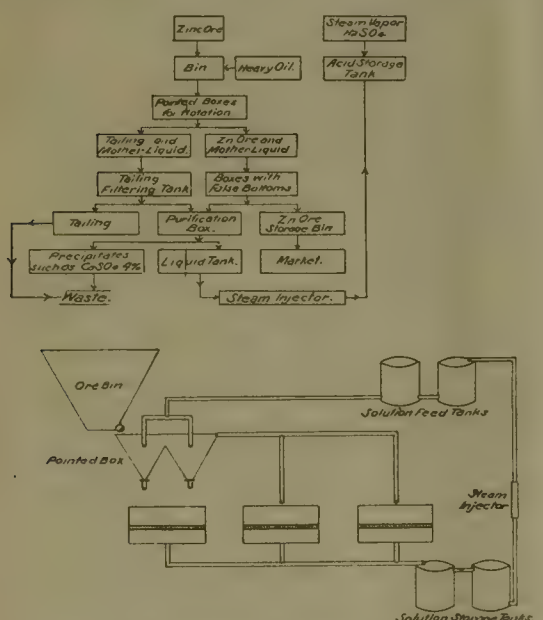
The electrolytic plant is a large one-story building with 396 baths of wood, lined inside with lead 41.5 in. deep, 27 in. wide, and 68.5 in. long, in twelve series of three rows of eleven baths each. Each bath contains 9 anodes and 10 cathodes; the former are now being increased to 12. The current in the bath is 0.3 volts. The Upper Kyshtim plant provides the current by gas engines. The electrolyte consists of a solution of sulphate of copper and free sulphuric acid—solution 1.2 sp. gr.—which is led into the bed of the baths and rises up to be siphoned into subsequent series. Thanks to the purity of the anodes, the electrolyte has not been changed since starting the plant. The Upper Kyshtim plant is now an auxiliary one. At Kyshtim there are millions of poods of fine ore besides the millions of poods of dust from the furnaces, the annual production of which, at Karabash, is calculated at 2,000,000 poods. To smelt these and the fine ore a large Siemens-Martin furnace has been built.

*Translated by the *Mining Journal* from the *Gorny Journal*.

Flotation of Zinc Ores in Japan

By Tadashiro Inouye

The Kamioka mine of the Mitsui Mining Co. is the principal producer of zinc in Japan. Up to the present ore has been marketed in the form of concentrate which has been shipped to Europe, but a smelter is now being built and it is proposed to make spelter for the local market. The mine is in the provinces of Hida and Etchu, the offices and principal works being about 35 miles from Toyama on a branch of the government railway. The property is said to have been opened twelve centuries ago, but was worked only on a small scale until purchased by the present owners in 1888. Now there are extensive underground workings reached by adits, and two large ore-dressing works, at Shikama and Mozumi, respectively, 10 miles apart. The ore is a mixed sulphide, occurring in irregular bodies metasomatically replacing limestone lenses in



FLOW-SHEET OF MILL.

rocks of presumed Archean age. One ore-shoot in the Tochiboro mine has a maximum cross-section of 50 by 300 ft. and has been mined for 1000 ft. in depth. The Tochiboro ore contains 1.3 to 2.5% Pb, 10 to 16% Zn, and from 3 to 4 oz. of silver per ton. The output is about 10,000 tons per year. The ore as it comes from the mine is treated in wet-concentration plants by means of classifiers, jigs, buddles, and tables. Argentiferous lead and zinc concentrates are produced, and a zinc middling, which is re-treated in a flotation plant. The lead concentrate is roasted in reverberatory furnaces and pots, and smelted in blast-furnaces. The rich lead is liquated and desilverized. The matte is roasted and refined by the *mabuki* process.

The flotation process used at the Kamioka mine was developed locally along lines described in Potter's 'Principles of Flotation,' the principal difference being the introduction of heavy oil in the heated and acidulated solution. During treatment the solutions are kept at 80 to 85°C. In making up the solution, 12 lb. of H_2SO_4 of 54°B. is used for 100 *kan* or 826¾ lb. The dilution is about 2:1 of solution to ore. Of the crude ore, 0.09 to 0.14 gal. is used for the same quantity of ore. The scheme of treatment is shown in the figures above.

The pointed box in which the separation occurs is made of wood, and is 5 by 2 ft. in plan. It is separated by a wooden partition into two parts, of which the second, 5 ft. deep, is the deeper. At the bottom is a hard-lead cock. The heading and tailing tanks are 6 by 6 ft. and 5 ft. deep. They are made of wood and have false bottoms, through which the solution drains, being carried to the solution-storage tanks by means of a stream of water. The solution-feed and storage tanks are all made of wood, and are approximately 6 ft. deep and 6 ft. in diameter.

About 16,500 lb. of material is treated in this plant in 10 hours. This corresponds to about 4% of the raw ore coming to the dressing plant. The feed, mixed middling from Wilfley tables and buddles and floated material from classifiers, contains 20 to 30% Zn. The product from the flotation plant assays 45 to 50% Zn. While finer material may be treated, the best results are obtained from ore between 50 and 100 mesh in size. The extraction is computed as 80% of the zinc, and the final tailing assays 5 to 6% Zn. The output amounts to 50 or 60 tons of zinc product per month. Following are analyses and sizing tests of the material treated:

Analyses of Materials Treated

	Jig Middling, %.	Wilfley Middling, %.	Buddle Middling, %.
Pb	0.47	0.40	0.28
Cu	0.18	0.19	...
Fe	4.27	4.93	5.00
Zn	24.13	27.32	34.90
SiO_2	35.74	34.00	28.40
Al_2O_3	6.74	4.88	2.80
CaO	1.18	2.46	3.00
MgO	0.71	0.46	...
S	16.26	20.22	...

Size of Material Treated

Mesh.	Wilfley Middling.	Buddle Middling.
50- 80	4.6	...
80-100	21.3	...
100-120	13.9	0.7
120-150	10.1	1.3
150-180	18.4	2.7
180-200	7.9	4.0
200	23.8	86.7

The jig middling is 30 mesh and finer in size. The distribution of the zinc in the jig middling is shown by the following representative sets of analyses:

	Sample A.		Sample B.	
	%.	Zinc, %.	%.	Zinc, %.
30	11.0	28.0	14.6	25.5
30-50	28.2	26.0	34.2	22.7
50-70	48.7	22.2	41.9	21.8
70	12.1	22.5	9.2	21.7
Total	100.0	23.9	99.9	23.0

The following results for the period extending from May to November in 1911 may be quoted, the figures being in *kan*, equal to 8.2673 lb. each:

	Amount.	Zn, %.	Zn Content.
Feed	695,703	21.9	152,577
Product:			
High-grade concentrate	143,207	52.7	75,450
Low-grade concentrate	102,393	45.6	46,665
Total	245,600	49.7	122,115

Extraction 80 per cent.

The expense for treating 695,703 *kan* (about 2880 tons) in the same period amounted to Y43,590.14; equal to Y6.28

per 100 kgs, or about $7.50 per ton. The principal items were:

Labor, days pay	Y 5,277.03
Labor, contract	2,448.86
Materials	34,324.66
Repairs	1,195.46
Total	43,246.01

For supplies the main items were as below:

	Amount.	Value.
Sulphuric acid, lb.	141,135	Y2366.58
Fuel, cu. ft.	1,589	817.78
Crude oil, gal.	1,258	227.04
Miscellaneous		21.06

Cyanidation at Treadwell

Gold ores at the Treadwell mines yield about half their value by amalgamation. In the case of the Alaska Mexican, the average percentage of recovery as free gold has been 46.66. In the mill of the 700 Ft. Claim the percentage has been 52.95. From the plates the pulp goes to vanners and the remaining saving is in the form of a gold-bearing pyritic concentrate. Formerly this was shipped to Tacoma for smelting, but now it is treated by cyanidation in a plant on Douglas Island, owned jointly by the Alaska Treadwell, Alaska Mexican, and Alaska United companies in the proportions of 60, 20, and 20%, respectively. The plant was described in 1911* by W. P. Lass, the capable superintendent, and the description need not be repeated. In the reports of the Alaska Mexican and Alaska United companies now available, the following interesting details regarding operation for the first half-year are made available:

OPERATING COSTS PER TON, MAY 16 TO DECEMBER 31, 1911

Operation	Labour	Power, Air and Steam	Supplies. Item.	Amount.	Cost	Sundry Supplies	Totals.
	$	$		Lbs.	$	$	$
Grinding	0·1123	0·1284	Pebbles	20·36	0·3090	0·0207	0·5698
Cyaniding	0·1955	0·0377	Cyanide	2·28	0·4725	0·0044	0·7770
			Lime	7·87	0·0669		
Filtering	0·1756	0·0313	Kelly Bags	—	0·0076	0·0105	0·2250
			Cloth	—	0·0208		
Precipitation	0·1193	0·0217	Lead Acetate	—	0·0480	0·0145	0·4846
			Zinc Dust	2·79	0·2147		
Refining	0·2164	0·0219	Sulphuric Acid	—	0·0564	0·0481	0·8778
			Fluxes	—	0·0350		
Superintendence	0·1284	—	—	—	—	—	0·1284
Repairs	0·1166	—	—	—	—	0·0884	0·1500
Assays and Accounting	0·0758	—	Assays	—	0·0478	0·0318	0·1549
Totals	$1·1349	$0·2394	—	—	$1·2743	$0·1629	$2·8115

Mining and Scientific Press, October 21, 1911.

Milling at the Butte & Superior

*At the new plant of the Butte & Superior Copper Co., Butte, the ore is dumped into the bins at the collar of the shaft, and fed into a crusher which reduces it to 4 in. ring. Thence it is carried by a conveyor belt to the secondary crusher at the head of the mill, where it is reduced to 1½ in. mesh. This is for the purpose of insuring a uniform mill-feed, both as to grade and size. From the secondary crusher the ore is automatically conveyed to the mill storage-bins, of 2000 tons capacity, which may be increased to 8000 tons at small expense. The ore is distributed uniformly throughout the length of the mill storage-bins by a mechanical traveling tripper. The crushed ore is withdrawn from the mill storage bins on apron feeders which dump it upon a third conveyor belt, and it is then fed to a set of rolls which reduce it in size to 5 mm. From the rolls the ore is elevated to the Richards-Janney hydraulic classifiers, and the larger sizes of ore are fed to the coarse jigs. The coarse jig tailing is then re-ground to 1½ mm. in the Chilean mills, and from there are conveyed to another set of Richards-Janney classifiers and the product goes to the fine jigs. All of the jigs are of the Harz type and have been adopted after thorough tests.

The tailing from the fine jigs is reground in the tube-mills and is conveyed to six large settling-tanks, each of which is 28 ft. diameter and 14 ft. high. In these tanks the jig tailing is combined with the overflow water from the hydraulic classifiers and settled to a thick pulp. The cleared overflow water is returned to the mill system and used over again and the pulp is drawn off from the bottom of the tanks and is ready for treatment in the flotation plant. The flotation plant consists of a heating box, mixing-boxes, and a spitzkasten. The ore is slightly heated and mixed with oil in the mixing-boxes and then decanted into the spitzkasten, where the gangue settles to the bottom. The concentrate is discharged into a launder by which it is conveyed to the concentrate-bins. In the concentrate-bins it is thoroughly dried, the water running off through screens. The concentrate from the coarse and fine jigs is re-treated in a set of cleaner jigs for the purpose of raising the grade from 45% to 50 or 55%. These concentrates are also carried by the launder to the shipping bins. The tailing from the cleaner jigs is sent to the tube-mills for further grinding and then to the flotation plant. The lead content of the ore is removed on three Wilfley tables, the only tables used in the mill. It will be remembered that the Butte & Superior was started as a copper mine but proved in depth to be a zinc mine. The zinc mineral is practically free from iron, making its concentration easy.

*From the *Butte Miner*.

OPERATING COSTS PER TON, TREADWELL MINES, MAY 16 TO DECEMBER 31, 1911

Month Ending.	*Total Tons Treated.	Average Value of Concentrate Recovered per Ton.	Average Value of Tailing Discharged per Ton.	Estimated Extraction Per Cent.	Labour.	Electric Power. K. W. Hrs.	Electric Power. Value.	Pebbles. Pounds.	Pebbles. Value.	Cyanide. Pounds.	Cyanide. Value.	Lime. Pounds	Lime. Value.	Zinc Dust. Pounds	Zinc Dust. Value.	Sundry Supplies.	Total Cost per Ton.
1911.		$	$		$		$		$		$		$		$	$	$
June 15th	2,113·00	52·4189	1·7634	96·6	1·2213	26·69	·1216	15·08	·1900	2·46	·5168	7·19	·0647	2·05	·1586	·4338	2·7068
July 15th	1,600·00	59·4549	2·0519	96·6	1·5609	26·47	·1100	14·62	·2018	3·08	·6765	8·50	·0801	2·63	·2215	·5255	3·3793
Aug. 15th	2,280·00	68·1625	2·0276	97·0	1·1319	23·66	·0954	19·59	·2859	2·63	·5526	6·40	·0594	1·84	·1427	·3545	2·6224
Sept. 15th	2,316·99	63·2121	2·2503	96·4	1·1138	26·56	·0195	19·70	·2789	2·50	·5257	6·56	·0593	3·51	·2888	·4007	2·7167
Sept. 30th	1,330·00	57·2152	2·3467	95·9	0·9389	27·46	·0601	27·35	·3972	1·37	·2842	7·82	·0696	3·10	·2412	·3542	2·3454
Oct. 31st	2,641·00	61·6594	2·0150	96·7	0·9772	33·00	·0950	26·96	·3724	1·93	·3827	8·03	·0715	3·73	·3111	·6009	2·8108
Nov. 30th	2,558·59	59·2367	2·3805	96·0	1·1452	31·72	·1730	22·37	·3824	1·95	·3686	7·81	·0691	3·25	·2067	·6306	2·9756
Dec. 31st	2,911·52	60·4150	2·1841	96·5	1·0807	26·68	·1276	17·52	·3339	2·23	·4842	7·00	·0657	2·20	·1552	·6241	2·8684
TOTAL AND AVERAGES	17,751·10	60·4375	2·1123	96·5	1·1349	27·98	·1076	20·36	·3090	2·28	·4725	7·37	·0669	2·79	·2147	·5059	2·8115

* This column is the number of tons ground and is not the same as tons received or tons discharged.

Bolivian Placers Again

The contradictory reports regarding the Tipuani placers in Bolivia give especial interest to the following extract from a letter published in *The Union Democrat* of Sonora, and written by R. T. McNeeley, W. E. Trosper, J. J. Scofield, and G. B. De Ferrari, four experienced California prospectors who visited the region this spring. The men feel that there are large opportunities in the country for experienced men properly financed, but warn all others against making the long and expensive trip. The excerpt is from a report to the partnership grubstaking the party. "As you all know, we started for the Bolivian goldfields on the strength of the Ferguson letter. On our arrival at La Paz we found that letter to be a fake. Naturally, we were much discouraged, but after careful investigation found that the great wealth of the Incas came from Bolivia and especially the Tipuani region. Therefore, it was reasonable to suppose, knowing that they had never been able to get below the water-line, that if a dredge could be put to work in some of those rivers—and there are many of them—we would undoubtedly find pay-dirt and lots of it. About this time, F. G. Schultz, knowing that we were there on a mining expedition, came to us with a proposal. He had his eyes on this concession for some time, but not having the capital to handle it himself, had simply been waiting for an opportunity to handle it on a royalty basis. He at one time was manager for the Boston Bolivian Rubber Co., and had gone up and down this river many times, panning all along, and had always found good prospects wherever he had worked. He spoke very highly of it and said if we could get a dredge in there our fortune was made. However, we were skeptical; it sounded too good to be true; but after discussing among ourselves and making more inquiries, we decided to go and look at the property. We were among the eight out of over a hundred who went into the country.

"We prospected all the way in, with indifferent success, and as it was too rough for dredging, we were not very favorably impressed. We finally reached the village of Guanay, where the Tipuani and the Mapiri rivers run together, forming the Rio Kaka, and it is on this river that this concession lies. We immediately made camp and started work, and, to our great surprise, found that Mr. Schultz had told us the absolute truth in every way. Every pan of dirt prospected from twenty to thirty colors. We could not get below the water-line, but ground that will prospect in this way on the surface will undoubtedly be very rich at bedrock. After doing all we could on this end, we immediately tried to get a boat, as we wanted to go the full length of the concession, and there are some places on the river where the banks are perpendicular, so it is impossible to get down except by boat. We were unfortunate in this, as we got to Guanay just when every available boat had gone down the river with cargo to the rubber plantation and would not be back for at least two weeks. We talked it over and decided to stay and wait for the return of boats, but on looking over our stock of provisions, which had become very much depleted owing to rains and mules falling over the bank, we found it would be impossible. We had already prospected about two miles and found it all the same.

"Realizing that we had something good, we hurried back to La Paz to see if there was any opposition. On our arrival there we found everything moving in good shape, with little chance of opposition. We intended sending a cable explaining, as we had sent for a code and expected to find it with W. R. Grace & Co., but for some reason it had not arrived. It would have taken two or three pages to explain without a code, and even then it would have been indefinite. We discussed the advisability of one of us staying, but as it would be two or three months before anyone was needed and it would not cost any more to come home than to stay there, and furthermore, as we didn't know for sure whether you could handle a proposition of that size, we thought it best to come home and give you the facts in person and assist in any way that we could in forming a company. If you wish to go ahead, we are ready to go back at any time and serve the company in any way that we can.

"We left Mr. Price and his partner at Tipuani working on a hydraulic claim. We were informed by responsible people that a great deal of money has been taken out a this place by divers, and we believe that Mr. Price and his partner have a good chance to 'make good.' Our concession starts 20 miles below where they are and is about 30 miles long. Beginning there an English company has a concession and is trying to operate a small dredge, but as it had to be packed in on mules it is a small affair and breaks down every time they start. They have raised a lot more capital and intend to go ahead."

Gold Discovery in Venezuela

By W. Henderson

*Some rich discoveries of gold have been made in the interior of Venezuela. One, in the municipality of El Callao, not far from the Yuruari river, has been named Salva la Patria. It is calculated that up to April 15 this mine has yielded over 35,000 oz. of fine gold. During the month of March more than 6000 oz. arrived at Ciudad Bolivar, and in the first two weeks of April the arrivals amounted to more than that, and the gold is coming in all the time. Near the Caroni river and also in the Paragua district gold has been taken out, but not in such large quantities. The extremely low level of the water in the Caroni river caused a small island to appear in its course, and from this some gold was taken; but the river is now rising and has covered the island, so that work there has necessarily ceased.

The following statement appeared in a letter from a merchant in the interior, in which he writes about the Salva la Patria:

"There are two *barrancas* (shafts) dug by a group, which are simple pools of gold. I have seen eight pieces of more than 40 oz. each, all containing more gold than rock. With such *barrancas* the greatest disorder prevails; outside people get in at night and have taken out more gold than the owners themselves, who have had to fence up the approaches and have an armed guard at night."

Of course the Government will soon restore order, and one does not now hear of any disturbance. There are some 2000 men digging or exploring around the Salva la Patria, but of course not all are successful. From what I understand, the gold is found in pockets or chimneys 50 to 100 ft. down, and not in true veins. Permits to work may be granted by the *jefe civil* (mayor) of the district; afterward the titles must be taken out in Caracas from the national government. The maximum permit is for 200 hectares (494.2 acres) and for a term of 90 years. It is a well known fact that the interior of Venezuela, even where gold has been discovered, has not been adequately prospected, and the larger part has not been explored, so these discoveries will probably continue. The gold now coming in is of a high fineness, and there is little expense in getting it out; but on account of various difficulties and high freight rates, due to inadequate facilities, a quartz mine has a hard time trying to make both ends meet. A concession has been granted for a railway into this part of the country, but English capital is desired, rather than American.

The only companies now working are the Gold Fields of Venezuela, an English concern which has not paid any dividends, but which is bringing in machinery and securing surrounding mines at low prices; and a French company which is opening the La Experiencia mine, situated between El Callao and Guasipati, with shafts and galleries, and expects to begin working in a few months. The old El Callao mill is crushing some quartz for private parties and is working the sands with the cyanide process. The directors of this group of mines have at last adjusted all their difficulties with the Venezuelan shareholders and propose to reorganize with a French company.

*From a consular report.

The Salida Smelter

By George J. Hough

The smelter of the Ohio & Colorado Smelting & Refining Co. at Salida, Colorado, is one of the most important reduction plants in the West. The works are about two miles west of Salida, on the line of the Denver & Rio Grande railroad, and are amply provided with tracks and switching facilities. The power-plant consists of one 500-hp. and one 300-hp. Corliss engine, which are served by a battery of five boilers. There are two No. 7 and two No. 8 Connersville blowers, and one engine and two blowers are used for each pair of furnaces, the two blowers delivering into one bustle pipe. The engines also furnish power for the pumps, but a large part of the power required for the plant is purchased from the local electric power company, as the samplers, the roasters, and the crushing departments are all run by electric motors. The sampling plant is complete, and has a capacity of 100 tons in 10 hours, or about three cars of ore can be sampled in one shift. A 1 10 shovel sample is taken from the cars and put through the crusher; in the case of large lots, the sample is cut down by a Vezin sampler to one-fifth, then

SALIDA PLANT, OHIO & COLORADO S. & M. CO.

passed twice through rolls and cut with a small Vezin sampler, giving 1 20 part of the original lot. But small lots, after the preliminary crushing, are crushed by rolls and then cut on the small sampler. This sample is then coned on the iron sampling-floor, and 1 5 taken in the usual manner; it is then crushed by 12 by 18-in. rolls to about 20 mesh, and cut down on a large split sampler to a few pounds in weight, duplicate samples being taken. The samples are dried 24 hours in a steam bath, ground fine in a cone-mill, then taken to the sample-room and cut down to a few ounces in weight, which is pulverized to pass a 120-mesh screen. While the ore-supply comes mainly from Colorado, ore is also received from neighboring states, Idaho furnishing a good deal of high-grade galena ore. Leadville furnishes the iron oxides for fluxing, and considerable silicious sulphide ore; the limestone used comes mainly from Garfield, a few miles from Salida, and does not carry any gold and silver. All sulphide ores are bedded before roasting, and the bedding system is very elaborate; on each side of the series of beds are the railroad tracks, while the beds are crossed at short intervals by small lateral tracks, making it easy to distribute the ore. The bedded sulphide ore is conveyed in mine-cars to the Godfrey roasting-furnaces; these are round brick furnaces of the moving-hearth type, and each has a capacity of about 35 tons per day. The sulphur content is reduced to 15%. From the Godfrey furnaces the roasted ore goes directly to the Dwight-Lloyd sintering machines, of which there are four; three large machines 48 in. wide and one small machine 36 in. wide. The improved Dwight-Lloyd machine has a moving grate similar to an endless belt, and having a width of 36 to 48 in. and a length of about 15 ft.; the ore is fed automatically on to the grate from a hopper, in such a manner as to give a uniform layer several inches thick. The charge passes under or through a fire-box with a down draft, setting up an intense roasting and sintering action in the layer of ore for a few minutes, after which the glowing sinter travels slowly for a distance of about 10 ft., when it is discharged from the grate as it revolves; the movement is slow, giving ample time for the sintering reaction and part cooling of the ore, which is discharged directly into steel cars. The sintered ore has about 5% sulphur. The capacity of the large-sized machine is about 85 tons daily.

In the smelting department there are four blast-furnaces, two with a hearth area of 45 by 144 in., and two 45 by 180 in.; the furnaces are run in pairs of one small and one large furnace, the two being served by one blast-main and having a capacity of about 420 tons per day; the blast pressure varies from 30 to 36 oz. The furnaces are fed by hand. Slag is tapped into large matte settlers, and the overflow is received in slag-pots mounted on trucks which are hauled by electric locomotives to the dump. The lead is tapped into small bullion pots carried on trucks; the dross is skimmed off, and the bullion cast into bars to be shipped East for refining. The plant employs about 275 men; with the exception of the foremen and superintendents, the majority of the employees are foreigners, Austrians predominating.

Working Cost and Profit on the Rand

Johannesburg Correspondence

The question of how to increase the profits on the Rand continues to attract attention. Undoubtedly the fall in the average grade last year from 28s. 6d. to 27s. 7d. was, in face of the steadily increasing costs of the two previous years, namely 1911 and 1910, a serious question, but at the meeting of the institution of local engineers a speaker attributed more than one-half of the decline in grade to the unbridled scramble for tonnage during the year on the East Rand Proprietary Mines. When, however, the same speaker came to deal with the 5d. increase in the working costs the effect of this unbridled scramble for tonnage in sending unprofitable ore to the mill was totally ignored, but it is clear that if in this particular instance this practice had the effect of lowering the average yield it had likewise a similar effect on the average working cost. Probably the chronic scarcity of native labor and power troubles had something to do with the increased cost of last year, but what is more important in the gold mining industry today is the fact that now, when the native supply is increasing, the average working costs are not coming down, having increased during the first two months of the year to the extent of 9d. per ton. It must not, however, be overlooked that owing largely to the starting up of several better grade mines and the adoption of cleaner methods of mining, the average value of the ore milled has increased from 26s. 8d. per ton last August to 28s. 3d. per ton in February, an improvement of 1s. 7d. per ton. Such an improvement is encouraging in showing that since August a better grade of ore has been sent to the mills, which may, to some extent, be due to the scramble for low tonnage costs having been restrained. If, however, working costs during that same period are studied, a good deal of the encouragement disappears, for they have increased 1s. 5d. per ton, so that the net gain was only 2d. per ton. Still a net gain of 2d. per ton makes a total gain on the Rand of nearly £300,000 per year in the working profit, while a similar gain can be produced by lowering the working cost in a legitimate manner. Most engineers will agree that, with honest mining on the Rand, it is easier to lower the costs than raise the grade without being accompanied by more than a corresponding increase in the tonnage costs, so that it is in this direction of more economical mining that efforts are needed.

The Messina mine, owned by the Northern Transvaal Copper Co., has produced to June 30, 1911, 65,788 tons of ore, yielding 9700 tons of concentrate assaying 53% copper. The estimated ore reserve to the eighth level is 430,000 tons, which, it is estimated, will yield a profit of £600,000. It is proposed to erect a smelting plant, capable of treating 120,000 tons per year, at an estimated profit of £150,000. The company has issued £250,000 6% debentures, and the Camp Bird, Ltd., has guaranteed 5 years' interest on these debentures.

Unwatering a Mine Under Difficulties

By C. B. Whitwell

The mine at which the work here described was done is a small property in Yuba county, California. It was bonded several years ago, and a shaft sunk to a depth of 350 ft. along the vein, the real object being to intersect a parallel vein of greater dip at the 800-ft. level. During the sinking of this shaft a first-class mine plant was erected including 65-hp. and 30-hp. Western gas-engines, to furnish power for the 5-drill air-compressor, a 5-stamp mill, rock crusher, and a Cornish pump capable of lifting 75 gal. per minute. At the 350-ft. level the vein became flat. By survey the vein, which it was desired to intersect, was determined to be less than 150 ft. away, providing the flat pitch continued. Unfortunately, the cylinder of the large engine cracked, and the company, having expended all its funds in erecting the machinery and stamp-mill, was unable to get a new cylinder on credit. The mine was kept free of water for two months, but finally allowed to fill. This caused forfeiture of the bond.

Before closing down, the owner employed men to overhaul the machinery and place new pump-rods where needed. With everything in first-class condition, and with a complete plant, it was but a short time before the property was again bonded. Before signing the bond, the machinery was examined and found to be in good running condition and the pump in first-class working order. In fact, everything appeared to be favorable for unwatering the mine in a very short time and at a small expense. The water had risen to within 25 ft. of the collar of the shaft. Accordingly, pumping was started and everything went along far ahead of schedule time for three days. At midnight of the third day, the night man entered my room with the information that everything was running smoothly but that the pump was throwing no water. The only conclusion seemed to be that the pump-rods had worked loose and become disconnected. As there was no break above water, there was no remedy for the trouble save to go about getting the water out in some other way. A skip was ordered. By the time this was operating, the mine had filled again, the water having been lowered over 100 ft. The skip handled the water nicely for the first 80 ft., then trouble began, as it constantly jumped the track. A day was spent in repairing the track.

The next trouble was the impossibility of trying to get the skip past a post which was set out of line with the others and so close to the track that the pin holding the bale to the skip would not pass. This necessitated the arduous task of sawing out a piece of the timber under water. Matters continued to move along again until the level was reached to which pumping had been carried. The skip would apparently fill all right, but rose from the water off the track. At first this was thought to be due to hitting the water too hard, so that the skip floated. After several unsuccessful attempts to hoist, I made an under-water survey and discovered that a rail had been carefully removed. Several schemes were tried for spanning this gap, but without success, and therefore hoisting by skip was discontinued. A small Hooker pump was immediately borrowed nearby, attached to the hoisting cable, and lowered on trucks to the water's edge. As the shaft was equipped with a 2-in. air line, this was disconnected near the water and 50 ft. of air hose attached. As fast as the water lowered, the pump was let down by the hoist, and extra lengths of column pipe added at the top. By using the air hose, very little time was lost, as it was only necessary to screw on an extra length of pipe every 20 ft. for the first fifty.

Fifteen feet below the point to which the water had been lowered by the Cornish pump the break in the rods was discovered. Evidence indicated that the nuts had been removed from the bolts and the bolts had worked out. Otherwise the rods were in good condition, were quickly connected, and pumping was resumed with the Cornish pump. Directly opposite the break in the rods was the space in the track formerly occupied by a rail. This rail had been removed and carried away. Unwatering a mine could not have been started under more favorable conditions. Everything indicated that the cost and time of unwatering would fall well within the limit of time allowed. The possibility of the human race producing an individual mean enough to perpetrate such a piece of work had not been taken into account; an act all the meaner since he had been employed and paid to fix things up in first-class shape. I suppose there are some who would say that he had done so.

Hoisting Ropes

A thorough study of hoisting ropes has recently been published in *Glückauf*, which may be summarized as follows: (1) The productive efficiency of lubrication has not been clearly proved except in dry shafts. This suggests the conclusion that the present lubrication process for wet ropes leave room for improvement, though it is certain that all known lubricating agents rapidly disintegrate in shafts with acid or salt water. Future experiments in this direction may provide a remedy. (2) Galvanizing or coating with zinc does not appear to have had a really protective efficiency in wet shafts, the reason being probably that zinc coating has but little power of resistance to salt water. It is also suggested that the wires have suffered by the galvanizing process, for, though it has been proved by Winter and others that that process, when properly and carefully executed, does not unfavorably affect the ropes, it is also well known that it often reduces the tensile strength of the rope by 50% and even more. (3) The efficiency of ropes in dry shafts stands in the proportion of 100 to 60 or 70 as compared to wet shafts, which, in view of the high prices of ropes, means a substantial economic advantage for dry shafts. (4) Tensile strength between 160 and 180 kg. per square millimetre does not unfavorably affect the flexibility or hauling strength of the ropes, while ropes of more than 180 kg. per square millimetre have given substantially lower efficiency figures. (5) The greater or lesser strain, as expressed by a higher or lower safety factor, put upon ropes has had no influence upon their efficiency. It may therefore be assumed that the advantages of a higher safety factor are neutralized by its disadvantages, namely, greater rope thickness combined with reduced flexibility and greater dead weight.

United States Quicksilver Production, 1911

The production of quicksilver in 1911 was the greatest since 1907, the total output being 21,256 flasks of 75 lb. each, valued at $927,989, against a production of 20,601 flasks, valued at $958,153, in 1910, according to an advance chapter by H. D. McCaskey, from 'Mineral Resources of the United States for 1911.' California was the greatest producer in 1911, with 18,860 flasks, valued at $867,749, and the remainder of the quicksilver came from Nevada and Texas. While there was an increase in the output of quicksilver last year, the amount produced was over 5000 flasks below the average annual output of 26,609.5 flasks for the decade ending with 1911. Until Texas began production in 1899, California supplied practically the entire output of the United States for the last half of the nineteenth century.

The annual domestic consumption appears to have been in recent years from 18,000 to 21,000 flasks, or about equal to the domestic production. The decrease of domestic stocks and higher prices in 1911, however, caused an increased importation of quicksilver—the heaviest in many years—from 667 lb., valued at $381, in 1910, to 471,944 lb., or 6293 flasks, valued at $251,386, in 1911. On the other hand, exports of quicksilver decreased from 1923 flasks, valued at $91,007, in 1910, to 291 flasks, valued at $13,995, in 1911—the smallest export in many years.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Zinc and Lead Mines

The Editor:

Sir—In your issue of the *Mining and Scientific Press* of June 8 you have a short article purporting to be a review of the lead and zinc activities of the various states, in which the writer thereof stigmatizes the lead mining industry of the Joplin district as a "rather attractive gamble" or as a "pretty speculation." Naturally the man engaged in mining here and with first-hand knowledge of the industry resents any such imputations, for the industry is not only a well established one, but the field offers to the industrious operator, engineer, or mining geologist such clear indications that prospecting and mining in this district to the student of actual conditions, not mere theories based on textbook knowledge, has passed beyond the 'gamble or speculation,' either ugly or 'pretty.' Of course we have our 'gambles,' and we have 'old-timers' selling out. We have our bad promotions no less so than other mining districts, nor more so either. For a man like yourself, who has known the hospitality of the district, made some attempt to study it, even issued a report upon it for the United States Geological Survey, to allow a journal of national importance to openly slur and insult the largest and most important zinc district in the United States seems to me incredible, and I trust that you are not personally guilty of the discourtesy and gross misstatement of facts.

OTTO RUHL.

Joplin, Missouri, June 13.

[We commend the promptness and fervor with which Mr. Ruhl flies to the defense of a district for which we own a partiality, but we do not agree that the language of our correspondent involves any open 'slur or insult' to the district. Lead and zinc deposits are as a class notoriously irregular, and in the case of the 'shallow diggings' at Joplin, to which the context shows our correspondent specifically referred, one "invests money at the risk of loss on the chance of unusual gain," and that, according to the Century dictionary, constitutes speculation. Men have made a profit of over $100,000 in 18 months from an expenditure of less than $10,000; we have also known them to make nothing from an equal expenditure, and, if anything, the last mentioned investors used the greater care and had the benefit of the more competent advice. As geologists and engineers, we would like to believe that mining can be freed from risk, but the facts are to the contrary, and we must pin our faith to the overbalancing 'unusual gain' that may fairly be expected from a certain portion of our ventures. There are men and companies that make money at Joplin and in other lead and zinc districts through times of high and of low prices alike, but to do so necessitates large capital, so as to spread the risk and average the loss. The attractiveness of lead and zinc mining for the ordinary small investor, and it is especially attractive, lies in the fact that it is always possible to enter the business with small capital expenditure and that at certain times the profits are so large as to make a "very pretty speculation" even for him who must put the bulk of his eggs in one small basket. Our correspondent was pointing out, and in this we join him, that, in view of the high price of metals, now was an especially good time to invest in lead and zinc. We are glad to note that in the Joplin district alone, $400,000 in new capital is said to have been recently invested. That $175,000 should have come from so careful a concern as the Consolidated Mines Selection Co., speaks well for the district. In Montana, on the Pacific coast, and all up and down the Rocky Mountains, there is an active search for zinc. The movement is not confined to America, as is shown by the interest in Australia and the building of plants in Japan. Zinc consumption is increasing, and a margin that in tonnage loomed large a few years ago is now small when measured in percentage of output. All of which gives proper comfort to zinc producers.—EDITOR.]

An Unusual Type of Mill

The Editor:

Sir—The mill of the Fort Bidwell Consolidated Mines Co., as described by W. G. French, in your issue of June 22, has one novel feature—that the rock-breaker is on a level with the battery floor and an elevator is used to throw the ore into the bin to be fed to the stamps. In your issue of January 21, I described this 5-stamp mill as follows: "The mill has 5 stamps, 1000 lb. each, with mortar set on concrete base, battery posts made of 12 by 28-in. timbers set in cast-iron sole-plates on concrete base. For a mill of this size I consider it most economical for the rock-breaker to be placed on the same level as the battery, with an elevator to the ore-bin. The rock-breaker is here under the care of the battery-man, for in a mill of but 5 stamps one man is easily capable of doing all the work. There are other advantages in this construction, such as less height needed for ore-bin, no vibration from breaker communicated to bin or building, the breaker is always in sight of the millman and does not run for hours without attention, as is often the case when in the attic of the ore-bin, and the dust, if any, is at once settled on the ground instead of filtering down from the ore-bin to every part of the mill.

"It was found on excavating for the millsite that what appeared to be a porphyry bedrock was underlain by tough blue clay of unknown thickness. Ten holes 4 ft. deep were drilled into this clay, the bottoms sprung with one-third of a stick of powder, and 1-in. rods, previously upset, were cemented in and turned over at the top. The concrete was laid on this foundation."

It will be seen from this that the rock-breaker was put on the battery-floor level with the five stamps. This mill was erected primarily to treat the Mountain View ore; which is a strictly free-milling ore, as 80 to 90% can be extracted on the plates. The idea of putting in a tramway to the Sugar Pine mine and the addition of another five stamps were later considerations. The ore-bin was divided into two compartments, one for the coarse ore and one for the fine and the broken rock from the breaker. Mr. French says the whole product goes to the rock-breaker. This is not so; there is a grizzly for the ore from the Mountain View mine, as well as for that from the Sugar Pine.

When ore was developed in the Sugar Pine mine it was decided to build an aerial tramway. To save the expense of building up the ore-bin another story and also to allow as much fall as possible between the two terminals, for the tramway goes over a mountain, I decided to leave the rock-breaker as it was and use the elevator as hitherto. There was no trouble and a rock-breaker man was not necessary. It was then decided to put in another five stamps. This was done with snow on the ground, and shortly after the machinery arrived it was impossible to get in any more freight. On making the excavation for the new five stamps it was found that the bed of blue clay dipped downward, necessitating a higher battery block. As I only had on hand enough cement for the usual size of block I fell short, and had no means of getting any in. What more natural than that I should adopt the form of construction that in other cases has proved successful (Silver Peak, for example), namely, a wooden base on top of the concrete for the mortar to set on. Some may call this poor construction, but while not as good as an all concrete block, it is still good.

The boiler and engine in use for the five stamps was sufficient to run ten stamps and a rock-breaker on a pinch, but could not run ten stamps, a rock-breaker, the tramway, and elevator, and I informed the officials of the company that five stamps must be shut down during the time the rock-breaker and tramway were running. I had in mind at the time that power would have to be increased; for the Sugar Pine ore, not being free milling, would re-

quire a cyanide process, and more power would then have to be applied. This second battery was put up, but not completed, for it has no ore-bin. I put in a temporary chute to lead ore from the present bin to the new battery, simply to try it. As a consequence of this lack of ore-bin the structure is not as stable as it should be. The first stamps in this respect are excellent, there being almost no vibration at the base of the battery posts.

It may be well for would-be critics to consider a few items. The staff correspondent of the *Mining World* states: "This also applies when the Ft. Bidwell Con. company spent $40,000 on a 10-stamp mill, and tried straight amalgamation, which saved but 15% of the heads on $100 ore." The 10-stamp mill, with tramway included, did not cost $20,000, and the original purpose for which the mill was put up was to treat the Mountain View ore, on which it saved not only 15%, but as high as 85%. The Sugar Pine ore did not come until later, and while the mill saved better than 15%, the company was not in a financial condition to install an expensive cyanide plant without some knowledge of the conditions that the ore required.

Last year the first team got to the mine in July, and the season practically closed in November. Both mills were erected with snow on the ground, and if anything was missing it was necessary to do without it. This required some figuring at times. These mills and tramway were put up by myself with what local help I could train. The one carpenter I had for a short time was very poor on rough timber work. The construction of both mill and tramway was made of hewn timbers, which cost much less than sawed lumber. This was particularly so of the tramway, which crosses a rough mountain, with the timber growing nearly where it was used.

ALGERNON DEL MAR.

Bishop, California, June 24.

Alaskan Development

The Editor:

Sir—After a continuous residence for the past eleven years in Alaska, and having been a close observer on the ground of the conditions prevailing here, I am led to the conclusion that the views of all writers on Alaskan development, including the utterances of W. L. Fisher and Gifford Pinchot, are much too narrow and distorted to form a safe and successful basis for government action. The main discussion in the press has magnified the importance of the Bering river and Matanuska coalfields out of all due proportion, where we are considering the 600,000 square miles af Alaska as a whole. A. H. Brooks, of the U. S. Geological Survey, estimates that under the most favorable conditions for shipment, the ocean transportation of Alaskan coals would not amount to more than 1,000,000 tons per year, which is a small matter when we are considering the development of so large a public domain as Alaska.

As matters now, and for a long time past—more than ten years—stand, the fuel and timber supply of Alaska have been so bottled up that they have not been available for use in the development of Alaska; and that is the reason why Alaska has made no increase during that time in population or its industries. Under present conditions the territory is on the decline, and must so continue until a governmental policy is inaugurated as liberal and encouraging to both labor and capital as that under which the 'States' were so successfully developed. We must still now, as in all our past, depend entirely on the prospector and pioneer to discover the natural resources and on capital to develop them. This seems too apparent to require further consideration. Neither of these forces will embark in development work without the promise and prospect of suitable reward. That reward always has been, and presumably always will be, the choice of ownership by the discoverer. The government leasing system of our lead and copper mines from 1807 to 1849 proved a dismal failure and cost the public much more to administer than it returned in rentals. Many citations by various writers of other countries, where it is said government leasing systems of public lands are operating successfully, are entirely misleading, for they fail to further inform the reader that all these leasing systems provide that the lessees may any time during the term of the leases purchase the leased lands at a price stated in each lease. A half truth may be more misleading than a whole lie. All writers on Alaska entirely overlook the paramount fact that the coal and timber is of vastly greater importance in promoting the development of the frost-bound region than for all other purposes. In fact, Alaska never can be developed to any but a limited extent without the practically full and unlimited use of the coal and timber scattered to the farthest interior. Of the 12,000 square miles of coal measured, so far as at present known, the larger percentage of acreage lies far from water transportation, but contiguous to the many mountains containing the mineral deposits. Though most of the interior coal measures carry lignite coal, it is of greater value in developing the interior than all the coal in the Bering river and Matanuska fields because of its proximity to places of local consumption. Railroad lines are important, but much less so than are the interior fuel and timber in the early development of Alaska. Unless the Government shall build railroads into the undeveloped portions of Alaska, and that comprises all Alaska except a narrow strip along tidewater, these roads will not be built until development shows their need, or until they will pay to operate. Building railroads in Alaska much ahead of development by private capital is out of the question. It would be like building mills to treat ore before the mines were found and sufficiently developed to produce.

Leaders of ultra conservation who found their theories before they (or, indeed, anyone in the States) knew enough about conditions in Alaska to frame a 'working hypothesis' will fail in the end to reap renown or benefit Alaska by blinking facts that are sure to come to the people in the near future. Alaska is too large a national asset to remain long unknown. Even though the Government could secure net returns, which I emphatically deny, under a leasing system applied to any of the resources of Alaska, it seems clear that if such system should retard the development of that territory it would not be desirable, for all admit that the speedy development of Alaska is paramount in importance. Unjust and extortionate treatment of Alaska, either by the government or by capital should not be permitted. The urging of a leasing system as a cure for such an evil is idle and foolish in the extreme. Everyone knows that the American people are demanding that capital shall be controlled, and the present administration is actively working to that end. Either the people will succeed in controlling or regulating capital, or our government will take the form of a plutocracy instead of a republic. If our government cannot prevent robbing by the rich and powerful in the States, it cannot do it in Alaska. Any leasing system that does not confer the right of the lessee to purchase will not develop Alaska. It will, on the contrary, drive out of business, and finally out of Alaska, every prospector, pioneer, and poor man seeking to acquire land for himself and his children. All Alaskans, given their preference, favor the right to purchase what they discover, and their views will be views of all who think of coming to Alaska. Who then will develop Alaska? Of all men it is not likely to be the man back East who sits in his easy chair and writes for public consumption and with the hope that he is making a national figure of himself. Alaskans are as like as two peas to the post-army of frontiersmen who were seeking fortunes and homes in the unexplored wilds that have marked our frontier boundary since the landing of the Pilgrim Fathers. They, of all men, knew best how to develop the regions they explored. The country wisely listened to them for a hundred years and never once found them in error. Will the country listen to them once again, or turn a deaf ear and follow the leadership of the ultra-conservationists as applied to Alaska? Alaska has thrown down the shovel and pick and stands anxiously awaiting an answer.

JULIUS THOMPSON.

Katalla, Alaska, March 1.

Special Correspondence

DENVER, COLORADO

Improvement in Mining Conditions. Hudson Mill. Smuggler Union and the Liberty Bell. Zinc in Demand. Wages at Aspen.

The general status of the mining industry in Colorado shows improvement over the conditions that have existed for the past few years. Manufacturing companies and engineers are active, and the prospect for a steady improvement is good. The state has about passed through a period of depression which was the result of a number of causes, chief among which were exhaustion of high grade ore deposits, inability to treat low-grade ores at a profit, and diversion of capital into irrigation and land enterprises. The first of these has not been remedied and there is no immediate prospect or hope that it will be; but the second and third causes of our depression have been largely overcome. The treatment of low-grade ore is no longer a serious problem from the metallurgical point of view, and the tendency to withhold money from irrigation and land projects has resulted naturally from an excess of such schemes and a deficiency of water. There is, therefore, a strong probability that more capital will now be available for sound mining ventures.

Following the lead of the Hudson mill in the Idaho Springs district, where success was attained in cyaniding silicious sulphide ores having an average value of $10 per ton, the owners of the old Newhouse tunnel have decided to erect a large custom mill at the tunnel mouth in which will be employed a combination process of amalgamation, concentration, and cyanidation. The plans call for a 300-ton sampling department, and three mill-units of 100 tons each. For the present only the first mill-unit will be constructed, and it will be completed and placed in commission this fall. Excavation has been started and machinery is now being purchased. The new plant will embody the latest in milling, and is expected to materially increase the mineral output of the district.

In the Telluride district the remodeling of the Smuggler-Union and Tomboy mills is progressing rapidly. At the former a complete cyanide equipment has been added for the treatment of slime, in addition to making changes in the stamp-mill, where Wilfley and Deister tables have replaced the old Gilpin county bumping tables. At the Tomboy mill some changes have been made in the ore-dressing system whereby the mixed lead-iron-zinc ore will be separated into three shipping products without the use of electrostatic or electromagnetic processes. The suit of the Smuggler-Union against the Liberty Bell for damages amounting to $600,600 for trespass and unlawful extraction of 74,000 tons of ore, was heard in Denver during the first week in June. The case was hotly contested, and several experts were employed by both sides. Toward the end of the trial the Liberty Bell made a defense of innocent trespass and claimed that only 53,000 tons of ore had been taken from Smuggler-Union ground. The jury, seemingly, failed to consider the defense of innocent trespass, for in its verdict it awarded the Smuggler-Union damages amounting to $403,000. This is one of the largest damage awards ever brought in by a jury in the federal court in Colorado. The Liberty Bell company will file a motion for a new trial.

Inquiry for zinc mines is greater than for many years past, and a number of important sales are being considered. Developed mines are scare, but the satisfactory state of the metal market and the prospect of good prices for zinc has had the effect of stimulating search for prospects or partly developed properties. Owners of well developed mines are in a position to realize good prices for their properties, and are not anxious to sell under present conditions. The Leadville district especially is doing a good business in zinc ore, and a large tonnage of both carbonate and sulphide ore is being shipped. The smelters are taking carbonate ore of a lower grade than formerly, and some contracts have been made for ore carrying as little as 20% zinc.

The trouble at the Smuggler mine, Aspen, which resulted in temporarily closing that property June 5, has been amicably settled, and the men have returned to work. A question of wages was involved. The miners presented their case in a most courteous and friendly manner to the management, and the latter conferred personally with the miners at a public meeting. The following schedule was asked by the miners: timbermen, $3.50 per day; machine men, $3.50; miners, shovelers, and trammers, $3. The schedule ruling differed from this only in the wages for shovelers and trammers, who were paid $2.75 per day, as in the Leadville district. Although Mr. Davis, the manager, frankly pointed out to the men that he believed that wages should be graded according to skill, and that miners should properly receive a higher wage than trammers and shovelers, he acceded to their wishes and announced that the schedule proposed by the men would be adopted. As a pure question of sociology he believed that the change was wrong in principle, but, inasmuch as a similar change had been considered at Leadville, he was willing to be governed by the proposal of the miners. The possible effect of the change on the discipline of the mine was pointed out to the men, but they assured the management of their hearty co-operation in improving the efficiency of the work. It is expected that the mine will be in full operation about July 1, but future operation will depend on the success in bringing about economies which are so necessary in a low-grade mine.

JOPLIN, MISSOURI

Prospecting Companies for Persons of Limited Means. — Experiment in Shaft Raising.—Concrete Collar to Protect Shaft from Floods.—Zinc and Lead Notes.

Co-operation in churn-drilling is becoming popular with persons of limited means in the Joplin district. The system may be adopted in other localities where mining conditions are similar. A company consists of 50 shares, the cost of each being $5 per month. A secretary is chosen at a nominal salary, say $25 per month. A churn-drill, costing possibly $2000, is purchased on payments of about $100 per month. These expenditures leave about $125 per month to pay for the drilling expenses. Leases on virgin land are obtained at 10% royalty or less. If the company is fortunate in finding ore in any of the first few holes sunk, it is quite likely an operating company can be found to take over the lease at an advanced royalty. Thus the prospecting company may receive a royalty of 20 or even 25% of the ores sold, depending on its richness, and in turn pay the 10% royalty to the land owner. Or possibly the prospected lease may be sold. In either case the shareholder reaps a big return on his investment. Several companies of this type are now operating in the district, and in almost every instance the shareholders are getting good returns.

At the Nowata mine a shaft is being dug from the bottom up instead of from the top down, and this is the only instance of the kind in the district. The shaft was started in the roof of a drift, 220 ft. beneath the surface. Hugh Correll, superintendent, is keeping careful cost figures and reports a great saving with the shaft now at a point about 100 ft. above the drift. The method of procedure is unusual. An ordinary 8-in. drill-hole was sunk at a point where it was necessary to sink the new shaft. This hole penetrated the drift. A boiler, hoister, and derrick were placed above the drill-hole and through it a heavy wire cable was lowered, being attached at the bottom to a substantial platform, containing an air-drill. The platform is raised into the shaft as though it were a cage. A drillman prepares the rounds of holes in the top of the shaft, which, in this case, corresponds to the bottom of the average shaft. A powder-man loads the rounds; the cage is lowered to a point of safety in the drift, pulled slightly to one side to escape the shower of broken rock, and the shots are fired by electricity. All the costs of shoveling the broken rock into tubs to be hoisted and the heavy costs of pumping in a newly sunk shaft are eliminated. The saving in time also is proving a big factor in favor of this novel shaft-digging

system. The Yellow Jacket mine, in a district flooded beneath several feet of water when a near-by river rises, has overcome the trouble by the construction of a concrete collar about the shaft. By a small investment, O. W. Sparks, manager of the mine, has saved thousands of dollars which would have been expended in pumping. The collar is substantially constructed and is 6 ft. high; sufficient to rise above the highest floods on record.

Almost $400,000 in outside capital, some of it from foreign countries, has been invested in Joplin mines within the past few weeks. The largest sale was that of the Mary C. mine, owned by Thomas Coyne, to the Consolidated Mines Selection Co., Ltd., of London, England, for $175,000. The Taylor Snapp tract of 400 acres sold to the M. W. Sheridan Syndicate, of Chicago, for $150,000. The Katy Lou mine sold to the Hydraulic Mining & Milling Co., of New York, for $50,000. The Birthday mine sold to the Nonandoga company for $5000. Zincblende is strong at $53 to $59, basis of 60% metallic zinc, with choice lots bringing $62. Lead ore is stronger at $58 to $60.

BLACK HILLS, SOUTH DAKOTA

PRODUCTION OF WASP NO. 2.—ELECTRIC POWER FOR THE HOMESTAKE.—ELECTRIC FURNACE FOR DEADWOOD COMPANY.

Wasp No. 2, during May, paid $15,000 in dividends. This was earned on the handling of 15,200 tons of ore that returned a little less than $2 per ton. The introduction of a number of labor-saving devices, the most important of which is a steam-shovel for stripping overburden, has made this accomplishment possible. The ore is a quartzite, mined in open-cuts, and is crushed to about $^1/_6$-in. mesh and cyanided. During the past month some unusually high-grade ore has been shipped to smelters, but the proceeds were not available for the May distribution of profits. This material has averaged more than $250 per ton. It is only a small body, occurring under the quartzite, and is removed after the quartzite is mined, so that the tonnage is comparatively small, and no particular effort is made to hurry its production. General samples assayed around $275 per ton, and the screenings gave better than $8000 per ton. H. C. Osterman, who has a lease on the Merritt mine, at Galena, is opening up this old property and taking out a first-class grade of lead-silver ore. The streak is not large, but there is enough of the ore in sight to make it an attractive proposition. He intends to make regular shipments to the Omaha smelter.

The Kiemer Gold Mining & Milling Co. was recently organized with the following officers: H. H. Kiemer, president; Olaf Seim, vice-president; Mrs. Elizabeth R. Kiemer, treasurer; Jesse Simmons, secretary, all of Deadwood. The company has 210 acres of ground adjoining the city limits of Deadwood, where there is a large showing of phonolite porphyry. On the surface careful sampling has shown an average of $5.20 per ton for a width of 30 ft., and the company intends to thoroughly develop this shoot. The Echo company, at Maitland, will soon resume work in its shaft, which is now 75 ft. deep, with the intention of quickly completing it to 200 ft. This decision was arrived at recently when some Eastern parties who are heavily interested in the property visited it. An electric hoist will be installed.

The work of electrifying the Homestake property is progressing at a good pace. All of the stamp-mills were equipped with the new power some weeks ago, and this week the work of placing motors for driving the crushers was completed. The crushers are put at the different shafts where ore is hoisted, and had previously been operated by independent Corliss engines. The New Reliance company has levied an assessment of 1c. per share to take care of floating indebtedness and make some few changes preparatory to starting the mill. Cince the return of good weather the Bismarck company has put a good crew of carpenters at work on the completion of its mill, adjoining the Wasp No. 2, and every effort will be made to finish the plant this summer. The severe winter made it necessary to suspend construction. The Deadwood Zinc & Lead Co. announces that it has decided to erect an electric furnace for smelting its ore. The ore carries about 9% zinc, 5% lead, $5 gold, and 5 oz. silver per ton. There is an immense quantity developed, and tests which have been made assure the officers that electric furnace will save a high percentage of the contents at a moderate cost.

The Castle Creek dredge at Mystic is in operation, and will be put in condition to withstand the coming winter and operate continuously. Last year, the first season it operated, was productive of good results, both financially and from a technical standpoint. Several things were learned about the ground, with the result that during the winter suspension a number of changes were made that should increase the efficiency of the boat. The main trommel has been lengthened, iron rings inserted, and a pump added to throw a constant stream of water into the trommel. These changes are planned to break up clay balls which it was discovered carried off a portion of the gold. Other minor changes have been made. The Golden Summit mill at Hill City is operating continuously on a vein 5 to 6 ft. wide

WASP NO. 2 MILL.

that contains a 2-in. streak of rich ore. This material is being sacked. The Forest City mill near Hill City is rapidly nearing completion, and is one of the most complete 5-stamp plants in the Black Hills. This property contains a small body of high-grade ore, practically all of which is free milling.

WASHINGTON, D. C.

CONSIDERATION OF APPROPRIATION BILLS.—SURVEY APPROPRIATIONS VOTED.—ECONOMIZING ON THE BUREAU OF MINES.

Interest at Washington the last two weeks has naturally centred on the two conventions, none the less, business is being transacted. In the House the Sundry Civil bill was taken up June 14 and has brought out some sharp debate, though not the usual fireworks. After an earnest consideration of the food served at Soldiers' Homes, with reading in detail of menus that made the reporters want to go out and get a bite, the annual contest between the cow and the oleomargarine trust came up. This time the cow lost. In the course of debate on the proposal to abolish local Registers and Receivers of the land office, A. W. Rucker, of Colorado, tried to persuade Congress to turn over the remaining public lands to the States, but received little encouragement. The annual effort was made to reduce the appropriation for protecting the public lands from land thieves, after which the committee steam-rollered F. W. Mondell, who thought that at least $50,000 per year should be spent in Wyoming on surveys. The Geological Survey appropriation aroused neither comment nor opposition, recalling the happy country that had no history, rather than 'the watch-dog's honest bark' that characterized the 'welcome as we drew near home' in the good old days of Holman from Indiana. However, the Bureau of Mines provoked a storm. The committee had granted an increase of $35,000 for fuel testing, but the best efforts of M. D. Foster failed to get a special appropriation of $50,000 for 'investigations and inquiries into the mining and treatment of ores and

other mineral substances,' and J. R. Mann, whose bright little smokerene is always working, saw to it that if there be any more mine inspection in Alaska it shall be paid for out of the general funds. The fact that the inspector was authorized to use a sleeping car if he could find one was too much, and the item was excised from the bill with a rush. So careful and virtuous had the Committee of the Whole become by that time that it indignantly refused to authorize the Secretary to accept land for laboratories or switch tracks for mine-rescue cars if offered for nothing to the Government. In the interest of economy rent will be paid. Then having corrected the totals and adjusted its papers the House passed to the next item, national parks, and hurried on the 'pork,' public building bills. In the Senate there has been much official debate over the army appropriation bill, and unofficial discussion whether F. E. Warren, of Wyoming, is to be allowed to keep his fort and promote his nephew. It is feared that the veto by the President will prove too popular and that a choice will need to be made between nephew and fort. Incidentally, the tariff has been discussed in a desultory way, but the tariff, like the poor, will always be with us, and no one feels hurried.

LONDON

REVIVAL OF INTEREST IN CORNWALL.—FORMATION OF NEW COMPANIES.—PROFITABLE OPERATIONS ON TAILINGS.

Cornwall is at the present time attracting attention once more, and appears to be at the threshold of another period of renewed prosperity. For instance, John Taylor & Sons are assuming the management of the Droskyn and Wheal Ramoth tin mines near Newquay. A syndicate called Droskyn Syndicate Limited has been formed with a capital of £7000 to acquire these ancient shallow mines and to carry out the preliminary work advocated by James Roberts, who is the prime mover in the scheme. The re-entry of John Taylor & Sons into Cornish mining is a noteworthy event. It is to be hoped that their experience this time will be more fortunate than their last venture in East Cornwall, namely, Drakewalls. They are now starting on rational lines, and, before erecting expensive mining and ore-reduction plant, propose to test the property by clearing and unwatering the Droskyn hoisting shaft and then extending the 40-fm. level on the main lode in both directions, and proving the backs so laid open by means of raises. If this preliminary work gives satisfactory results, a company is to be formed with a nominal capital of £118,000, of which £60,000 will be working capital. It is satisfactory to note that the grantee of the lease is content to transfer the option in exchange for 8000 fully paid shares in the larger company when formed, so that the whole of the capital of the syndicate is available for prospecting. The formation of the West of England Tin Corporation is another noteworthy event. This private company has been organized to acquire and deal in mining claims in the West of England, and generally to act as an exploration company. The capital is £50,000, all of which will be available to carry on operations. The directorate includes John Gilbert and Horton Bolitho, both of Carn Brea & Tincroft Mines, and A. V. Agar Robartes, while E. S. King is associated with the company. It is interesting to find that Lord Clifden, through his son, is active in the revival of the country's chief industry, and it is to be hoped that some of the other large landowners will follow his excellent example. Such a company as this can do much to direct attention to the mineral resources of Cornwall, and, controlled by practical men, should have a successful future.

The reward of vigorous development in a good district is clearly shown by recent discoveries made on the Carn Brea & Tincroft, and the lesson should not be lost sight of by those other mines in the country which are content practically to mark time in this respect. The 320-fm. cross-cut has intersected Duncan's lode at 97 fm. from Martin's East shaft. The full width is not yet known, but for the first 8 ft. it assays 30 lb. of black tin per ton. It is interesting to note that it was estimated by the late management that this cross cut would reach the lode at a distance of 65 fm., but at the shareholders' meeting in February last, when already 80 fm. had been driven, Mr. King, who had resurveyed the position, said he thought 100 fm. would be nearer the mark, and this proves to be the case. A good deal of criticism locally has been leveled at Mr. King on this point, but he must now be glad that he stuck to his guns. The other discovery is the North lode at the 160-fm. level from Highburrow East shaft, which, at the point of intersection, was 3½ ft. wide and assayed 90 lb. of black tin per ton. This lode, however, has always been patchy where worked in other parts of the property, so it will be safer to await further development before working much of it. Ten rock-drills are now in operation at Carn Brea & Tincroft solely on development. For the first five months of the year 34,328 tons of ore has been treated, producing, according to the ticketing sales, 411 tons of black tin, or 27 lb. per ton. The concentrate has realized £47,281, or an average price of £115 per ton. It is quite evident that the current six months will show record figures all round, and the gross profit should exceed that shown in the best half-year so far in the company's history, when an amount of £10,162 was earned. In spite of the greater development, the normal working cost has not increased, although, of course, the advance in the price of coal owing to the coal strike had an adverse effect, for 1,500,000 gal. of water is being pumped each 24 hours by the five pumping engines. Experiments have recently been made by Mr. King with a revolving buddle, which, by means of scythe-shaped knives, automatically removes the three products, concentrate, middling, and tailing, and so does away with the heavy labor involved by the shoveling on the buddle, a point to which visiting engineers to Cornwall have so often directed attention.

The Cornwall Tailings Co. started eighteen months ago to treat the vast dumps at Carn Brea & Tincroft. The moving spirits financially were Australians connected with Broken Hill and other mining interests in the Commonwealth. The results obtained show that the company is one of the most profitable, if not the most profitable, in all Cornwall. A review of the yearly report for the period ended February 29 last will be of special interest. A profit of £11,264 was made, out of which a dividend at the rate of 25% was paid. In addition, a reserve fund has been set aside for depreciation, amounting to £5000. The tonnage treated was 62,578 wet tons, including the re-treatment of 6643 tons of by-products; thus the weight of tailing handled from the dump was 55,935 wet tons, equal to 47,535 dry tons, assaying 20.9 lb. of metallic tin per ton (as compared with 19 lb. for the previous year), and containing a total of 442 tons of metallic tin. From this was recovered 277 tons of black tin, containing 170 tons of metallic tin, the gross value of which was £31,380, which, less smelter charges, £3534, and cost of purchase, treatment, etc., £12,658, left a working profit of £15,188, from which head-office charges, depreciation, etc., £3924, must be deducted to arrive at the net profit of £11,264, stated above. The recovery of 170 tons of metallic tin equals an extraction of 38.5% of the tin contained in the tailing as shown by chemical analysis. The interesting statement that 13 lb. of black tin per ton was extracted, whereas the vanning-assay of the tailing only showed 10 lb. per ton, makes it clear that, on a large scale, a more complete extraction of slime tin is possible than by the vanning-assay method. The gross value of tin extracted per ton of wet tailing was 11s. 2½d., less smelting costs, 1s. 3d., leaving 9s. 11½d. per ton. The costs of purchase, treatment, etc., including the re-treatment of by-products, amounted to 4s. 6d. per ton, leaving a profit of 5s. 5½d. per ton. The new pipe-line, through which it is proposed to pump the tailing by aid of water, will shortly be at work, and this change from carting the stuff, it is anticipated, will save 5d. per ton. It is estimated by Arthur Richards that there still remains 1,100,000 tons of tailing for treatment. Ross K. Macartney, for several years chief engineer at Mount Bischoff, has recently been appointed general manager of the works.

BOSTON

STRIKE AT REFINERIES AFFECTS COPPER STOCKS.—REPORT OF LAKE COPPER CO.—UNFAVORABLE SHOWING OF UTAH CONSOLIDATED.

The East has not yet had a repetition of the extremely hot weather which last year characterized June and July, and caused a considerable curtailment of copper refinery output, but there has been something of a stand-off with last year's conditions in the strike situation at Baltimore and Perth Amboy. This strike affecting the Guggenheim interests, has been protracted for over a month and will undoubtedly be a substantial factor in holding down the copper deliveries to be announced by the Copper Producers' Association early in July. It seems that labor complications came at the psychological moment to further strengthen copper metal conditions. With the further decrease of visible stocks abroad, and the trouble experienced at these important Eastern refinery plants, there is no prospect of any increase in copper stocks during the summer, and the chance of cheaper copper seems remote. The political situation has apparently no bearing upon copper metal sentiment. There is a strong combination of natural trade forces sustaining copper even at the present high levels, and this seems to measurably override any unfavorable factors in the market.

In the Lake Superior district the possibility of important lode discoveries keeps Boston guessing. The Houghton Copper Co., the shares of which are traded in on the Curb here, has lately been active and advanced in quotations. This is due to the company finding the rich west lode which was opened up by the adjoining Superior mine. Houghton has heretofore been a neglected and inactive stock though its developments are reported to have been for some time in favorable ground. The present discovery is said to be one of the richest showings ever made south of Portage lake. Houghton has a small share capitalization and its position, sandwiched between Isle Royale and Superior, gives the stock a prospect of much promise. News recently received from Isle Royale, Superior, and Houghton points to important ground being opened in that territory. The Hancock shaft has cut at the bottom rock heavily impregnated with copper, that is believed to be the Pewabic lode, making the subsequent proceedings of great importance to Boston. The annual report of the Lake Copper Co. has been the subject of study. It showed a balance of quick assets over all indebtedness of $87,512, of which $59,462 was cash. Notwithstanding this greatly reduced amount of working capital, William A. Paine, president of the company, gives the assurance that no new financing will be necessary. The company has placed and paid for all of its important equipment, and is now developing its capacity to shipments of 500 tons of rock per day. From these shipments, and a 17½c. copper market, it is figured that the company will be self-sustaining. Lake now has the benefit of an experienced and conservative management. Lake is a rich mine and should make good, despite the fact that its recovery now is but little better than 15 lb. of copper per ton. This does not include mass and barrel copper, which is shipped direct to the smelter, enabling the company to increase its average content somewhat above the present recovery. The trend of the Lake lode has not yet been definitely ascertained. The dip to the west is now less than it was some months back, and while extensive underground work has been done, no intelligent theory as to its direction or correlation with other formations in the district can be made.

It is evident that Utah Consolidated, at one time the greatest mine of the Bingham district and the lowest cost copper mine in the world, is in danger of passing. For the past two or three years Boston has been receiving periodical sensational accounts about the decline of this property. Last year certain Boston interests, believing that the management had acted disingenuously with the stockholders and the public in the giving out of particulars concerning the physical condition of the property, made an effort to wrest control from the Broughton crowd. The effort came within an ace of succeeding, though it was not renewed this year. Early in the year, Boston was regaled with the naive statement that Utah Consolidated was fast turning into a lead mine. It will be remembered that it was originally a gold mine, at a time before Bingham developed into importance as a copper producer. When the mine turned into a copper producer, for a period it was considered the biggest copper mine in Bingham. The facts now seem that Utah Consolidated has been gouged of all its rich ore and has only about 200,000 tons of copper ore running a little better than 2%, helped out by about $1.25 per ton in gold and silver. Added to this is a small tonnage of lead ore, but the lead developments to date have been disappointing, and no shipments of lead ore are being made at present.

KALGOORLIE, WESTERN AUSTRALIA

The April production of the important mines of Western Australia was as follows:

Name.	Tonnage.	Value.	Profit.	Div'd.
Associated	10,530	$70,500	$8,500	.....
Associated Northern	1,282	20,500	.....	.....
Burbans Main Lode	1,700	21,000	.....	.....
Golden Horse-Shoe	24,269	169,000	9,500	.....
Golden Ridge	2,936	26,300	8,500	*$34,500
G. Boulder Perseverance	20,758	106,000	7,000	.....
G. Boulder Proprietary	17,702	235,800	129,000	*328,000
Great Fingall	5,557	50,500	5	.....
Hainault	5,622	32,400	2,500	.....
Ivanhoe	20,330	190,400	80,000	†350,000
Kalgurli	10,310	106,000	45,000	†120,000
Lake View & Star	17,704	105,000	17,000	†50,000
Mountain Queen	3,735	17,000	5,600	.....
Oroya Black Range	4,700	42,500	13,200	.....
Oroya Links	11,010	66,500	16,500	.....
Sons of Gwalia	.....	.....	.....	‡101,000
Sons of Gwalia South	.....	.....	.....	.....
South Kalgurli	9,351	59,500	13,400	‡37,500
Yuanmi	4,280	43,500	20,400	.....

*March. †April. ‡May.

The Perseverance made $7000 profit on the treatment of $4.80 ore. The April gold output from the state was valued at $2,420,000.

Labor troubles of a petty nature have upset the smooth working of the mining industry. All the foundries have been shut down now for ten weeks, and the molders are just returning to work after a signal defeat. As a result of the strike the Lancefield mine is closed indefinitely, although the eighth level at present shows 23 ft. of ore worth $9 per ton. The company was out of repair parts and was forced to stop work. Over 400 men are out of employment. The finances of this company are somewhat involved, but will probably be now adjusted. The latest producer, the Yuanmi, is also down on account of the trammers demanding more wages and refusing to submit to arbitration. There has also been trouble with the engineers at the Ivanhoe, though that is now settled. The Gwalia South is to be closed, and the property sold to the Sons of Gwalia for $27,500, if the shareholders agree. The company has not done well of late, and has examined many properties with a view to purchasing a new mine. Work on the water-supply for the Ora Banda and Marvel Loch districts is now being rushed. The plant of the Associated Northern at the former place is somewhat behind, through the molders' strike and the water not being ready. There has been little heard from the Poynesville district of late. Some six months ago it promised fairly well, although the lodes were small. The Associated is looking better of late, likewise the Oroya Links. Cross-cutting from the Edwards shaft of the Boulder at 2650 ft. the Horse-Shoe has cut No. 4 lode from the east, and 460 ft. from the northern boundaries; assays are high. At the 210-ft. level, Bullfinch main shaft, the south cross-cut of the west drift at 44 ft. cut a mineralized vein, from 49 to 67 ft., which was 28 in. wide and assayed $18.70.

General Mining News

ALASKA

Copper River

Shipments of copper for Seattle, in May, were 1,720,391 lb. This brings the total for the first five months of this year up to 14,455,589 pounds.

Juneau

The report of the Alaska Treadwell G. M. Co. for May states that 84,280 tons of ore was crushed and 1585 tons of concentrate saved. The estimated value of the free gold was $104,555.37; of the concentrate, $88,970.63. The value of the total production was $193,526, with a realizable value of $191,590.74. The estimated net profit was $71,602.19. The yield per ton of ore milled was $2.30. The stock of broken ore was increased 2926 tons, and development for the month amounted to 929 feet.

Valdez

The Mineral Creek Mining Co. has found a vein of rich ore in an adit driven during the winter to prospect for an ore-shoot showing at the surface. Where the vein was cut it was only 18 in. wide, but in a drift the ore has widened to 28 in. Samples taken have assayed from $50 to $100 in gold with 30 oz. of silver per ton. This ore is higher in silver than any yet discovered in the district. The Kenai M. & M. Co., operating placer ground on Copper creek, has discarded its hydraulic elevator and will operate its claims this season by hydraulic mining. Prospecting has proved the ground to contain $1 per yard, but this amount has not been recovered by the elevator. The company has several giants ready for operation and a good head of water from a ditch line supplied from Stetson creek.

ARIZONA

Gila County

(Special Correspondence.)—Superior & Boston continues to ship ore from the stope below the sixth level on the Great Eastern vein and is preparing to reopen the Limestone shaft and mine the ore that is blocked on the second and third levels of the Limestone vein. A winze has been started on the shoot of ore disclosed by the drift on the twelfth level on the Great Eastern vein. Crosscuts are being driven east and south on this level. Enlargement of the Copper Hill shaft of the Arizona Commercial continues. After the foreclosure sale in July, it is proposed to erect at this shaft the double-drum hoist now at the Eureka shaft and connect it with an electric motor. Power will be transmitted from the Old Dominion power-plant. Compressed air for the drills will also be furnished by this plant and development started below the fourth level. The Old Dominion company is canceling many of the leases on its various properties on account of the passage by the state legislature of the miner's lien law which provides that liens shall attach to mining claims for debts contracted by lessees.

At the Miami mine construction has been started on the new mine machine-shop and the new change-house at No. 4 shaft. These buildings will take the place of the ones at No. 2 shaft, which are situated directly over the orebody and will have to be abandoned, as the extraction of the ore by the caving system progresses. No. 4 is the permanent working-shaft and is situated at some distance from the orebody.

The Guggenheims have relinquished their option on the Needles group of 27 claims and the so-called independent group of 13 claims, three miles west of Miami and adjoining the claims of the Southwestern Miami and the South Live Oak development companies. The claims contain a considerable area of mineralized schist that is believed to hold possibilities for the development of a body of low-grade copper ore similar to the Miami and Inspiration deposits. The option called for total payments of $625,000. The ground was examined by five of their engineers at various times, and orders have been placed for machinery and supplies for churn drilling, but it was finally decided not to prospect the property.

Underground work has been discontinued at the Black Warrior mine. E. M. White, the manager, says that this is temporary, and that development and mining will be resumed in three or four weeks, after the construction work now under way is completed. A new stable and warehouse are being erected at the mine, necessitated by the recent sale of the campsite to the Inspiration company for the erection of its proposed 7500-ton concentrator. Ore that has been accumulating in the bins is being shipped. At the Duquesne mine, seven miles northwest of Miami, three men are mining the gold-lead ore on contract and about 100 tons of ore is on the dump ready for shipment. The ore occurs as free gold and lead carbonate with limonite-stained quartz at and near the intersection of fissures in limestone closely associated with porphyry dikes and averages $15 to $25 per ton in gold and lead.

Globe, June 20.

Pinal County

The Ray Consolidated Copper Co. is increasing the output of the mines, and the June shipments to the Hayden plant are expected to exceed those of May, when 2100 cars, estimated to hold 126,000 tons of ore, were delivered to the concentrator. The foundation for the new compressor has been finished, and the building is well under way. The excavation for the foundations for the hoist and crusher at the No. 3 shaft is being rushed, and the foundations will be begun in July. The electric pump that was recently placed in the Humboldt shaft has drained the water entirely from the central section of mine No. 2. A precipitating plant consisting of 600 ft. of launders is being erected in Copper canyon at the southern extremity of No. 2 mine. If the results of this are satisfactory, another plant will be placed near the entrance to the same mine. A new hospital will be erected by the company at Ray to replace the one now maintained at Kelvin. The business portion of the town of Ray was recently swept by a fire which caused damage estimated at $400,000, with about 5% covered by insurance.

Yuma County

The Horn property in the Turtle mountains, about 20 miles southeast of Parker, has been bonded to William Neagle, in the interest of W. A. Clark. Work will be resumed at once. The shaft is to be deepened and development carried on in the adits where orebodies are exposed. The machinery for the new mill to be constructed near Rincon Landing in the Whipple Wash district, has arrived, and the work of assembling the machinery and erecting buildings started.

CALIFORNIA

Inyo County

The May production of the Skidoo Mines Co. is reported as $17,720, from 1209 tons of ore milled. The cost of development for the month was $1504.18, and of operation $7202.08, giving a net profit of $9013.74. Lost time in mill operations during the month amounted to 10½ days.

Modoc County

(Special Correspondence.)—At High Grade the snow is rapidly melting, roads are being opened, and active prospecting has commenced. A number of lessees are operating on claims in the district. The Sunshine company, which recently passed into the hands of Charles Fulton, B. X. Dawson, and associates of Los Angeles, has leased the Lucky Dutchman to R. L. Wade and Fred Schrott. The Ajax, Cedar, and Gold Stripe claims have been taken by A. Keitel, F. D. Sherry, and associates of Denver. The April Fool claim, near the Sunshine, has been acquired by Frank M. Myers, who is supposed to represent San Francisco people. The Del Floy has passed under bond and option to F. L. Evans, of Portland, Oregon. On the Shasta View, which is reported under a three-years lease to George Kent, of Seven Troughs, Nevada, the prospect shaft is down 50 ft. and is advancing to the 120-ft.

point. It is also reported that the property of the Fort Bidwell Con. Mines Co. is to be opened to lessees, and that the company plans to mine the developed ore and to order a cyanide plant.

Fort Bidwell, June 21.

PLUMAS COUNTY

The Old Bullion quartz mine, on the Indian Johnson property, half a mile west of Greenville, has been leased again, and will be reopened for development. In early days the property was worked by various lessees, but the shaft was allowed to fill with water several years ago, and the mine was abandoned. The shaft is now being drained and the seepage water shut off. The mine, as far as it has been developed, showed one small vein of rich ore.

COLORADO

JEFFERSON COUNTY

The new experimental ore-dressing and metallurgical plant built for the Colorado School of Mines at Golden, at a cost of $125,000, will be opened July 1. Plans for the building were drawn by Frank E. Shepard, president of the Denver Engineering Works Co., and were approved by D. W. Brunton and Philip Argall. The plant is in charge of W. Traphagen, and William G. Haldane is manager.

TELLER COUNTY (CRIPPLE CREEK)

Operations have been resumed on the 1000-ft. level of the Camilla shaft. The shaft-house was destroyed by fire about two months ago, and it was necessary to shut down to make repairs to the machinery. In a drift at the 1000-ft. level a vein had been cut two days before the fire, and development will now be continued at this point. The Beacon hill property of the Black Belle G. M. Co. has been divided into four leasing blocks, and reasonable working conditions and low-grade royalties are provided in the terms of the contract. In the Orpha May mine of the Stratton estate a large orebody has been found. The mine is operated through the deep shaft of the John A. Logan claim adjoining, and the ore was discovered in a cross-cut from the 1000-ft. level of the Logan shaft. The ore is low grade, and from 9 to 12 ft. wide, so cheap mining is possible. Twenty sets of lessees are now engaged in the development of the Raven and Gold hill holdings of the Doctor-Jack Pot Mines Co., and shipments are being made from the Ingham, Lucky Corner, Jack Pot, and Doctor mines. The ore shipped averages about $20 per ton, but from this the company is paid a fair sum in royalties. The main building of the Gaylord mill, at the Dante mine on Bull hill, has been enclosed, and work has commenced on the other mill buildings. The machinery will be placed as soon as delivery is made at the mine, and it is expected that the plant will be in operation by September 1.

The annual report of the Findley Con. Mining Co. shows that the company operated at a loss of $2189 last year. The output of the mine was 3597 tons of ore which netted $19,378. During the year the company drove 1331 ft. of cross-cuts and drifts and 300 ft. of raises. A promising orebody was opened on the twelfth level, but it extended only 100 ft. upward, and as soon as it was exhausted the company abandoned underground operations. Negotiations are now under way for the sale of the low-grade ore dump. The company recently organized a new corporation, the Findley Mines Co., incorporated under the laws of Wyoming, with a capital of 2,000,000 shares with a par value of 2½c. each, instead of 1,250,000 shares of $1 each which was the old capital. Shares will be issued in number equal to those outstanding so the *pro rata* interest will be the same. The new company takes over all the property of the old.

IDAHO

BONNER COUNTY

The Idaho Continental mine, north of Priest lake, and 23 miles from Parthill, will be equipped with a concentration plant. John D. Ryan, president of the International S. & R. Co., has advanced $150,000, which will be used for the purchase of machinery required for a 300-ton concentrator, a hydro-electric power plant, a 12-drill compressor plant, and a sawmill, and also for the erection of the buildings necessary to house the machinery and furnish accommodations for the employees. At a recent meeting of the directors of the Idaho Continental company, a ten years' contract was signed with the International S. & R. Co. which gives the latter company the right to handle the entire output of the mine. The road from Parthill to the mine is to be prepared so that auto trucks may haul machinery and ore in the summer months. Ore-sheds of large capacity will be built for the storage of the winter output. The Idaho Continental group consists of 20 claims, on which $100,000 has been spent in the last two years, developing the mine to a depth of 500 ft. Several years ago the mine was operated for a time, and several tons of high-grade silver-lead ore shipped. The property was examined recently by Frederick Burbidge, of Spokane, formerly general manager for the Bunker Hill & Sullivan company; Reno H. Sales, chief geologist for the Amalgamated Copper Co.; and Fred T. Greene, formerly with the Amalgamated Copper Co., but now a general mining engineer at Butte; and their reports agree on an estimate of $1,000,000 net of ore in sight above the 500-ft. level.

IDAHO COUNTY

The Mineral Zone group of eight claims, two miles north of Elk City, has been sold by Mrs. M. A. Parr to J. R. Painter. This group of claims was recently examined by J. H. Mackenzie and B. C. Austin in the interest of Fred W. Bradley, of San Francisco, who held an option on the property pending the examination. After the final report Mr. Bradley was unable to make terms acceptable to Mrs. Parr, and upon the lapse of the option the claims were immediately bought by Mr. Painter. The Colonel Sellers and Enterprise claims are considered the most important of the group. Upon the Colonel Sellers a rich shoot of ore was found last winter while assessment work was being done. It is reported that a body of ore 125 ft. long and 5 ft. wide has been opened, with an average value of $30 per ton.

MONTANA

LINCOLN COUNTY

(Special Correspondence.)—The Vermillion Silver & Lead Co., owning quartz claims near the boundary line between Sanders and Lincoln counties, will begin shipping ore about July 1. Four men are engaged in running an adit in on the vein, and this adit is now in 225 ft. As the mountain is very steep, they have a depth on the vein of nearly 400 ft. The vein is about 7 ft. wide, with a streak of shipping ore about 20 in. wide. The ore contains gold, silver, and lead, and the average value of the entire vein is about $12 per ton.

Libby, June 22.

SILVERBOW COUNTY

(Special Correspondence.)—The East Butte Copper M. Co. has filed a report with the county assessor which shows that in the year ended May 31 the net earnings of the company were $250,187.32, as compared with $118,986.84 for the preceding year. The output of the mine during the year was 94,532 tons of ore, with an average yield of $16.51 per ton, making a total gross yield of $1,560,660.52. The cost of mining was $4.31 per ton, and the treatment charges were $4.91 per ton. Transportation and selling charges amounted to $225,288.88, while additions to the mine and surface equipment cost $11,795.30. An item in the report of $202,080.85 is called 'smelter deductions' and represents the difference between the assay value of the ore and the actual smelter recovery. The total expenditures were $891,226.83. At present the East Butte company is producing copper at the rate of 1,400,000 lb. per month, and the value of the May output was $260,000.

The Butte mines payroll for May was $1,350,000, which is $100,000 greater than any month since 1907. It is expected that the June payroll will even exceed May, and

that by the close of the month of July the wages paid the miners of Butte will total a million and a half a month. This does not include the payrolls of the Washoe and Great Falls smelters of the Anaconda company.

The Montana chapter of the American Mining Congress has been formally organized. Among those who became associated with the chapter are John Gillie, general superintendent for the Anaconda company; E. P. Mathewson, manager of the Washoe smelter; A. B. Wolvin, president of the Butte & Superior; Sam McConnell, superintendent for the Butte Central Copper company; C. J. Stone, manager of the Butte-Alex Scott; Oscar Rohn, manager for the East Butte company; John D. Pope, manager for the North Butte company; Ed. Hickey, president of the Tuolumne company; W. B. Fisher, manager for the Davis-Daly company; Charles W. Goodale, J. C. Adams, and B. H. Dunshee of the Anaconda company.

Butte, June 22.

The North Butte M. Co. mined 411,908 tons of ore in the year ended May 31, 1912, as compared with 429,511 tons in the preceding year. The report on the year's work contained the following comparison of results, per ton treated:

	1912.	1911.
Yield	$10.16	$8.64
Mining	4.19	4.11
Smelting	3.43	3.36
Total expenses	7.77	7.23
Profits	2.39	1.41

NEVADA

Esmeralda County

The Jumbo Extension Mining Co. has taken a lease for a year on the Bonnie Clair 20-stamp mill, 38 miles south of Goldfield. Experiments have been made on the ore which indicate a profitable return after the payment of all charges. E. S. Van Dyck, manager for the company, estimates that there is enough ore on the dump and in the stopes of the Polverde workings, adjoining the Clermont on the southeast, to keep the mill running for a year, treating 100 tons per day. Development has been carried on in the Polverde for a year, and the ore deposit is now proved from a point below the 900-ft. level to a point above the 800-ft. level, a distance of 275 ft. along the dip. Along the strike it is proved for a distance of nearly 300 ft. It ranges from one foot to ten feet in thickness. Portions of the body will produce a good grade of shipping ore, and the balance a good grade of milling ore, but it is intended to break the entire mass as a whole and thus deliver a higher-grade milling product, with an average value, according to samples taken for milling tests, of $20 per ton. The company also owns claims in Diamondfield that aggregate about 66 acres. Lessees are now operating these claims and report the discovery of a vein with 2 ft. of $28 ore and 4 ft. of $7 ore.

The Blair M. & M. Co. has purchased, in Goldfield, machinery for a mill and cyanide plant of 50 tons daily capacity. This company owns a group of six claims, and has taken a bond on the Barton mine, a mile from the Pittsburg Silver Peak. The plant will be on the site of the old Blair mill, the ground having been leased from the Pittsburg Silver Peak, and ten 850-lb. stamps of the old plant will be used with the new equipment. The flow-sheet of the new mill was designed by Willett Barton, formerly mill superintendent for the Florence Goldfield Mining Co. The ore will be crushed in a Phillips 9 by 15-in. crusher to ¼-in. size; then by finishing rolls and the ten stamps through a 20-mesh screen. Dorr thickeners will be used in the mill, and the final precipitation will be by the Merrill process. The water for the plant will be furnished by the Pittsburg Silver Peak company from its main pipe-line, and the electric power will be supplied by the Nevada-California Power Co. The new company already has in sight about 5000 tons of milling ore, and about 1400 tons is on the dump at the mine. The mill tests conducted on this ore indicate that it will average about $18 per ton, and that a profit can be made on $8 ore. Development on the old Barton mine has been resumed, and other properties which have milling ore exposed will be leased. The plant will also be conducted as a custom mill, and it is intended to treat the low-grade silver and base ores found in the district. W. O. Bradley, manager for the Pittsburg Silver Peak company, has been aiding the new enterprise and the mill tests have been conducted at the Silver Peak plant. E. R. Noyes, of Goldfield, president of the new company, and C. V. Bob, general manager, hope to have the mill ready for operation in August.

Lyon County

The report of the Nevada Douglas Copper Co. covering the period from December 1911 to and including March 1912 shows receipts from ore settlements, gypsum mining, and miscellaneous sales, of $152,428.89. The expenditures of the company for development, mining, maintenance, and general expense amounted to $105,599.84. There was also $33,101.29 due from sales of copper in accordance with contract. The total profits for the period were therefore $79,930.34. The total assets of the company were given as $6,265,350.95, including all property, investments in the Nevada Copper Belt railroad, and treasury stock.

Nye County

The Adaven Mining & Smelting Co. has leased its property to George Wingfield, who will operate the plant and eventually become one of the largest stockholders. The company owns a group of claims near Marble in the Lodi district and a fully equipped modern smelter. The ore, which is low grade, is a carbonate carrying lead, gold, and silver, with the gold in higher proportion than in most silver-lead mines.

In the Mizpah Extension mine a body of good ore has

THE TONOPAH-BELMONT SHAFT.

been found in the east drift on the vein on the 1000-ft. level. The shoot, which is 3 ft. wide, has been opened for 50 ft. in the drift, and by a short raise. The average assay of the samples runs from $9 to $12 per ton, but there are occasional small kidneys of specimen ore which show ruby and native silver. The vein has not yet been identified with any of the known veins in the Belmont company's territory. In raise No. 9 on the shaft-vein of the Tonopah-Belmont from the 1100-ft. level, a shoot of ore 5 ft. wide has been opened. When this vein was cut in sinking, no ore was found, and the present discovery is therefore encouraging. On the thirteenth level, both east and west drifts on the vein continue in good milling ore. The work of building ore-bins on the head-frame of the shaft is progressing, as is also the construction of the automatic railway to both the waste dump and crushing plant. New 1¼-in. cables, each 1800 ft. long, together with heavier sheave wheels, have been placed on the head-frame, to handle the safety cages and the 3-ton skips. At the new mill the piping is being placed, and a trial run will soon be made of the tube-mills and pumps on the tank floor. The refining-room is nearly completed, the precipitate presses, melting furnaces, and slag crusher are all in place. The mill is expected to be in operation by July 1, but the old mill at Millers will be run until August, as at least a month will be required to get the new plant into smooth running order. The output of the

Montana-Tonopah for May was 4611 tons, and the same rate has been maintained in June. In stope 162 on the shaft-vein a good body of rich ore has been found which is being used to grade up the poorer ore from some of the lower levels. This vein, which is flat, is being explored on all levels from the 162 intermediate down to the 700-ft., and a cross-cut is being driven to pick up the downward extension of the vein on the 765-ft. level. The May output of the Tonopah Extension was 4497 tons, and of the West End 3206 tons.

WHITE PINE COUNTY

(Special Correspondence.)—The Copper Mines Co. has commenced shipments from the mine in the Robinson district to the Steptoe smelter, on the same basis that the ores of the Giroux are treated. The Copper Mines Co. has 3000 tons of sulphide ore on the dump which will average 15% copper. This ore is produced on the 215-ft. level and from a winze 75 ft. in depth which is going down on a 4-ft. vein. Ore with less than 6% copper will be shipped to the concentrator at McGill.

Ely, June 20.

The Giroux Con. Mines Co. is now shipping 1000 tons of ore per day to the Steptoe plant. A part of this ore is coming from the stock piles of the Morris and Bunker Hill, but the mines are now hoisting fresh ore from the stopes. The Bunker Hill is now equipped with skips, and 500 tons of ore can be hoisted daily from the shaft. The Morris shaft is also equipped to handle a large tonnage, but the underground workings are not in condition for a large output. The old dumps are being loaded by a steam shovel with a clam-shell dipper at the rate of 15 to 20 cars per day, and in a few weeks the stock-pile ore will be entirely cleaned up.

NEW JERSEY

The strike in the Perth Amboy plant of the A. S. & R. Co. has been settled. The men have been granted an increase in wages of 10 to 15 cents per day. Two months ago a bonus system was put into effect, and the present advance, which the men will now receive, equals the bonus which was paid to them heretofore. So the men are really returning to work with no increase.

NEW MEXICO

GRANT COUNTY

The fourth section of the Chino Copper Co.'s mill will be started in July, and the fifth section in August, according to D. C. Jackling. An average of 3000 tons per day is now being treated by three sections of the concentrator. The stripping is well ahead of the mining, and the tonnage can easily be increased.

PENNSYLVANIA

(Special Correspondence.)—The University of Pittsburg School of Mines announces a change in the undergraduate courses. The purely elective system has been replaced by the group system, four groups of studies being provided: Group I, Mining, with two options, one in general mining and one in coal-mining; Group II, Metallurgy, with two options, one in general metallurgy and one in metallurgy of iron and steel; Group III, Geology; Group IV, Ceramics. The work of the first two years is common to all courses, and is intended to lay the broad foundation necessary for all engineering. A course in management intended to train men along executive lines, has also been arranged as a graduate course. For practical men who cannot afford the time to take the full mining course, short courses have been arranged, intended especially for those who desire to secure a fire-boss' certificate, a foreman's certificate, a state mine inspector's certificate, or a training for mine electrician.

UTAH

SALT LAKE COUNTY

It is reported that the Yampa mine will resume operations July 1, and the smelter will be started later if the showing in the mine is satisfactory. The Yampa company closed its smelter nearly two years ago, when an excellent contract was secured with the Garfield plant of the A. S. & R. Co. Later when the smelter refused to renew the contract the mine was closed. An examination of the property by engineers of the Utah Consolidated demonstrated a large body of low-grade ore which can be worked profitably at the present high price of copper. The May production of the Utah Copper Co. was 10,068,336 lb., the largest in the history of the company.

The Michigan Utah Consolidated company has started the construction of a tramway to extend from the old City Rocks adit to Tanners flat. This tramway will consist of fourteen towers of concrete and steel, protected against snowslides and so arranged that the cables may be operated unless several successive towers are removed. Ores from other companies will also be transported over the cableway, and a hoist will be placed at the City Rocks adit where connection was made with the Solitude adit 300 ft. below. The Solitude adit will still be used for development purposes and all waste will be transported to dumps on the Big Cottonwood side.

UTAH COUNTY

The Beck Tunnel Con. Mining Co. has issued its report for the year ended June 1, 1912. The production of the mine was 4241.57 dry tons of ore, with a market value of $46,141.62. The silver produced amounted to 68,381 oz. and the gold to 840.3 oz. Operating reports show 1816 ft. of development for the year, with costs per ton as follows:

OPERATING COSTS

	Mining.	Development.	Total.
Supplies	$0.011	$0.015	$0.026
Explosives	0.287	0.136	0.423
Lumber and timber	0.034	0.007	0.041
Blacksmith	0.116	0.052	0.168
Power	0.168	....	0.168
Air	0.473	0.089	0.562
Water	0.015	0.002	0.017
Payroll	3.747	0.406	4.153
General office	0.460	....	0.460
Totals	$5.311	$0.707	$6.018

These costs were further distributed to show purpose for which the money was expended.

MINE

		Per Ton.
Development	$16,365.05	$3.429
Tramming	1,030.07	0.216
Hoisting	4,232.49	0.890
Surface expense	1,440.90	0.302
Surveying and assaying	1,100.83	0.230
General expense	1,162.85	0.244
Totals	$25,332.19	$5.311
Exploration	3,374.64	0.707
Total	$28,706.83	$6.018

PLANT

		Per Ton.
Supplies	$175.84	$0.037
Lumber and timber	13.06	0.003
General office	135.00	0.028
Totals	$323.90	$0.068
Buildings and fixtures	31.56	0.007
Cars and tracks	22.34	0.004
Machinery	270.00	0.057
Totals	$323.90	$0.068

The treasurer's report shows cash on hand at the beginning of the period, $3722.90, and an overdraft at the end of the year of $1296.21.

The Yankee Con. Mining Co. has found zinc ore in the old stopes, opened in the early history of the property, and is planning shipments to Oklahoma smelters.

CANADA

British Columbia

The Granby smelter at Grand Forks is treating 22,000 tons of ore per week, nearly all of which is from the company mines. The total shipments of blister copper from the smelter amounts to nearly 10,000,000 lb. to date this year. A large portion of the Granby mine above the third level, that had been deprived of its pillar supports, caved recently, bringing down a large amount of ore that can be shipped at a small cost for handling.

Ontario

The ore shipments from Cobalt for the first five months in 1912 shows a decrease from a similar period in 1911 of 1236 tons, due to the increased proportion of ore now treated by concentration. The bullion shipments from the district show a corresponding increase, and give promise of an increased output in silver for the year. The shipments from January to May inclusive are as follows:

Ore

	Tons.
Buffalo	517.47
Chambers-Ferland	193.60
Cobalt Townsite	6,569.61
Colonial	41.60
Coniagas	882.73
Crown Reserve	230.06
Hudson Bay	312.65
Kerr Lake	333.62
La Rose	1,527.66
McKinley-Darragh	1,123.56
Nipissing	874.54
O'Brien	244.98
Right of Way	153.48
Temiskaming	489.92
Trethewey	207.43
Beaver	180.90
Casey-Cobalt	24.50
City of Cobalt	812.51
Cobalt Lake	206.74
Provincial	22.22
Drummond	218.56
Total	8,568.34

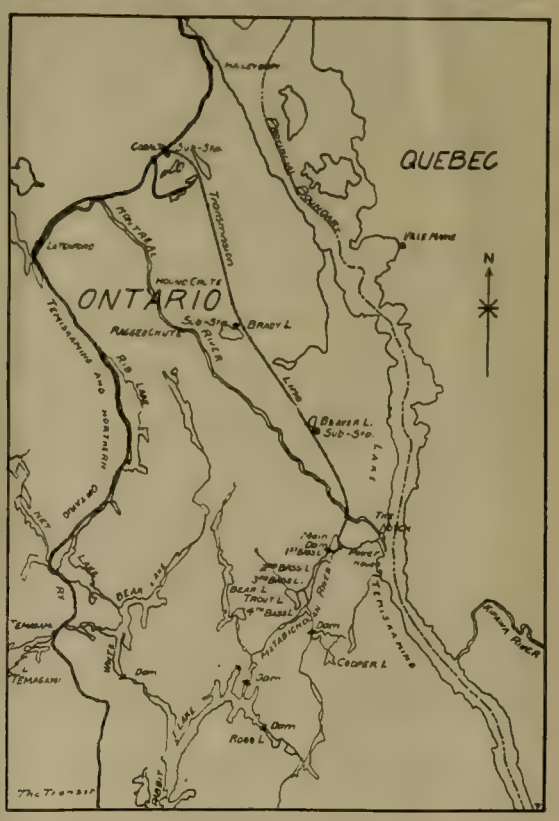
Bullion

	Ounces.	Value.
Nipissing	1,587,763.75	$920,892.18
Crown Reserve	207,203.00	115,951.19
Temiskaming	56,833.00	33,804.96
O'Brien	88,433.01	50,964.00
Nova Scotia	49,010.00	31,800.00
Buffalo	38,938.00	22,714.54
McKinley-Darragh	10,327.00	6,069.37
Kerr Lake	7,240.25	4,381.21
Trethewey	5,703.66	3,238.00
City of Cobalt	1,618.40	1,000.00
Colonial	1,698.00	1,018.00
Miscellaneous	16,268.81	10,798.64
Totals	2,071,036.88	$1,202,632.09

The Casey Cobalt Mining Co. has shipped a carload of ore, with the highest value of any single lot ever loaded in Cobalt. The car contained 43¼ tons, which averaged over 5500 oz. of silver per ton. The total value of the car was $132,235. The best previous record for one car was held by the Temiskaming at $127,000 for a shipment made early in the year.

The Buffalo Mines, Ltd., has issued a report for the year ended April 30, 1912, which states that 50,167 tons of ore was broken in the mine during the year, of which 44,510 tons was hoisted and 5657 tons left underground. The mill treated 46,801 tons, averaging 32.35 oz., a total of 1,490,760 oz. with a recovery of 80.63% in the shape of concentrate weighing 1064 tons and averaging 1017 oz. per ton, and 1796 lb. of bullion. The cyanide plant treated 7744 tons of slime from the concentrator, averaging 10 oz. of silver, and recovered and turned into bullion 48,476 oz. The total recovery by milling and cyaniding was 1,250,453 oz., or equal to 83.88% of the original content. The financial statement of the company shows an income from mining operations of $853,807.58, and from other sources $29,486. The expense of operation and administration was $325,482.24 and for transportation $80,465.01. From the net income of the company dividends to the amount of $470,000 were paid, and $81,154.19 added to the surplus, which now amounts to a total of $389,577.67. During the year 1157 ft. of driving was done, and 53,864 sq. ft. of stoping.

At the Hollinger mill 10 stamps have been put into operation dropping on ore, and the others will gradually be brought into action. It is reported that all the machinery



PART OF ONTARIO.

is running smoothly. The Vipond mill has also started ore through the crushers and is preparing to treat the full capacity of 150 tons per day.

MEXICO

Sonora

The production of the Greene-Cananea Copper Co., including the output of subsidiary companies, for the past four years is given in the annual report as follows:

	1908.	1909.	1910.	1911.
Copper, lb.	19,128,000	45,547,689	45,491,500	44,897,466
Silver, oz.	449,246	933,549	1,159,789	1,295,297
Gold, oz.	3,046	5,877	5,570	5,892
Net income.	$606,305	$1,102,559	$1,184,750	$1,318,472

L. D. Ricketts reports that the Cananea Duluth mine has been opened to the sixth level. During the year 1911 the fifth and sixth levels were thoroughly developed and the main hoisting shaft was raised through. These levels are now ready for production. The orebody on these levels is not as wide as on the upper levels, but is richer in copper and contains notably more silver, so that the showing on the sixth level is better than any other level in the mine. The cost of the copper produced by Greene-Cananea is given as 8.907c. after deducting a credit for gold and silver content.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

R. L. Beals is in Nevada.

Robert Linton is in New York.

S. H. Ball has gone to Europe.

Roy H. Clarke has gone to Nome.

F. W. Tweedy was in San Francisco.

Victor G. Hills has gone to the Yukon.

F. L. Garrison was at Ely, Nevada, last week.

F. L. Sizer has left for Arizona, expecting to visit Bisbee.

L. F. Vogt expects to return to Pittsburg about August 1.

Gelasio Caetani has gone to Telluride, Colorado, for six weeks.

W. E. Defty has gone to Pinal county, Arizona, on examination work.

J. C. Branner has gone to the Hetch-Hetchy valley on professional work.

A. G. Keiller has gone to the Aguacate mines, San Mateo, Costa Rica.

F. W. Bradley has gone to Alaska, expecting to return early in September.

Daniel Van Wagenin has completed an examination of the Lander oilfields.

George W. Evans has gone to northern British Columbia on professional work.

T. H. Jenks has returned to Denver from a professional trip to Nuevo Leon, Mexico.

F. D. Fraser is now superintendent of the North Star mine at Orient, Washington.

J. H. Hartley is with the Abangarez Gold Fields of Costa Rica, in charge of the Mina Guacimal.

Howard W. Dubois is on his way from Prince Rupert to the Quesnelle placers, in the Cariboo district.

F. H. Probert has gone to New York, on his way to London, expecting to be away about six weeks.

H. H. Armstead has gone to Colorado Springs, where he will remain a few weeks before proceeding to Guanajuato, Mexico.

E. J. Schrader has been appointed acting general manager for the Nevada-Rockland property, at Pine Grove, Nevada.

Howard Poillon has returned from a two-months' inspection of the vanadium deposits of New Mexico, Arizona, Colorado, and Utah.

J. H. Nelson has resigned as mill superintendent for the El Favor Mining Co. and is now with the Cia. Minera Barreno y Anexas, San Luis Potosi.

M. K. Shaler, who has been opening a placer mine in the Belgian Congo, has completed his work and is on his way home. His address temporarily will be 921 Ohio street, Lawrence, Kansas.

Obituary

Theodore Albert, for a number of years president of the William Powell Co., died may 27 at his home in Cincinnati, Ohio.

James Moffet recently died at his home at Los Angeles, at the age of 75 years. Mr. Moffet was largely interested in the Orphan Girl mine, near Butte, and had large interests in Mexican mines.

Samuel P. Lewis died at his home in Buffalo, June 10. The son of one of the first ironmakers to come from Wales to the United States, he was in the employ of the Illinois Steel Co. for nearly 30 years, finally going to the Lackawanna Steel Co., of which he was superintendent in charge of mills at the time of his death.

Market Reports

LOCAL METAL PRICES

San Francisco June 27.

Antimony	11—11½c	Quicksilver (flask)	43
Electrolytic Copper	18—18½c	Tin	50—51½c
Pig Lead	4.75—5.70c	Spelter	7½—7¾c
Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50			

METAL PRICES

(By wire from New York.)

NEW YORK, June 27.—Copper is much less firm and prices are unsettled. Consumers are holding off for better terms. Lead, however, remains firm as last week. Spelter is still strong and advancing in price.

Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
June 20	17.45	4.50	6.90	61⅛
" 21	17.50	4.50	6.90	61⅛
" 22	17.48	4.50	6.95	62
" 23	Sunday.	No market.		
" 24	17.30	4.50	6.96	62
" 25	17.30	4.50	6.97	61⅛
" 26	17.30	4.50	6.97	61⅛

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	June 27.
Camp Bird Ltd	$ 7⅛
El Oro	4
Esperanza	7⅛
Oroville Dredging	1⅛
Santa Gertrudis	8
Tomboy	6

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, June 27.		Closing Prices June 27.
Adventure	$ 9¼	Mohawk	$ 71⅛
Allouez	47	North Butte	30⅛
Calumet & Arizona	76⅛	Old Dominion	58½
Calumet & Hecla	530	Osceola	127
Centennial	25	Quincy	93
Copper Range	59½	Shannon	16
Daly West	5⅛	Superior & Boston	2⅛
Franklin	12⅛	Tamarack	48
Granby	54½	Trinity	6⅛
Greene Cananea, ctf.	10⅛	Utah Con	11⅛
Isle-Royale	34½	Victoria	4
La Salle	7⅛	Winona	6
Mass Copper	7	Wolverine	112⅛

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, June 27.

Atlanta	$ .24	Mayflower	$ .02
Belcher	.05	Mexican	2.85
Belmont	10.00	Midway	.44
B. & B.	.12	Montana-Tonopah	2 5
Booth	.09	Nevada Hills	1.90
Chollar	.02	Ophir	1.07
Combination Fraction	.15	Pittsburg Silver Peak	1.07
Con. Virgina	.52	Round Mountain	.40
Florence	.53	Savage	.14
Goldfield Con.	4.90	Tonopah Extension	2 00
Gould & Curry	.02	Tonopah of Nevada	7.00
Jim Butler	.63	Union	.54
Jumbo Extension	.36	Vernal	.14
MacNamara	.24	West End	1.70

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. June 27.		Closing Prices. June 27.
Amalgamated Copper	$ 86⅛	Miami Copper	$ 28⅛
A. S. & R. Co.	86⅛	Mines Co. of America	3
Braden Copper	7⅛	Nevada Con	22
B. C. Copper Co.	6	Nipissing	7⅛
Chino	34⅛	Ohio Copper	⅛
First National	2⅛	Ray Con	22⅛
Giroux	5⅛	Tenn. Copper	43⅛
Goldfield Con.	4⅛	Tonopah Belmont	10
Greene-Cananea	10⅛	Tonopah Ex.	2
Hollinger	13⅛	Tonopah Mining	7
Inspiration	19⅛	Trinity	7
Kerr Lake	2⅛	Tuolumne Copper	3½
La Rose	3⅛	Utah Copper	63⅛
Mason Valley	14⅛	West End	1⅛
McKinley-Darragh	1⅛	Yukon Gold	3⅛

Company Reports

ROUND MOUNTAIN MINING COMPANY

This company was organized in 1906 with an authorized capital of 1,000,000 shares of $1 each, to operate mines at Round Mountain, Nye county, Nevada. The company owns 222.08 acres of patented ground and 121.63 acres of unpatented ground. The seventh annual report, for the year ended March 31, 1912, shows that 874,018 shares have been issued. The quotation March 31 was 47c. per share. The report of the president, J. R. Davis, shows that during the year 54,915 tons of ore of a gross content of $7.09 per ton was milled, yielding $6.24 per ton, or 88% of the total content. The operating cost was $4.96 per ton. Miscellaneous earnings made the net operating profit $1.36 per ton. At the beginning of the year the ore reserve was estimated at 111,928 tons; at the end of the year it had been increased to 145,820 tons, of an estimated content of $7 per ton, 7508 ft. of development work having been done during the year at a cost of 90c. per ton milled or 56c. per ton developed. For mine and mill construction during the year $33,999.91 was expended. The following figures of production and operating costs per ton will be of interest:

	Per Ton.	
Gross content of ore	$7.09	
Tailing loss	0.85	
Net realization	$6.24	
Miscellaneous earnings	0.08	
Shipping cost		$2.00
Development		0.90
Milling		1.16
Bullion tax, transportation, marketing, insurance		0.07
Office expense, taxes and insurance, general expense		0.32
Depreciation		0.31
Litigation		0.20
		$4.96
Net operating profit		1.36
	$6.32	$6.32

DEXTER WHITE CAPS MINING COMPANY

This company, with an authorized capital of 1,000,000 shares, of which 777,475 have been issued, owns properties at Manhattan, Nevada, which are being operated by lessees. Previous operations by lessees have yielded 1249 tons of ore with a bullion return of $44,579, yielding a royalty to this company of $5121. In January 1912 this lease was purchased by John B. Kirchen and others, since which time development work has been carried on. The new lease, operative until November 1, 1913, provides for the performance of a specified amount of work per month and the payment of royalties on ore of $5 grade or better. The chief feature of the report are the results of an examination of the property by S. C. Durkee, who concludes that 17,500 tons of ore of milling grade can be considered as developed, but gives no exact statement as to the estimated content of the ore per ton.

THE LUCKY TIGER-COMBINATION GOLD MINING COMPANY

This company, which has an authorized capital of $8,000,000 in shares of $10 each, $7,153,370 having been issued, owns all the capital stock of the Tigre Mining Co., S. A., of El Tigre, district of Moctezuma, Sonora, Mexico. During 1911 the latter company mined 46,945 tons of ore, of which 1866 tons was shipped and the remainder milled; 5922 tons of old tailing was treated by cyanidation in addition to current tailing. This ore, which had an average content of $27.75 per ton, was mined at a cost of $3.05 per ton and milled at a cost of $1.63 per ton, other expenditure brought the total operating cost to $14.825 per ton. The profits during 1911, after deducting depreciation of $88,675, were $328,846, and dividends amounting to $357,601 were paid. During the year 16,980 tons of a gross value of $23 per ton was developed, the total ore reserve amounting to 218,315, with a content of $19.20 per ton, and 86,894 tons of tailing, of a content of $9.17 per ton. During the year the new stamp-mill, cyanide plant, and electric-power plant were completed at a cost of $50,104, $221,208, and $239,207, respectively. The work of this company was described at some length in the *Mining and Scientific Press* of March 16, 1912. For the purposes of the federal income tax assessors, the depreciation upon the investment per ton of ore mined has been fixed at $6 and a depreciation of $753,826 has been entered upon the company's books for ore mined during preceding years. During the past four years dividends amounting to $1,267,601 have been paid. The following summary of mining and milling costs will be of interest:

	Per Ton.
Development	$0.65
Stoping	1.129
Filling	0.037
Framing	0.472
Timbering	0.612
Hoisting	0.024
Pumping	0.027
Sorting	0.473
Blacksmith work	0.160
Sampling and assaying	0.096
Surveying	0.043
Superintendence	0.262
Mine construction	0.005
Mining cost	$3.990
Stamp-mill:	
Crushing	0.458
Regrinding	0.062
Concentrating	0.456
Cyanide plant:	
Conveying and screening	0.131
Tube-milling	0.934
Classification, elevating, developing	0.243
Treatment	1.804
Filtration	0.382
Precipitation	0.181
Melting	0.252
Alterations	0.360
Milling cost	$4.287

Dividends

Copper Range has declared a dividend of 50c. per share.

The Calumet & Arizona has declared a dividend of $1 per share.

Superior & Pittsburg has declared a dividend of 30c. per share.

The Tonopah-Belmont M. Co. has declared a dividend of 25c. per share payable July 1.

The Nipissing has declared a regular dividend of 5% and an extra one of 2½ per cent.

THE agreement for amalgamation of the Kaiping (Chinese Engineering & Mining) and Lanchow coal mining companies, signed in January last, has been ratified by the Chinese Government and the British minister. The combination will be called the Kai-lin Mining Administration. The Kaiping company receives 60% of the profits and the Lanchow company 40% up to a total of $1,500,000, above which there will be an equal division. On the expiration of ten years the Lanchow company will receive the right of purchasing the whole of the Kaiping properties at a price to be arranged.

Book Reviews

Any of the books noticed in this column are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

COALFIELDS AND COLLIERIES OF AUSTRALIA. By F. Danvers Power. Pp. 412, ill., index. Critchley Parker, Melbourne and Sydney, 1912. For sale by the *Mining and Scientific Press*. Price $10.

Whereas there have been many books published describing the goldfields of Australia, this is the first comprehensive account of the great coalfields which now yield more in annual return, as they mean more for the industrial independence of the commonwealth, than the gold in all the states. In 1910 coal ranked first among the minerals won, with a value of £62,000,000, as against gold at £58,000,000 and silver-lead at £52,000,000. Australia contains the great coalfields of the Pacific. In New South Wales alone it is estimated that there is 115,000,000,000 to 150,000,000,000 tons of available coal, counting on mining as practicable to a depth of 4000 ft. In the other states there are important though smaller coalfields, and the industry is less well developed. Mr. Power has described not only the coal itself but the methods of mining and utilizing it. Following chapters on the nature and origin of coal, its sampling and analysis, irregularities in beds, gases in mines and ventilation, are several chapters describing the coalfields of the individual states. These chapters are succeeded by five in which are discussed coal-mining conditions in New South Wales, explosives, and the individual collieries. The last two chapters in the book treat, the one of the coal trade, labor conditions, analysis of coals, and rescue apparatus, and the other of the Victorian state coal mine; the latter chapter being contributed by G. H. Broome, the general manager.

In preparing the book, Mr. Power has read the literature of coal widely as well as studied the local industry. His general chapters are fresh and notably superior to those generally found in such books. He has quoted extensively from the work of M. R. Campbell, E. W. Parker, and J. A. Holmes, and their associates in the work started by the United States Geological Survey at St. Louis. Apparently the later work done at Pittsburgh by the Bureau of Mines, at Urbana, Illinois, by S. W. Parr and his associates, in Chicago by A. Bement, U. G. Abbott, and others, and the writings of David White were not available in New South Wales in time to be incorporated. This is to be regretted, since the book must probably stand for some time unrevised. American engineers will be mainly interested in the discussion of mining conditions and mining methods. As to the latter, Australians as well as Americans have built mainly on English models. The mines are opened mainly by adits and worked either by long-wall or by a room and pillar system much like that common through the Middle West. Shafts where sunk follow the English model, being round and brick lined. Steel tipples seem to be common. In design, the Australians seem here to have something to learn from Americans if steel is to be economized. As to machinery, there is so much that is familiar that few American names are missing. Babcock & Wilcox, and Sterling boilers, Sullivan, Goodman, and Jeffrey machines, Norwalk compressors, Aldrich pumps, McEwan engines, show that good machinery is cosmopolitan. Even machines with strange names, such as the Pick-quick long-wall coal cutter used in the thin veins at Mt. Kembla, show many points of resemblance to foreign types. This particular machine is closely similar to the Lee long-wall coal cutter developed at Mystic, Iowa, about twenty years ago. The Australian type draws itself along by winding a rope, whereas the Iowa prototype could be made to cut to an irregular face, since it traveled on short rails and was fed forward by rack and pinion. However, the Lee machine never found any place for itself outside the field in which it was developed. The 'Pick-quick', we will hope, may do better.

It is interesting to note that this, the most recent manual on coal-mining, is exclusively an Australian product. The author is lecturer on mining at the University of Sydney, and the publisher is equally an Australian. It is an excellent piece of work and a book well worth having.

H. F. B.

James Lewis & Son's Copper Report

Standard copper steadily advanced in price during the month of May, from £70 3s. 9d. to £75 10s. for cash, and £71 to £76 for three months prompt. This was due to the rapidly improved statistical position and the serious depletion of stocks, arising from the expanding consumption both in Europe and the United States in conjunction with diminished supplies. During the month European stocks diminished 6952 tons, and in view of the large export of 32,582 tons from the United States to Europe and the active demand for home consumption, a material reduction in the stocks of American refiners is expected to be announced in the course of this week, strikes having occurred at the works of two refining companies. About 60,000 tons of standard copper changed hands on the London metal exchange, and closing values on June 3 were £76 17s. 6d. for cash, and £77 7s. 6d. for three months.

European stocks have decreased 6952 tons and the visible supply 7302 tons during the month. The German consumption for the first four months of the year has increased 15,769 tons to 70,564 tons, as against 54,795 tons in the same period last year. The total European increase this year is 18,288. The demand continues satisfactorily for manufactured copper, and India is now coming into the market for the metal.

The total arrivals in England and France for the month were 13,683 tons and the deliveries 18,516 tons fine. The arrivals in England from Chile during the month were 1331 and the deliveries 1591 tons fine, and from other countries the arrivals and deliveries were 7422 and 11,219 tons respectively. The arrivals in Liverpool and in Swansea from the United States were 1727 tons bars, etc., and 495 tons plates, etc., equal to about 2211 tons fine copper. In London the arrivals were 275 and in France 4250 tons fine. The Chile Charters for the month were 1650 tons, including 650 tons for the United States. The total imports to date this year are 7655 tons and the deliveries 5544 tons less than during the same period last year.

Quotations June 3 were: Standard, £76 17s. 6d. for cash and £77 7s. 6d. three months prompt; English best selected ingots, £81 to £82, and tough cake £81 to £82 per ton, less 2½% delivered Birmingham; electrolytic wire bars, £78 5s. to £78 15s. net cash c.i.f.; 13s. 6d. to 13s. 9d. for ore of 20%; and 14s. to 14s. 3d. per unit for Chile regulus or American matte free from silver.

STOCKS OF COPPER (TONS FINE)

	1912			
	Jan. 1.	Apr. 1.	May 1.	June 3.
Chilean in—				
Liverpool and Swansea	4,225	4,807	5,203	4,943
France	714	633	778	784
American in—				
Liverpool and Swansea	12,939	9,825	8,215	5,890
France	4,033	5,248	4,690	3,933
Sundries in—				
Liverpool and Swansea	786	741	1,148	503
London and Newcastle	6,462	5,377	5,060	4,565
Birmingham	346	767	850	516
France	507	537	567	542
English in—				
Liverpool and S. Wales	17,346	14,215	14,210	14,212
Total, England and France	47,358	42,150	40,721	35,888
Sundries in—				
Germany and Holland	13,400	10,900	10,121	8,002
Total European stocks	60,758	53,050	50,842	43,890
Afloat as advised by mail and cable to date—				
From Chile	1,575	2,325	2,050	1,800
From Australia	8,350	5,700	7,000	6,900
Total visible supply	70,683	61,075	59,892	52,590

COPPER MINES are being opened in Hupeh province, China, not far from the iron mines of the Han-Yeh-Ping company. A portland cement plant is now in operation near Shih-hwei-yao, on the Yangtze, a wire-rope tramway being used to carry the barrels of cement to the warehouses, by the river.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

TIMBER AND STONE ENTRY—RESERVOIRS AND DITCHES

Reservoirs and ditches constructed by a placer claimant for use in connection with his mining operations on another subdivision are not such improvements as will prevent the acquisition of the land upon which they are situated under the Timber and Stone Act, for the reason that all patents granted under that act must contain reservations of all vested and accrued water rights and ditches and reservoirs used in connection therewith.

John H. Parker (Land Department), 40 Land Decisions 431. February 21, 1912.

MINING LEASES—CONSTRUCTION

Where a lease was executed to certain parties to work an asphalt mine over a period of 50 years on a royalty basis, and after four years of operation the lessees shut down their plant, owing to trust competition and failed to prosecute any further work during the next seven years, the lessor was allowed to cancel his lease, notwithstanding that he had been paid a nominal rental of $20 per year while operations were suspended.

Breckenridge Asphalt Co. *v.* Richardson, (Kentucky) 146 Southwestern 437. April 3, 1912.

PATENT IMPROVEMENTS—MEASURE OF VALUE

In determining whether the requisite expenditure of $500 in labor or improvements has been made upon a mining claim for which a patent is sought, the proper test is whether the reasonable value of the work performed or improvements relied upon amounts to that sum. Proof of the actual amount paid or the actual number of days spent in prosecution of such work is not conclusive. They are elements to be considered in arriving at the reasonable value, but the value of each of these elements must be shown to be reasonable in itself.

Samuel B. Beatty *et al.*, (Land Department) 40 Land Decisions, 486. March 6, 1912.

INNOCENT PURCHASER OF MINING CLAIM PROTECTED IN ALASKA

A lessee in possession of a mining claim in Alaska under an agreement to work the same continuously and pay over to the lessor a percentage of the minerals extracted is a purchaser for a valuable consideration within the meaning of the act of June 6, 1900, which protects such purchasers against prior unrecorded conveyances. And a prior conveyance is deemed unrecorded where it was not acknowledged in such a manner as by law entitles it to record—for example, where it has but one witness where the law requires two, and where an erasure and alteration was made subsequent to the acknowlegment.

Waskey *v.* Chambers (United States Supreme Court) 32 Supreme Court Reporter, 597. May 13, 1912.

LODE CLAIMS—SUCCESSIVE RE-LOCATION BY SAME PERSON

Where a locator had initiated several times the location of a certain claim, using different names for the claim each time, but had perfected only the last of these locations by making a proper discovery, his last location will be valid, providing the rights of third parties have not intervened before the location is finally perfected. The rule that a locator cannot, by re-location, extend the time within which the necessary steps must be taken to complete his location, does not apply if he perfects it before the rights of others intervene. The completion of a discovery cut already commenced, so as to make its dimensions conform to the requirements of law, is sufficient discovery work in this case to support the last location.

Eureka Exploration Co. *v.* Tom Moore Mining & Milling Co., (Colorado) 123 Pacific, 656. May 6, 1912.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

PLATINUM coins were first struck in Russia in 1828 in an effort to make a market for the metal. Originally platinum trading was a state monopoly and the official price was fixed at about $3.13 per ounce.

BEACH SAND containing gold and platinum occurs at many points along the Pacific coast. Attempts have been made frequently to work the material by some concentration process. Cost of handling and metallurgical losses have prevented any great success. Attempts to treat by direct cyanidation have met the difficulty of high cyanide consumption. It is claimed that large tonnages containing 80c. to $1 in gold occur where available for reclamation by suction dredges.

SOFT COAL is often stacked in piles out of doors and requires no careful grading. Anthracite must be protected from the weather and means must be provided for careful handling at all times, and for sharp separation of sizes, as also for screening to remove all dust and small sizes before shipments is made. Anthracite especially is a fuel for winter consumption only, being used through the Northwest almost exclusively for domestic heating purposes. Its handling, therefore, becomes almost entirely a matter of receiving during the summer months, and storing in ample quantities for shipment to meet the demands of an entire winter, when navigation is closed and no shipments can be received by water.

MINERS' INCH as a unit of measurement of quantity of water was adopted to furnish an easy method of approximation. It may be roughly defined as the quantity which will flow through an orifice 1 in. square, with a head of 6½ in. on the centre. This is an inaccurate unit, since the quantity which will flow through a hole 2 in. square does not equal 4 times the quantity passing a 1-in. hole. Bowie found in 1885 that in California the unit varied from 1.2 to 1.76 cu. ft. per second. For this reason many states have fixed the value of the miners' inch in terms of feet per second; thus in California and Montana 40 miners' inches = 1 cu. ft. per second; in Colorado 38.4. In Arizona, Idaho, Utah, and Nevada 50 miners' inches is taken as equivalent to a cubic foot per second; this makes the miners' inch correspond to 1.2 cu. ft. per minute.

FIRE prevention is more important than putting fires out after they are started. This rests upon the construction of the building and upon management and internal administration. Buildings may be classified into fire-resisting, or what is ordinarily called fireproof construction. The choice lies between the steel frame skeleton, enclosed with fireproof tile, or that enclosed with reinforced concrete. There is little to be said in favor of one over the other, except that with reinforced concrete a more skilled control is required through all the building processes. The high first cost of this class of construction is justified by the long term of life possible. Up to date, no limit has been found of general acceptance, and a probable depreciation of ½% per annum seems the best available figure. The second type of construction is what is known as mill, or slowly burning construction. This means that while the interior construction may be combustible, the heavy plank floors and their massive supporting timbers offer no hidden spaces, nor are they readily attacked by flame. The third type is the ordinary, or light joist construction, particularly objectionable from the fact that it presents the largest exposed area subject to ready ignition, and is the most difficult, both as respects prevention and fighting of fire. Its low cost is offset by the expensive upkeep and the high rate of depreciation, averaging 4 to 4¼% per annum.

Recent Publications

TECHNOLOGIC PAPERS OF THE BUREAU OF STANDARDS. No. 7. THE TESTING OF CLAY REFRACTORIES, WITH SPECIAL REFERENCE TO THEIR LOAD-CARRYING CAPACITY AT FURNACE TEMPERATURES. By A. V. Bleininger and G. H. Brown. 78 pp.; ill., maps, index. Washington, December 15, 1911.

TOPOGRAPHIC MAPS have been issued by the U. S. Geological Survey recently as below:

Biggs, California, in Butte county; scale 1:31,680.

Butte City, California, embracing parts of Butte, Colusa, and Glenn counties; scale 1:31,680.

Caldwell, Ohio, embracing parts of Morgan, Noble, and Washington counties; scale 1:62,500.

Canal Dover, Ohio, embracing parts of Carroll, Stark, and Tuscarawas counties; scale 1:62,500.

Kosmosdale, Kentucky-Indiana, embracing parts of Bullitt, Hardin, and Jefferson counties, Kentucky, and Floyd and Harrison counties, Indiana; scale 1:62,500.

Meridian, California, embracing parts of Colusa and Sutter counties; scale 1:31,680.

A map of North America (28 by 38 in.); scale 1:10,000,000 (approximately 158 miles to 1 inch).

Catalogues Received

STEPHENS-ADAMSON MFG. CO., Aurora, Illinois. 'The Labor Saver,' May issue.

ALLIS-CHALMERS CO., Milwaukee, Wisconsin. Pamphlet No. 1028, 'Pulverator.' 8 pages. Illustrated. 3½ by 6¼ inches.

DENVER FIRE CLAY CO., Denver, Colorado. Pamphlet, 'Antidote to Cyanide Poisoning.' 4 pages. Illustrated. 6 by 9 inches.

CHICAGO PNEUMATIC TOOL CO., Chicago. Pamphlet, 'Chicago Pneumatic Compressors.' 12 pages. Illustrated. 3½ by 6¼ inches.

INGERSOLL-RAND CO., 11 Broadway, New York. Form No. 4021, 'Jackhamer Type BCR-43 Drill.' 12 pages. Illustrated. 6 by 9 inches.

MANHATTAN DRILLING CO., 25 Broad street, New York. Catalogue No. 51, 'The Dobbins Core Drill.' 20 pages. Illustrated. 6 by 9 inches.

NELSON VALVE CO., Philadelphia, Pennsylvania. Catalogue S, 'Nelson Steel Valves and Fittings.' 62 pages. Illustrated. 5 by 8 inches.

HYATT ROLLER BEARING CO., Newark, New Jersey. Bulletin No. 604-E, 'Hyatt Roller Bearings as Applied to Mine and Industrial Cars.' 24 pages. Illustrated. 7 by 10 inches.

MACOMBER & WHYTE ROPE CO., 507 South Clinton St., Chicago. Catalogue K, covering its line of wire rope, including patent Kilindo non-rotating wire rope. 72 pages. Illustrated. 7 by 10 inches.

BROWN HOISTING MACHINERY CO., Cleveland, Ohio. Catalogue J, 'Brownhoist Cranes.' 42 pages. Illustrated. 6 by 9 inches. Also Pamphlet S, 'Brownhoist Suspended Bins.' 36 pages. Illustrated. 6 by 9 inches.

INGERSOLL-RAND CO., 11 Broadway, New York. Form No. 4204, 'Arc Valve Tappet Rock Drills'; 16 pages. Illustrated. Form No. 4111, 'Type "BC" Hammer Drills'; 16 pages. Illustrated. Form No. 7004, 'Cameron Steam Pumps'; 12 pages. Illustrated. All 6 by 9 inches.

HYATT ROLLER BEARING CO., Newark, New Jersey. 'Something About Hyatt Roller Bearings.' This is a beautiful specimen of printing as well as an interesting description of the plant of this company. The various departments are handsomely illustrated and a perusal of this book will convince the reader of the superior equipment and the careful attention given to the manufacture of Hyatt roller bearings. 52 pages. 9 by 12 inches.

Commercial Paragraphs

THE NEVADA ENGINEERING CO. has a contract for a 10-stamp mill for the Esmeralda Mining Co. at Gold Circle, Nevada.

THE DORR CYANIDE MACHINERY CO. of Denver announces that its offices are now situated at 733-5 First National Bank building.

Two units, each consisting of thirty-two 8-ft. diameter HARDINGE conical pebble mills, are about to be constructed at Lake Linden for the regrinding of the copper tailing which will be reclaimed from Lake Linden.

THE ABENDROTH & ROOT MANUFACTURING CO., with general sales offices at 50 Church street, New York City, announces the appointment of the Mexican Steel Products & Machinery Co., 208 Mutual building, Mexico City, as general agents for the company in Mexico, handling the complete line of Root water-tube boilers, Root spiral riveted pipe, and hydraulic mining machinery.

A. Vander Naillen, Jr., who for many years conducted the school of mines bearing his name, now announces that he has become associated with the HEALD'S SCHOOL OF MINES in San Francisco. He has arranged at the school, 425 McAllister street, suitable rooms which visiting engineers, architects, surveyors, and draftsmen may make their temporary headquarters without charge. A reference library, desks, drawing tables, and instruments are provided, and they are open to use by all engineers.

THE MANHATTAN DRILLING CO. has purchased the patents for the 'Dobbins Core Drill,' and is now manufacturing various types of Dobbins machines, and also operating a general core-drilling contracting business. Offices are maintained at 25 Broad street, New York. One of this company's drills at the Battery Park building, No. 24 State street, boring a 6-in. well has reached a depth of 500 ft., and at this depth is drilling from 10 to 16 ft. per 9-hour shift. At the Grand Central Station a class 'M' drill, boring a series of 6-in. holes, has averaged over 19 ft. per 9-hour shift.

In spite of the fact that the Mexican rebels still insist on making trouble along the American border, mining is going on briskly in the lower and middle sections of Mexico. Some inconvenience is caused to mining machinery manufacturers in trying to get machinery into the country. As an instance, the OLIVER CONTINUOUS FILTER CO. recently had occasion to ship a filter to the Cubilete Mining Co. at Ocotlan, Oaxaca. Instead of shipping this filter by rail direct by way of Mexico City, it was shipped by steamer from San Francisco to Salina Cruz on the west coast, thence by rail by way of Santa Lucrecia to Veracruz, and from Veracruz to Ocotlan.

Announcement was made June 1, 1912, that the three associated companies, the ALBERGER CONDENSER CO., ALBERGER PUMP CO., and the NEWBURGH ICE MACHINE & ENGINE CO., will in future be known as the ALBERGER PUMP & CONDENSER CO. The officers of the new company are George Q. Palmer, president; William S. Doran and D. H. Chester, vice-presidents, and William R. Billings, secretary-treasurer. The main offices are at 140 Cedar street, New York. The large amount of condenser and centrifugal pump orders in hand has demanded important additions to the plant and equipment of the company's works at Newburgh, New York. Important orders are being executed for the U. S. Navy Department, Isthmian Canal Commission, U. S. War Department, American Gas & Electric Co., Public Service Corporation of New Jersey, Cleveland Electric Illuminating Co., The Robin's Dry Dock & Repair Co., and many others of the largest corporations in this country and its dependencies. The line of apparatus manufactured by the Alberger Pump & Condenser Co. consists of surface, jet, and barometric condensers of various designs, cooling towers, a complete line of volute and turbine type centrifugal pumps, steam turbines, feed water heaters, hot water service heaters, and expansion joints.